ANNUAL REPORT

OF THE

STATE ENGINEER AND SURVEYOR

ON THE

Canals of New York.

1869.

ANNUAL REPORT

OF THE

State Engineer and Surveyor

ON THE

CANALS OF NEW YORK,

For the Year 1868.

TRANSMITTED TO THE LEGISLATURE JANUARY 14, 1869.

ALBANY:
THE ARGUS COMPANY, PRINTERS.
1869.

STATE OF NEW YORK.

No. 11.

IN ASSEMBLY,

January 14, 1869.

ANNUAL REPORT

OF THE STATE ENGINEER AND SURVEYOR ON THE NEW YORK STATE CANALS FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1868.

OFFICE OF THE STATE ENGINEER AND SURVEYOR,
ALBANY, *January* 14, 1869.

Hon. TRUMAN G. YOUNGLOVE,
Speaker of the Assembly:

Sir—I have the honor to transmit herewith to the Legislature my Annual Report on the canals of the State, for the year ending September 30, 1868.

Yours, very respectfully,
VAN R. RICHMOND,
State Engineer and Surveyor.

REPORT.

OFFICE OF THE STATE ENGINEER AND SURVEYOR,
ALBANY, January 14, 1869.

To the Honorable the Legislature of the State of New York:

The State Engineer and Surveyor, in obedience to the provisions of act, chap. 377, Laws of 1850, has the honor to submit herewith his Annual Report for the fiscal year ending September 30th, 1868.

ENGINEER DEPARTMENT.

By act, chap. 477, Laws of 1865, the Canal Board authorized the appointment of three Division and three Resident Engineers; and by act, chap. 794, Laws of 1866, the Board was authorized to appoint an additional Resident Engineer in charge of the Chenango Canal Extension. The existing laws, therefore, only recognize seven official engineers.

The subordinate engineers are appointed by the State Engineer and Surveyor and Canal Commissioner in charge, upon the recommendation of the Division Engineer. The offices of the Division and Resident Engineers are located as follows:

At Albany, for the Eastern Division.

At Syracuse, for the Middle Division.

At Rochester, for the Western Division.

At Owego, for the Chenango Extension.

The expenditures on account of the engineering department for the fiscal year ending September 30th, 1868, amounts to $81,260.00, as follows:

Eastern Division	$24,753 03
Middle "	39,680 98
Western "	16,825 99

The following shows the amount of work done under the supervision of the Engineer Department during the fiscal year:

Eastern Division	$179,718 71
Middle "	376,392 70
Western "	132,393 36
Total	$688,504 77

The cost of engineering equals $11\frac{8}{10}$ per cent upon the whole amount of work done. The engineering expenses includes a large amount not properly chargeable to construction work, being for the supervision of "contracts for ordinary repairs," cross-sectioning and computing quantities for thorough repairs of completed canals, making and revising plans for rebuilding structures, &c.

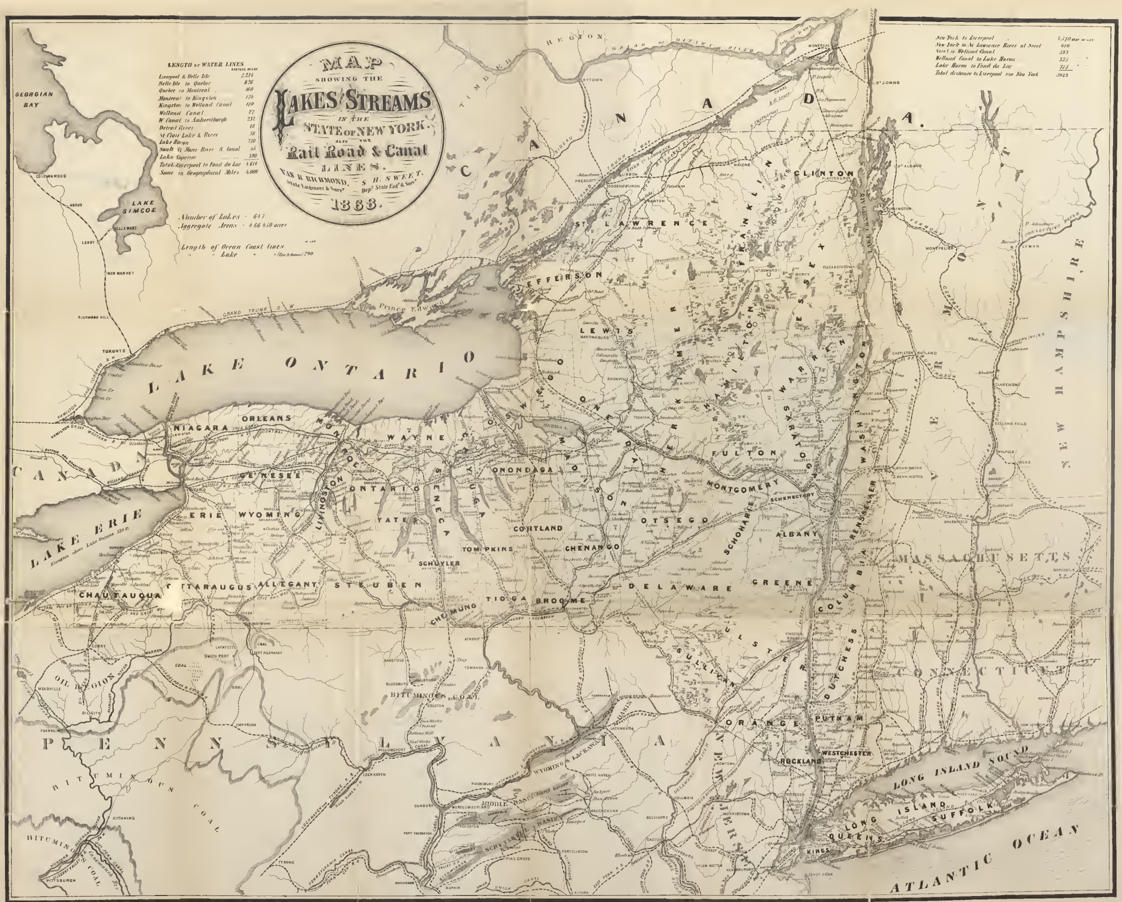
CANALS.

The State canals, for convenience in construction and the superintendence of repairs, are divided into three divisions, Eastern, Middle and Western; each under the charge and supervision of a Canal Commissioner, a Division and Resident Engineer.

Eastern Division.

Names of canals.	Miles.
Erie canal from Albany to east bank of Oneida Lake canal,	133.58
Albany basin (called one mile for tolls by chapter 200, Laws of 1849)	.77
Port Schuyler and West Troy side cut	.35
Pond above Troy dam	3.00
Champlain canal and Waterford side cut	66.00
Glen's Falls feeder and pond above	12.00
Black River canal	35.33
Black River feeder and pond above dam	12.09
Delta feeder	1.38
Black River improvement	42.50
Total miles	307.00

This division was in charge of D. C. Jenne up to the 1st of December last, Division Engineer, and O. L. Wetmore, Resident Engineer. Upon Mr. Jenne's resignation, Mr. O. L. Wetmore was appointed Division Engineer, and was in charge of the division up to February 20th. The division is now in charge of E. H. Crocker, Division Engineer, and Peter Hogan, Resident Engineer.


MAP
SHOWING THE
LAKES AND STREAMS
IN THE
STATE OF NEW YORK.
ALSO THE
Rail Road & Canal
LINES.
VAN R RICHMOND, State Engineer & Surv.r
S. H. SWEET, Dep.y State Eng.r & Surv.r
1863.
LENGTH OF WATER LINES
STATUTE MILES
Liverpool & Belle Isle 2,234
Belle Isle to Quebec 826
Quebec to Montreal 160
Montreal to Kingston 174
Kingston to Welland Canal 170
Welland Canal 27
W Canal to Amherstburgh 232
Detroit River 18
St Clair Lake & River 58
Lake Huron 270
Sault St Marie River & Canal 55
Lake Superior 390
Total Liverpool to Fond du Lac 4,614
Same in Geographical Miles 4,000
Number of Lakes 647
Aggregate Areas 466 450 acres
Length of Ocean Coast lines
" " Lake " " (Erie & Ontario) 290
New York to Liverpool 3,570 STAT MILES
New York to St Lawrence River at Sorel 410
Sorel to Welland Canal 397
Welland Canal to Lake Huron 335
Lake Huron to Fond du Lac 715
Total distance to Liverpool via New York 5423
GEORGIAN BAY
LAKE SIMCOE
LAKE ONTARIO
LAKE ERIE
C A N A D A
CANADA
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
CONNECTICUT
PENNSYLVANIA
NEW JERSEY
LONG ISLAND SOUND
LONG ISLAND
ATLANTIC OCEAN
OIL REGION
BITUMINOUS COAL
ST LAWRENCE
JEFFERSON
FRANKLIN
CLINTON
ESSEX
LEWIS
HAMILTON
HERKIMER
WARREN
WASHINGTON
SARATOGA
FULTON
MONTGOMERY
SCHENECTADY
OSWEGO
ONEIDA
ONONDAGA
MADISON
OTSEGO
SCHOHARIE
ALBANY
RENSSELAER
NIAGARA
ORLEANS
MONROE
WAYNE
CAYUGA
GENESEE
ONTARIO
LIVINGSTON
SENECA
YATES
ERIE
WYOMING
CORTLAND
CHENANGO
TOMPKINS
SCHUYLER
CHAUTAUQUA
CATTARAUGUS
ALLEGANY
STEUBEN
CHEMUNG
TIOGA
BROOME
DELAWARE
GREENE
COLUMBIA
ULSTER
SULLIVAN
DUTCHESS
ORANGE
PUTNAM
ROCKLAND
WESTCHESTER
SUFFOLK
QUEENS
KINGS
TORONTO
MONTREAL
KINGSTON

Middle Division.

Names of canals.	Miles.
Erie canal from east side of Oneida Lake canal to east line of Wayne county	68.58
Oneida Lake canal	6.00
Oswego canal	38.00
Cayuga and Seneca canal	22.77
Crooked Lake canal	8.00
Chemung canal and feeder	39.00
Chenango canal	97.00
Oneida River improvement	20.00
Seneca River towing path	5.00
Baldwinsville canal	1.00
Cayuga inlet	2.00
Limestone feeder	.80
Butternut feeder	1.55
Camillus feeder	1.00
Total miles	310.70

This division was in charge of William H. H. Gere to the 20th of February last, and now in charge of M. S. Kimball, Division Engineer, and Howard Soule, Jr., Resident Engineer. The Chenango canal extension was in charge of B. M. Hanks to the 1st of June, and now in charge of Charles L. McAlpine, Resident Engineer.

Western Division.

Names of canals.	Miles.
Erie canal, from east line of Wayne county to Buffalo	148.50
Genesee Valley canal, from Rochester to Millgrove	113.50
Dansville branch of this canal, from junction at Spraker's to Dansville	11.00
Genesee feeder at Rochester	2.25
Genesee feeder at Oramel	.75
Total miles	276.00

This division was under charge of W. W. Jerome, as Resident and acting Division Engineer up to his resignation, February 20. Since which time it has been in charge of Daniel Richmond, Division Engineer, no Resident Engineer having been appointed to the vacancy.

From the above statements it will be seen that there are 893.70 miles of navigable canals and feeders, and there are also 5.68 miles of unnavigable feeders, making a total of 899.38 miles of canals and feeders under the supervision of this department, exclusive of the Chenango canal extension in process of construction.

CANAL STATISTICS.

Statement of total length navigable miles of canals, feeders and rivers, with lakes, connected artificially with canals in New York State.

	Miles.
Total length of artificial canals and feeders	893.70
Length Hudson river, New York to Waterford	155.00
Lake Champlain, Whitehall to Rouse's Point	111.00
Oneida lake	22.00
Cayuga lake	39.00
Seneca lake	35.00
Crooked lake	19.00
Total	1,274.70

Bridges.

The total number of bridges upon all of the State canals is one thousand three hundred and eighteen, as follows:

Upon the enlarged canals, viz: The Erie, Oswego, Cayuga and Seneca, bridges of not less than seventy-two feet clear span:

Street and road bridges of iron	161	
Street and road bridges of wood	236	
Farm bridges of iron	6	
Farm bridges of wood	192	
Tow path and change bridges of iron	1	
Tow path and change bridges of wood	31	
		627

Bridges of not less than fifty feet span, located upon the Champlain, Chenango, Black River, Oneida Lake, Chemung, Crooked Lake and Genesee Valley canals:

Street and road bridges of iron	19	
Street and road bridges of wood	328	
Farm bridges of wood	320	
Tow path and change bridges of wood	24	
		691
Total		1,318

The approximate length of canal bridging from the foregoing is as follows: Total length of iron bridges, 2¾ miles; total length of wood bridges, 13¾ miles; total, 16½ miles.

Locks.

NAME OF CANAL.	Length in miles.	Number of locks.	Feet of lockage.	Feet lockage per mile.
Erie canal (57 double, 15 single)	351.78	72	654.80	1.86
Navigable feeders of same	3.35	.....	.....	.....
Champlain canal	66.00	33	179.50	2.72
Pond above Troy dam	3.00	.....	.....	.....
Glen's Falls feeder and pond	12.00	.....	132.00	11.00
Black River canal	35.33	109	1,082.25	30.63
Black River feeders	13.47		.....	.....
Black River improvement	42.50	1	.....	.....
Oneida Lake canal	6.00	7	62.00	10.33
Oswego canal	38.00	18	154.85	4.07
Oneida River improvement	20.00	2	7.85	0.39
Seneca River towing path	5.00	.....	.....	.....
Baldwinsville canal	1.00	1	8.00	8.00
Cayuga and Seneca canal	22.77	11	76.61	3.36
Crooked Lake canal	8.00	27	277.83	34.73
Chemung canal and feeder	39.00	53	504.88	12.95
Cayuga Inlet	2.00	1	.....	.....
Chenango canal	97.00	116	1,015.33	10.46
Genesee Valley and feeder	116.50	114	1,045.39	8.96
Dansville branch	11.00		82.50	7.50
	893.70	565	5,283.79	5.9

Placing the locks upon the Erie canal in a single line, their aggregate length is $2\frac{3}{4}$ miles; and together with the Oswego, and Cayuga and Seneca, $3\frac{3}{4}$ miles; and upon the lateral canals 13 miles, making a total continuous line of $16\frac{3}{4}$ miles.

Cost of all the weigh locks on the New York State Canals.

CONTRACTOR FOR SCALE.	Location of lock.	Cost of Buildings and Scales.			Total, including locks and culverts.
		Buildings.	Scales.	Total buildings and scales.	
Sampson & Tibbits Scale Co	Waterford	$823, 00	$3, 500 00	$4, 323 00	$29, 114 00
	Albany	8, 275 00	4, 896 00	13, 171 00	35, 004 00
	Troy	8, 230 00	4, 000 00	12, 230 00	46, 674 00
Squire Whipple	Utica	8, 275 00	4, 896 00	13, 171 00	56, 593 00
Fairbanks & Co	Syracuse	8, 283 00	4, 050 00	12, 333 00	38, 466 00
Duryea & Forsyth	Rochester	6, 671 00	4, 896 00	11, 567 00	51, 442 00

Dimensions and capacity of the New York State Canals.

NAME OF CANAL.	When authorized.	When completed.	Length in miles.	Size of Canal.			Number and Size of Locks.			Average burthen boats.	Maximum burthen of boats.
				Width on surface.	Width on bottom.	Depth of water.	Number of locks.	Length between quoins.	Width in clear.		
Erie canal	1817	1825	363	40	28	4	83	90	15	70	76
" enlargement same	1835	1862	350½	70	56	7	71	110	18	210	240
Oswego canal	1825	1828	38	40	24	4	18	90	15	70	76
" enlargement same	1847	1862	38	70	56	7	18	110	18	210	240
Cayuga and Seneca canal	1825	1828	21	40	24	4	10	90	15	70	76
" enlargement same	1836	1862	23	70	56	7	11	110	18	210	240
Champlain canal	1817	1822	66	50	35	5	20	100	18	80	85
" Glen's Fall feeder	1822	1837	12	50	35	5	12	100	18	80	85
" pond above Troy dam	1822	1837	3	....	....	....	1	....	....	....	....
Black River canal and feeder	1836	1849	50	42	26	4	109	90	15	70	76
" improvement	1849	1861	42	....	....	....	1	110	18	70	76
Genesee Valley canal	1826	1861	124¾	42	26	4	112	90	15	70	76
Chenango canal	1833	1836	97	40	24	4	116	90	15	71	76
Chemung canal and feeder	1829	1831	39	42	26	4½	53	90	15	85	90
Oneida River improvement	1839	1850	20	80	60	4½	2	120	30	70	76
Oneida Lake canal	1832	1836	7	40	24	4	7	90	15	70	76
Baldwinsville canal and Seneca towing path	1838	1839	5¾	40	24	4	1	90	15	70	76
Crooked Lake canal	1829	1833	8	42	26	4	27	90	15	70	76

Feeders.

The following embraces all the available feeders for supplying the Erie canal with water during the dry season, with approximate cost of each, paid from enlargement fund:

NAME OF FEEDER.	When brought into use.	Source of supply.	Miles entering the canal from Albany.	Supply cubic feet per minute.	Total cost of feeder.
Mohawk River at Cohoes	.....	Champlain canal	....	6,570	.....
Rexford Flats feeder	1844	Mohawk River	26	10,979	$25,000 00
Schoharie Creek feeder	1845	Creek	51	6,800	30,000 00
Rocky Rift feeder	1856	Mohawk River	78	10,602	190,000 00
Little Falls feeder	1843	Mohawk River	87	12,643	12,500 00
Ilion Creek feeder	1838	Creek	98	800	1,000 00
Chenango canal	1836	Through lock	110	911	.....
Butts' Creek	1838	Creek	124	1,400	530 00
Mohawk feeder at Rome	1858	Mohawk River	125	11,766	25,976 36
Black River canal at Rome	.....	Through lock	125	1,294	.....
Oneida Creek feeder	1835	Creek	140	1,500	34,498 00
Cowassolan creek feeder	1858	Creek	143	320	10,089 65
Erieville reservoir	1850	Reservoir	....	2,130	36,837 03
Chittenango Creek feeder	1840	Creek and outlet	152	250	7,555 33
Cazenovia Lake reservoir	1857	Reservoir	...	2,631	10,884 73
De Ruyter reservoir, through	1863	Reservoir	158	3,972	158,378 20
Limestone Creek	1852	Creek and outlet		210	14,871 30
Orville (Butternut Creek) feeder	1858	Creek	161	450	45,000 00
Camillus feeder	1843	Creek	175	1,500	11,327 68
*Skaneateles Lake reservoir	1844	Reservoir	185	7,520	14,927 55
†Genesee River feeder	1826	Genesee River	259	350	42,750 54
Genesee Valley canal	1842	Through lock	259	861	.....
Oak Orchard Creek feeder	1840	Creek	303	1,400	29,722 42
Lake Erie, Buffalo	1856	Lake	350½	35,000	.....
				121,867	.....
Total cost enlargement feeders					$701,848 79
Total cost original Erie canal feeders					101,147 00

It appears from the foregoing statement that the total quantity of water received into the Erie canal from its numerous feeders is 121,867 cubic feet per minute, equal in volume to a river 198 feet wide, seven feet deep, flowing with a surface velocity of one and one-fourth miles per hour.

Number, extent and approximate cost of structures upon the Erie canal.

Quantities.	Kind of structures.	Price.	Amount.
437,869	Square feet flooring in 158 iron bridges	81 c.	$354,673 89
516,259	do do 382 wood bridges	38 c.	196,178 42
540 sets	Bridge abutments	$2,750	1,485,000 00
540 do	do embankments, &c.	1,800	972,000 00
57 do	Double locks, aggregate length 9,833 feet	73,850	4,209,450 00
13 single	Locks, do do 2,415	31,560	441,840 00
2 do	Guard locks do do 345	23,000	46,000 00
5 do	Weigh locks do do 737	47,036	235,180 00
24,235	Lineal feet of trunk in 32 aqueducts	310	7,512,850 00
2,363	do waste walls, waste wiers	42	99,246 00
11	Stop gates	2,000	22,000 00
190	Stone arch culverts, aggregate spans 1,523	4,000	760,000 00
94	Composite do do do 435	1,700	159,800 00
	Total approximate cost of structures	.....	$16,494,218 31

Statement showing the total cost of construction of the New York State canals, together with the cost of repairs, maintenance and collection; also the total amount of tolls received from each. (Each canal is credited with the amount of tolls upon the tonnage contributed to the Erie, and charged with its proportion of repairs and maintenance upon the same.)

NAME OF CANAL.	EXPENDITURES.			RECEIPTS.
	For construction, enlargements and improvem'ts.	For repairs, maintenance and collect'n.	Total for construction, management, &c.	From tolls.
Erie and Champlain	$46,018,234	$12,900,333	$58,918,567	$81,057,168
Oswego	3,490,949	4,639,219	8,130,168	9,283,230
Cayuga and Seneca	1,520,542	1,200,044	2,720,586	2,184,300
Chemung	1,273,261	1,794,649	3,067,910	2,012,575
Crooked Lake	333,287	459,374	792,661	520,416
Chenango	2,782,124	1,022,026	3,804,150	737,285
Black River	3,224,779	498,866	3,723,645	242,603
Genesee Valley	5,827,813	1,689,303	7,517,116	1,306,913
Oneida Lake	64,837	123,234	188,071	65,180
Baldwinsville	23,556	25,035	48,591	1,261
Oneida River improvement	146,994	25,005	171,999	204,288
Seneca River towing path	1,488	20	1,508	5,251
Cayuga inlet	2,968	.....	2,968	4,596
Totals	$64,710,832	$24,377,108	$89,087,940	$97,625,066

Comparative statement showing the receipts per ton per mile for transportation over the New York Central, Erie Railway, and the New York State Canals; the tonnage of each, with percentage of gain and loss each year, from 1854 *to* 1864, *inclusive:*

FISCAL YEAR.	NEW YORK CENTRAL.			ERIE RAILWAY.			NEW YORK STATE CANALS.		
	Number of tons moved one mile.	Percentage, increase and decrease.	Per ton per mile. Cents. Receipts	Number of tons moved one mile.	Percentage, increase and decrease.	Per ton per mile. Cents. Receipts	Number of tons moved one mile.	Percentage of increase each year on tonnage.	Receipts per ton, per mile, including tolls.
1854	81,168,080	.....	3.05	130,808,034	.....	2.57	668,559,044	4½-	0.86½
1855	99,605,836	22. †	3.20	150,673,998	14. †	2.43	619,170,651	7¾-	0.94⅛
1856	145,733,678	46. †	2.97	183,458,046	21. †	2.48	592,009,603	4⅓-	1.11
1857	145,873,776	0.8†	3.13	167,100,850	8⅓-	2.45	484,750,864	18. -	0.80
1858	142,691,178	2. -	2.59	165,895,635	0.8-	2.32	564,842,095	16¼†	0.80
1859	157,136,000	10. †	2.13	147,127,039	11. -	2.17	544,309,072	3⅗-	0.68
1860	199,231,392	26. †	2.06	214,084,395	46. †	1.84	809,524,596	48¼†	1.00
1861	237,392,974	20. †	1.96	251,350,127	17. †	1.73	863,623,507	6⅗†	1.08
1862	296,963,492	21. †	2.22	351,092,285	39. †	1.89	1,123,548,430	30. †	0.96
1863	312,195,796	5½†	2.38	403,670,861	15. †	2.09	1,034,130,023	4-5-	0.87
1864	314,081,410	0.6†	2.90	422,013,644	5½†	2.41	871,335,180	16. -	.....
Total	2,132,073,612	.....	2.60	2,587,274,914	.....	2.22	8,175,803,065	.....	0.91

† For percentage gained, and - for loss.

From the foregoing, the average receipts of the New York Central were $2\frac{6}{10}$ cents; Erie, $2\frac{22}{100}$, and New York canals $\frac{91}{100}$ cents per ton per mile, or the average of both roads $2\frac{3}{5}$ times the cost upon the canals.

The total value of the total tonnage of the New York State canals for 1864 was $274,500,000. The value of total tonnage arriving at tide-water from the Erie and Champlain was $145,500,000, and the value of wheat and flour which came to the Hudson river for this year was $48,333,333.

Statement showing: 1. *The tolls on all the canals in the State (including rents from surplus waters), received in each fiscal year from* 1846 *to* 1866. 2. *The cost of repairs and collection of tolls.* 3. *The percentage which the cost of repairs and maintenance of all the canals bears to the gross amount of tolls.* 4. *The surplus revenues each year after paying the cost of maintenance.* 5. *The aggregate of the total movement on all the canals from* 1846 *to, and including,* 1866:

YEARS.	(1) Tolls collected.	(2) Expenses of collection and repairs.	(3) Per cent of cost of maintenance on tolls.	(4) Surplus revenues in each.	(5) Tonnage of all the canals.
1847	$3,463,710 26	$641,650 08	18.52	$2,822,060 18	2,869,810
1848	3,156,968 38	855,850 64	27.11	2,301,117 74	2,796,230
1849	3,378,920 18	685,803 91	20.30	2,693,116 27	2,894,732
1850	3,393,081 37	835,965 81	24.64	2,557,115 56	3,076,617
1851	3,703,999 34	907,730 20	24.50	2,796,269 14	3,582,733
1852	3,174,857 49	1,049,045 92	33.04	2,125,811 57	3,863,441
1853	3,162,190 14	1,098,476 92	34.73	2,063,713 22	4,247,853
1854	2,982,114 97	1,237,866 20	41.51	1,744,248 77	4,165,862
1855	2,632,906 11	989,792 12	37.59	1,643,113 99	4,022,617
1856	2,721,740 63	786,633 40	28.90	1,935,107 23	4,116,082
1857	2,531,804 38	970,453 46	38.33	1,561,350 92	3,344,061
1858	2,047,391 01	1,078,878 91	52.69	968,512 10	3,665,192
1859	1,814,362 47	897,878 96	49.49	916,483 51	3,781,684
1860	2,381,301 28	746,976 78	31.33	1,634,324 50	4,650,214
1861	3,358,033 97	706,786 14	21.05	2,651,247 83	4,507,635
1862	4,797,283 09	773,398 32	16.12	4,023,884 77	5,598,785
1863	5,029,596 32	770,882 52	15.33	4,258,713 80	5,557,692
1864	4,310,293 02	1,028,909 46	23.87	3,281,383 56	4,852,941
1865	3,521,631 63	1,927,373 59	54.73	1,594,258 04	4,729,654
1866	4,253,224 92	1,434,989 73	33.74	2,818,235 19	5,775,220
Totals	$65,815,410 96	$19,425,343 07	.....	$46,390,067 89	.....

Yearly average of gross tolls $3,290,770 54
Yearly average of cost of maintenance 971,267 15
Yearly average of surplus revenues 2,319,503 39

NOTE.—The above table is a twenty years' exhibit of the receipts from tolls and cost of maintenance of all the canals in the State since the Constitution of 1846 went into effect, as well as the annual surpluses of revenue carried to the capital of the Sinking Funds and used in the payment of the interest and principal of the debt charged by the Constitution upon the canal revenues. In these tables no account is made of moneys received from taxes, or other sources of revenue than those derived from the canals. Separate statements of these taxes will be given in the proper tables. The expenditures for collection, superintendence and repairs have been largely in excess of the estimates of 1846.

Statement showing original cost of the canals, including enlargement and extensions, the same including legal interest; also, the cost of repairs, maintenance, including legal interest on same, the aggregate receipts from canals, including legal interest on same, and the revenues contributed to the Erie and Champlain canals by the lateral canals, from completion up to and including 1866; *as prepared by the Auditor, in answer to a resolution from the Constitutional Convention.*

CANALS.	Cost of construction, enlargem't, ext'nsion and improvement.	Interest on cost of construction, &c.	Cost of repairs, maintenance, and collection.	Interest on cost of maintenance, &c.
Erie and Champlain	$46,018,234 19	$69,232,418 84	$17,552,621 80	$21,196,944 63
Oswego	3,490,949 24	3,174,037 95	1,812,571 42	1,735,991 48
Cayuga and Seneca	1,520,542 59	1,363,287 73	620,050 22	758,059 21
Chemung	1,273,261 86	1,635,704 70	1,139,770 30	970,699 26
Crooked Lake	333,287 27	535,896 06	258,282 78	236,180 06
Chenango	2,782,124 19	5,119,376 29	970,169 49	745,683 48
Black River	3,224,779 55	4,454,243 92	445,011 36	270,291 78
Genesee Valley	5,827,813 72	7,969,085 39	1,405,342 66	1,211,081 19
Oneida Lake	64,837 68	89,452 58	123,234 92	117,989 42
Baidwinsville	23,556 14	16,077 32	25,035 26	7,674 62
Oneida River improvement.	146,994 02	146,098 42	25,005 50	18,280 65
Seneca River towing path..	1,488 33	552 08	19 54	19 99
Cayuga inlet	2,968 16	423 61	.....	.....
	$64,710,836 94	$93,736,654 89	$24,377,114 75	$27,268,895 77

CANALS.	Aggregate cost of each canal, including cost of maintenance and legal interest on cost of construction.	Aggregate cost of each canal, including cost of maintenance and legal interest on cost of construction and maintenance.	Aggregate receipts or income from each canal, with interest thereon.	Revennes contributed to the Erie and Champlain canals by the laterai canais.
Erie and Champlain	$132,803,274 33	$154,000,218 96	$192,455,779 57	.....
Oswego	8,477,558 61	10,218,550 09	4,415,957 01	$6,719,600 60
Cayuga and Seneca	3,503,880 54	4,261,939 75	1,740,049 42	378,782 36
Chemnng	4,048,736 86	5,019,436 12	884,816 98	1,556,801 34
Crooked Lake	1,127,466 11	1,363,646 17	94,340 87	478,042 64
Chenango	8,871,669 97	9,617,353 45	1,204,040 85	123,276 40
Black River	8,124,034 83	8,394,326 61	162,900 89	128,027 00
Genesee Valley	15,202,241 77	16,413,322 96	1,158,085 43	675,042 46
Oneida Lake	277,525 18	395,514 60	123,060 84	.....
Baidwinsville	64,668 72	72,343 34	2,240 75	.....
Oneida River improvement.	818,097 94	336,378 59	362,728 18	.....
Seneca River towing path..	2,059 95	2,079 94	8,348 10	.....
Cayuga iniet	3,391 77	3,391 77	7,166 19	.....
	$182,824,606 58	$210,093,502 35	$202,619,510 08	$11,059,572 80

Balance sheet, showing the net gain and loss to the State of each canal, as deduced from the foregoing tables, as prepared by the Auditor of the Canal Department, upon a resolution from the Constitutional Convention.

CANALS.	Cost.	Profit.	Cost.	Profit.
	Crediting each lateral canal with its tolls proper, and charging it with its cost of construction, maintenance and repairs, charging and crediting interest at seven per cent.		Crediting each lateral canal with its tolls proper and tolls on its contribution to the Erie and Champlain canals, and charging it with its own cost of construction, maintenance and repairs; also, with its proper proportion of the cost of maintenance of the Erie and Champlain canals, charging and crediting interest at seven per cent.	
Erie and Champlain	.....	$38,455,560 61	.....	$23,108,326 01
Oswego	$5,797,593 08	.....	.....	2,950,548 18
Cayuga and Seneca	2,521,890 33	.....	$123,491 90	.....
Chemung	4,134,619 14	.....	1,767,201 88	.....
Crooked Lake	1,269,305 30	.....	406,088 87	.....
Chenango	8,413,312 60	.....	8,223,431 69	.....
Black River	8,231,425 72	.....	8,103,255 80	.....
Genesee Valley	15,255,237 53	.....	14,301,989 47	.....
Oneida Lake	272,453 76	.....	272,453 76	.....
Baldwinsville	70,102 59	.....	70,102 59	.....
Oneida River improvement	.....	26,349 59	.....	26,349 59
Seneca River towing path	.....	6,263 16	.....	6,265 16
Cayuga inlet	.....	3,774 42	.....	3,774 42
Total	$45,965,940 05	$38,491,947 78	$33,268,015 96	$26,095,263 36
Present cost to the State of the entire canal system	.....	*7,473,992 27	.....	†7,172,752 60
Total	.....	$45,965,940 05	.....	$33,268,015 96

* To September 30, 1866.
† Crediting the lateral canals with tolls received to December 31, 1866.

Note.—The apparent discrepancy of $301,239.67 in the above balance sheet is accounted for from the fact that the result in one case is obtained from the account for *fiscal years*, the entire period closing with September 30, 1866, while the result obtained in the other covers the entire period (with the exception of the account of the Erie and Champlain canals), ending with *December* 31, 1866—the discrepancy being the amount of revenue or tolls received from the lateral canals from October 1 to December 31, 1866 and the difference in interest.

In ascertaining the amount of tolls contributed by the lateral canals to the Erie, it was necessary (in order to report during the sitting of the Convention) to obtain the result from each year of navigation, instead of for each fiscal year, and this plan favors the lateral canals to the extent of three months' receipts of tolls, without the charge of maintenance and repairs for the corresponding period. If there had been time to ascertain the contributions by fiscal years, the apparent aggregate cost to the State of *all the canals* would have been alike in both results; there would simply have been a difference in the distribution of the cost.

Number and tonnage of boats built and registered annually since 1859.

TONS.	1859.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	Total numb'r.	Total tonnage.
300	....	....	1	....	....	....	....	....	1	300
280	....	....	....	2	....	....	....	....	2	560
250	2	2	15	3	....	....	4	8	42	10,500
240	....	....	5	1	....	1	3	40	54	12,960
230	....	....	2	2	3	3	4	28	42	9,660
225	....	....	12	28	2	11	4	24	81	18,225
220	....	3	41	87	69	30	19	43	294	64,680
210	....	....	5	16	....	....	....	....	21	4,410
200	4	33	169	298	254	98	45	68	987	197,400
195	....	....	1	2	....	....	....	....	3	585
190	....	....	16	6	25	3	....	....	50	9,500
180	12	60	36	11	70	7	4	4	215	38,700
175	....	....	5	22	....	....	....	....	27	4,725
170	7	17	3	....	8	....	3	....	55	9,350
160	....	....	1	4	9	2	....	4	20	3,200
150	11	14	27	88	24	24	8	11	330	49,500
145	....	....	1	....	....	....	....	....	1	145
140	1	2	19	13	14	15	3	5	96	13,440
135	....	2	1	2	....	....	....	....	12	1,620
130	2	2	3	4	16	3	2	7	144	18,720
125	1	5	8	1	3	5	2	4	221	27,625
120	9	22	15	12	15	6	6	21	608	72,960
118	....	....	....	7	....	....	....	....	85	10,030
115	....	5	....	4	3	4	4	12	32	3,740
110	1	4	5	5	5	2	6	2	165	18,150
105	2	....	1	....	....	....	....	....	6	630
100	14	55	67	194	61	38	11	75	862	86,200
95	5	13	19	21	14	38	5	21	613	58,235
90	38	42	41	51	102	66	37	65	1,125	101,250
85	8	35	25	1	8	4	2	2	303	25,755
80	25	49	43	4	18	19	8	6	1,323	105,840
75	21	19	10	2	7	1	6	4	1,333	99,975
70	16	4	5	1	10	7	6	4	923	64,610
65	4	2	2	....	....	....	....	....	555	36,075
60	8	3	6	....	6	6	3	4	773	46,380
55	10	.....	....	....	....	....	....	....	343	18,920
50	1	2	2	2	5	1	1	1	528	26,400
45	3	2	....	1	6	3	....	....	187	8,415
40	....	1	1	....	....	....	....	....	168	6,720
35	....	1	....	1	....	....	....	....	41	1,437
30	....	....	....	1	9	....	1	....	73	2,190
25	....	....	1	3	....	1	....	....	30	750
20	....	2	1	1	4	1	1	1	31	620
15	1	....	....	....	....	....	....	....	12	180
10	1	2	....	....	....	....	....	....	16	160
5	1	1	....	2	1	....	....	1	12	60
2	....	....	....	....	....	....	2	....	5	10
Total	208	404	615	903	771	399	200	485	12,850	1,291,497

COST OF TRANSPORTATION UPON THE ENLARGED CANALS—1867,

With Horse Power.

On canals, the cost of movement depends upon the burthen of boats and the amount of lockage; on railroads, upon the grades and curves, which affect the economy of transportation.

To determine the comparative cost of transportation between railroads and canals, both should be reduced to level grades; that is, the increased expense overcoming grades and curves reduced to its equivalent of level road, and the time or detentions in passing locks, to that of uninterrupted navigation, or to a uniform speed of two miles an hour.

Thus, taking the speed of freight trains at 15 miles an hour, the resistance on a level is=$9\frac{3}{10}$ lbs. per ton, and the total resistance due to a 30 feet grade is=$[(\frac{15}{11}\times\frac{15}{7}+8)+(2240\times\frac{30}{528})]$=22.04 lbs. Assuming the length of incline at 10 miles, its equivalent of level road would equal ($\frac{22}{9.3}$ of 10) 23.72 miles; hence, if the cost of transportation over this 10 miles was 15 cents, the cost on a level road would equal ($\frac{15}{23.72}$ mills) $6\frac{3}{10}$ mills per ton per mile.

From an accurate calculation, the grades of lockage on the Pennsylvania canals increase the actual cost of transportation (exclusive of tolls) 40 per cent. Upon the New York State canals, the average time, for the season, consumed in overcoming $11\frac{37}{100}$ feet of lockage, is equal to that in passing over one mile of canal. The time in passing through the locks average 25 feet, as equal to one mile, but in falling from and recovering the original speed, together with other detentions, bring it down to the above standard.

The length of the Erie is $350\frac{1}{2}$ miles, and the total lockage 654.80 feet, which, reduced to its equivalent of level canal, would equal 407.8 miles in length.

From experiments in France, it was determined that when the sectional area of the canal was $6\frac{46}{100}$ times, and its width $4\frac{1}{2}$ times that of the boat, the conditions were then the same as the movement of the boat in an indefinite space of water.

The resistance to the movement of a boat in a canal is caused by the piling up of the water at the bow by being confined within the banks, and falling from this height, escapes along the sides, producing, by displacement, a counter action and resistance, the more considerable as the interval between the sides of boat and canal is reduced.

No experiments of this nature have been made in this country, with our build or model of boats; but it is deemed sufficiently accurate to use the formula obtained from the barges upon the Languedoc canal, as they partake of the general build of our boats.

Dubuat's formula $P''=P'[(1-0.183)\times(1-q)\times(\frac{c}{s}-1)]$; or $P'=P\frac{8.46}{\frac{c}{s}+2}$ (where q=ratio between the resistance with and without a prow; c=sectional area of canal; s=sectional area of boat; P=resistance of a boat in an indefinite fluid, and P'=that experienced in a canal.) This formula was found to nearly double the resistance actually experienced on the Languedoc canal.

D'Anbuisson made a series of experiments, and corrected the for-

mula of Dubuat, so that the resistance from calculation agreed with the observed resistance. The formula, as corrected, $P'[(1—0.26\left(\frac{c}{s}—1\right)]$, or with sufficient exactness, $2.6639\frac{s2v2}{cx2s}$=lbs., was found to agree with the actual force expended. This part of the calculation embraced in the cost of transportation, covers the expense of *towing*, and is, upon different canals, in proportion to the resistance.

The resistance, at a speed of two miles an hour, with the large class of Erie canal boats (210 tons burthen) would be from the foregoing formula $=\left(2.664\frac{111.6^2x2.932}{441x(2x111.6)}\right)$ 428 lbs. The force required to develop the standard value of a horse power at two miles per hour, is 187½ pounds; deducting $\frac{1}{6}$ for oblique action, we have the force exerted in the direction of the boat's motion, equal to 156¼ lbs. From experiments in France, ordinary horses exerted an effort of 143⅓ lbs. for six consecutive days at a speed of two miles an hour. Then the number required to tow the present boats with the full average cargo would be three horses. The average time from Buffalo to Albany for the season upon the Erie canal reduced to a level at a speed of two miles an hour, would be 8½ days, the same as experienced from 1853 to 1862 both inclusive. The Auditor in his report makes the average time, for the past four years, from Buffalo to Albany upon the season tonnage, ten days, and the average burthen or cargoes, 156 tons, and the total number of navigable days in ten years (the age of our present boats), 2,268 days. Assuming the Auditor's data, the following shows the cost of transportation:

Age of present boats, 10 years, or 2,268 navigable days.

Cost of largest class of boats and furniture	$5,000 00
Interest on same for 10 years	3,500 00
Repairs of boat, with interest on same	2,061 00
Expense of crew, $185 per month	16,556 00
Expense of towing, $0.38 per mile, 79,826 miles	30,334 00
Total for 2,268 days	$57,451 00

Total for one day	$25 33
Total per mile	72
Average burthen of boats up and down tonnage, for the season	156
Actual cost, exclusive of tolls, per ton per mile	$4\frac{61}{100}$ mills.
The average carriers' charges upon all classes of freight upon the canals was for 1867, $5\frac{66}{100}$ mills per ton per mile, leaving a profit of	$1\frac{65}{100}$ mills.

Average receipts from tolls for the season upon all class of freights..... $4\frac{3\,8}{1\,0\,0}$ mills.

Total cost per ton per mile..... $10\frac{0\,4}{1\,0\,0}$ mills.

It appears from the Auditor's report for 1867, that the following were the charges upon up and down freight between Buffalo and Albany:

Tolls upon round trip—each way.....	$3 16
Freight upon round trip.....	3 87
Total round trip.....	$7 03
Same per ton per mile	10 mills.

The following statement shows the comparative receipts per ton per mile upon the New York Central, Erie Railway and New York State canals; also the business performed by each from 1865 to 1866, both inclusive:

YEARS.	New York Central.		Erie Railway.		New York State Canals.	
	Tons moved one mile.	Average receipts per ton per mile.	Tons moved one mile.	Average receipts per ton per mile.	Tons moved one mile.	Average receipts per ton per mile.
		Cents.		Cents.		Cents.
1865.....	264, 993, 626	3.31	388, 557, 213	2.76	843, 915, 779	1.10
1866.....	331, 075, 547	2.92	478, 485, 772	2.45	1, 012, 448, 034	1.00
1867.....	362, 180, 606	2.53	549, 888, 422	2.04	958, 362, 953	0.90
Totals.....	958, 249, 779	2.92	1, 416, 931, 407	2.42	2, 814, 726, 766	1.00

From the foregoing statement, the average receipts per ton per mile on the New York Central was $2\frac{9\,2}{1\,0\,0}$ cents; Erie Railway, $2\frac{4\,2}{1\,0\,0}$ cents, and the New York State canals, 1 cent, and that the business of the canals for 1867 was as much as the three years of the New York Central.

With Steam Power.

Attempts have hitherto been made to substitute steam for horse power upon the canal. These have all thus far failed, probably from the fact, that the machinery used was not properly proportioned to the work which it was designed to perform, and *that too high a rate of speed was sought to be obtained.* The law connecting the resistances offered to bodies moving in water with the power required to overcome such resistances, may be stated as follows:

The resistance varies as the *square* of the speed, and the power exerted varies as the *cube* of the speed; hence, if two horses were sufficient to tow a boat at a speed of two miles an hour, the number required to tow the same at a speed of four miles per hour would be $(2—\frac{4}{2}\frac{3}{3}—\frac{2\times6}{9}\frac{4}{})$ 16 horses. It appears, therefore, in order to double the speed, the propelling power must be increased eight times. The obvious effect of the double speed would be to reduce the time of transit one-half; this, however, would be secured only at an expenditure for propulsion eight times as great as that due to a speed of two miles per hour.

The foregoing determinations and comparisons are based upon the assumption that two horses will tow a loaded boat at a speed of two miles per hour upon the canal; as shown by M. D'Anbuisson's formula, 44 per cent more power is required to maintain the same speed in an indefinite fluid. For example, as shown in a former calculation from D'Anbuisson's formula, the traction or resistance encountered upon the Erie canal with the large class of boats, carrying 210 tons, at a speed of two miles an hour, is 428 lbs., requiring about three horses; then the resistance, at a speed of four miles an hour, would be $(\frac{4\,3\times4\,2\,8}{23})$=3424 lbs., requiring over 23 horses.

If steam power should be provided sufficient to obtain an average speed a little in excess of that realized from present horse power, then it might undoubtedly be successfully and economically employed upon our canals.

A successful application of the principle of low speeds seems to have been made by Mr. Edward Backus, of Rochester. If the results of the several trials made, are correctly stated by the inventor of this novel mode of steam propulsion, then the cost of transportation may be reduced about 32 per cent, as obtained from the following calculation, based upon the same general method employed for determining the cost of horse power. It is stated in the circular of results, by the inventor, that the extra cost of machinery and placing same in the boats is $2,500, and the consumption of fuel from 1,500 to 1,660 lbs. of coal in twenty-four hours. Taking the same average for the boats hitherto used, and allowing 20 per cent for the aggregate detentions for the season (the same as now realized), and the following shows the cost of transportation:

Cost of boat and furniture	$5,000
Cost of machinery	2,500
Interest on same	5,250

Repairs of boat and interest on same	$2,061
Expense of crew (same on boat with horse power) $185 per month	16,556
Expense of fuel (1,660 lbs. coal per day for 2,268 days) at $7 per ton	13,174
Total expense for ten years	$44,541

Total expense for one day $19 64
Forty miles averaged per day for the season, per mile .. $49\frac{1}{100}$ cents.
156 tons average cargoes for the season, per ton per mile, $3\frac{14}{100}$ mills.
showing a saving of 32 per cent over horse power.

The consumption of fuel, as reported, seems greatly in excess of that required, and can, undoubtedly, be reduced one-half when the system shall have been perfected. Should this saving be realized, the cost per ton per mile will then be $2\frac{36}{100}$ mills, a saving of about 50 per cent.

The following extract from a letter written by Gen. Quimby, U. S. A., who witnessed two trials of this boat, will convey an idea of the character of this new mode of propulsion:

In this boat the motive power, steam, causes a wheel located near the center of the boat to roll on the bottom of the canal, and thus drive the boat in the same manner that the locomotive is propelled by its driving wheels. The wheel, placed at one end of a lever frame, readily adjusts itself to the varying depths of the water, and its weight, together with the cog-like projections distributed over its circumference, prevents slipping and consequent loss of traction. It has been found that in the whole extent of the Erie canal there are not to exceed twenty miles in which the depth of the water is too great for the wheel to work well. For very deep water, a screw propeller wheel is used and the motive power is changed from the ground wheel to it with the utmost ease and expedition.

Statement showing the total amount of work done during the fiscal year ending Sept. 30, 1868; also, the amount of work remaining to be done upon all existing contracts upon the New York State Canals.

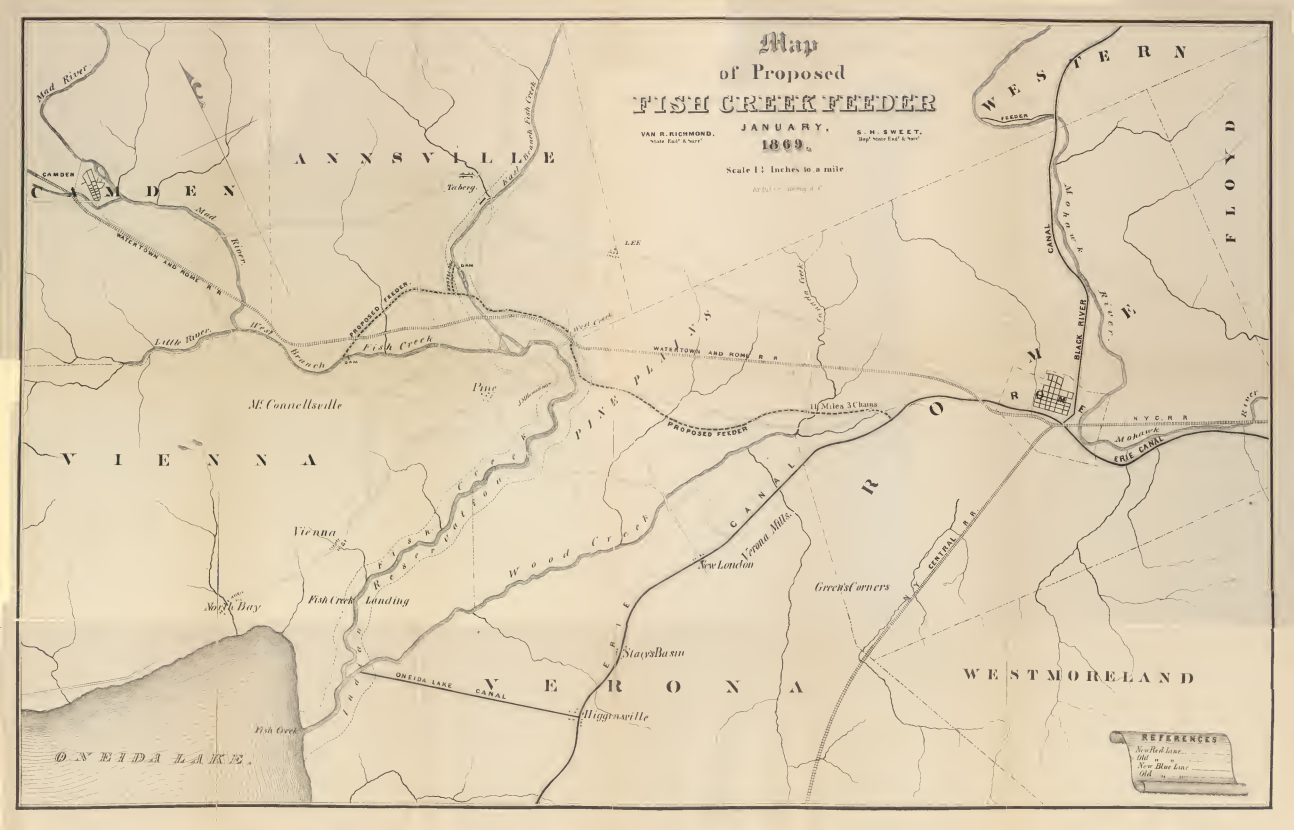
NAME OF CANAL.	Ordinary and Extraordinary Repairs.	
	Am't done during fiscal year.	Am't remaining to be done.
Erie canal	$174,060 71	$235,448 89
Champlain	65,028 83	107,752 58
Black River	1,280 00	7,520 00
Oswego	101,161 65	69,961 00
Chenango	67,251 78	22,117 00
Chemung	15,404 64	19,460 00
Crooked Lake	24,934 97	35,828 00
Cayuga and Seneca	.....	13,961 00
Genesee Valley	64,395 28	125,292 73
Total for ordinary and extra repairs	$513,517 86	$637,341 20
SPECIAL IMPROVEMENTS AND EXTENSIONS.		
Champlain canal improvement	$50,673 50	$57,439 00
Oneida Lake canal enlargement	31,560 00	226,440 00
Chenango canal extension	73,953 41	382,077 50
Black River improvement	18,800 00	1,640 00
Total for improvements	$174,986 91	$667,596 50
Grand total	$688,504 77	$1,304,937 70

IMPROVEMENTS RECOMMENDED.

I would most earnestly call the attention of the Legislature to the necessity of making liberal appropriations for the removal of the "bench walls" upon the Erie canal, and the immediate construction of Fish Creek feeder, for furnishing an additional supply of water to the summit or "long level." Both of these improvements should, in my opinion, be made at the earliest practicable period. They have been repeatedly urged in the annual reports of the Canal Commissioners, and my predecessors for the past eight or nine years. I would also recommend that, as soon as the surplus revenues can be applied, the locks upon the Western Division be doubled. The rapid increase of tonnage from the west will soon make this improvement imperative.

Removal of the Wall Benches.

The construction of the enlargement of the Erie canal was authorized by act, chapter 274, Laws of 1835. The form and size of the prism was adopted by the Canal Board, and constructed with wall benches up to the suspension of 1842, as shown in diagram No. 1. This plan was changed February 17, 1849, by Canal Commissioners Cook, Beach and Hinds, as shown in diagram No. 2, dispensing with


Map
of Proposed
FISH CREEK FEEDER
VAN R. RICHMOND, State Engr & Surv.
JANUARY, 1869.
S. H. SWEET, Asst State Engr & Surv.
Scale 1½ Inches to a mile
Mad River
CAMDEN
CAMDEN
ANNSVILLE
Taberg
North Fish Creek
Mad River
WATERTOWN AND ROME R R
LEE
PROPOSED FEEDER
Little River
West Branch
Fish Creek
West Creek
Cedar Creek
WATERTOWN AND ROME R R
McConnellsville
Pine
PINE PLAINS
11 Miles 3 Chains
PROPOSED FEEDER
VIENNA
Vienna
Wood Creek
Fish Creek Landing
North Bay
Wood Creek
ERIE CANAL
New London
Verona Mills
Green's Corners
N.Y. CENTRAL R.R.
Stacysburn
VERONA
WESTMORELAND
ONEIDA LAKE CANAL
Higginsville
Fish Creek
ONEIDA LAKE
WESTERN
FEEDER
CANAL
Mohawk
River
FLOYD
BLACK RIVER
N.Y.C.R.R
Mohawk River
ERIE CANAL
REFERENCES
New Red Line
Old " "
New Blue Line
Old " "

the benches and carrying the walls to the bottom of the canal upon a slope of 1¼ to 1.

The tonnage of the Erie canal in 1849 was less than half the present business, yet at this early day the embarrassment to navigation from the bench walls was seriously felt. Since then the embarrassments have gradually increased, as the business has augmented, from the settling of these benches towards the center of the canal, greatly reducing the width at the bottom; and to-day there is less capacity than in 1849, with double the business to perform. The canal with bench walls is only 42 feet wide at the bottom, while the proposed change gives 56 feet, a space that freely admits of the passage of three boats abreast, while the former will only pass two.

The removal of these benches, and substituting plan No. 2, with walls running to the bottom of the canal, would greatly increase the capacity for transportation, render navigation easier and safer, and require less repairs.

There are at present eighty miles of canal constructed with bench walls; sixty-five miles of which are upon the Eastern Division, sixteen upon the Middle, and three miles upon the Western Division. The estimated cost of this improvement is $1,600,000.

Construction of Fish Creek Feeder.

Supply of Water to the "Long Level."

The necessity for an increased supply of water for the long level has long been experienced. This deficiency was most seriously felt at Syracuse (lock forty-seven), from rapid lockages to pass the accumulation of boats from the Oswego canal; to keep up the short levels west of lock forty-seven; to supply the weigh lock and first level of the Oswego canal. To provide for a relief at this important point, the De Ruyter reservoir was constructed, which has given the desired relief at this end of the long level. Since its construction, however, the enlargement of the Oneida Lake canal has been authorized, and will be brought into use in 1869, for which no provision has been made for supplying this canal of enlarged capacity and tonnage. This, together with the fact that the volume of many of the streams supplying the canal are gradually diminishing by clearing and cultivating the lands around their sources and channels renders new sources of supply necessary.

Surveys and estimates were made in 1861 for the construction of Fish Creek feeder. The stream was found to yield an abundant and

permanent supply; its sources being covered by uninterrupted forests. Gauges were made at its lowest stages in 1835 and 1860. In 1835 it was found to yield 13,725 cubic feet per minute, and in 1860 it was 13,512, making an average flow of 13,618 cubic feet per minute. an excess of more than 6,000 cubic feet than is required for the maximum deficiency upon the long level, including the enlarged Oneida Lake canal.

The estimated cost of this feeder, including land damages is $335,000, based upon constructing it 11 miles in length, 15 feet wide on the bottom, 31 feet at surface, 4 feet deep, with a descent of six inches per mile, capable of delivering at the canal, 3 miles west of Rome, 7,500 cubic feet per minute.

Taking into consideration the permanency of this stream, its volume and favorable location for a reliable and immediate relief to not only the long level, but to all the levels between it and Little Falls, upon which navigation is greatly impaired, for want of a sufficient supply of water, I am of the opinion that this improvement is of the first importance, and should be at once placed under contract.

DOUBLING THE LOCKS ON THE WESTERN DIVISION.

There are on the line of the Erie canal, 57 double, 13 single and 2 guard locks. The uninterrupted line of double locks extends from Troy to Port Byron, at the western end of the Montezuma level, 194 miles from Albany and 158 miles from Buffalo. The remaining locks to Buffalo are single, with the exception of No. 61, at Macedonville, and the five combined locks at Lockport.

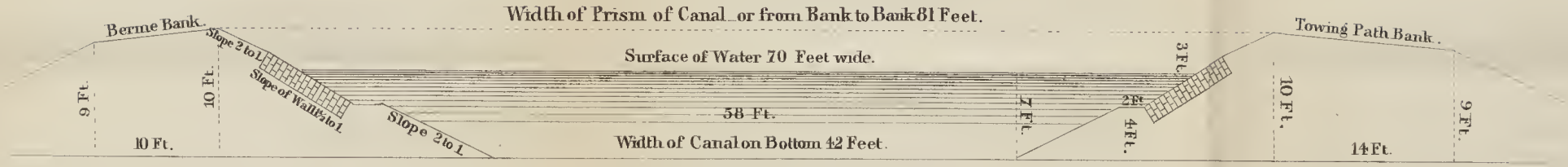
The greatest number of lockages in any one season, since 1856, was in 1862. They were at different points as follows:

Lock three miles west of Schenectady	34,977, double.
Syracuse lock	38,409, double.
Geddes lock	31,019, double.
First lock east of Rochester	24,597, single.
Lockport locks	30,906, double.
Black Rock guard lock	25,806, single.

From the foregoing, it appears that single locks are taxed 80 per cent of the double locks; whereas, for a fair proportion, they should perform only 50 per cent. It is not, however, this disproportion that materially affects at present the business of the canal. The most serious objection to single locks is their liability to accidents, which are now often occurring, and in which navigation is entirely suspended

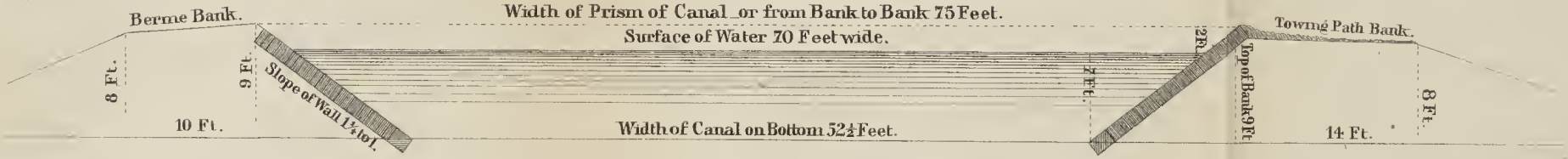
Nº 1.

CROSS SECTION OF ENLARGED CANAL, WITH BENCH WALLS.



Nº 2.

CROSS SECTION OF ENLARGED CANAL, WITHOUT BENCH WALLS.



Lith of Weed, Parsons & Co, Albany N.Y

until the necessary repairs can be made; whereas, with double locks navigation remains uninterrupted, however great the accident to one of the locks. These interruptions from accidents at the locks upon the western division are becoming more frequent, from the age of the structures, and are a source of great alarm to those relying upon the canal for the transportation of freight to tide-water. I am, therefore, of the opinion that these locks should be doubled as soon as the surplus revenue can be applied for this purpose. The estimated cost of this improvement is $425,000.

REPAIR CONTRACT SYSTEM.

By reference to the Auditor's report, it will be observed that the tonnage from the western states over the Erie canal to tide-water has doubled since 1852, while that from this State has decreased one-half. The falling off in the tonnage from this State is produced by a very general change in its character, having become of a more perishable class of merchandise, and requiring quick transit by the railroads.

It is to the western trade that the attention of those interested in the future commerce of our canals should be directed, and to so manage and improve the canals, as not only to control but retain this vast tonnage, which has increased over our canals at an average annual rate of about 15 per cent. It is for this great prize that American capitalists are projecting new rail and water lines by the shortest routes to the seaboard; and it is this growing and powerful competition that should induce the State to adopt every means to secure the full working capacity of our canals, and, above all, reliable and uninterrupted navigation.

Our canals do not lack capacity when in good navigable condition, and will, with the improvements already recommended and a change in the present system of repairs that shall be more to the interest of the State than individuals, fully answer the demands of western commerce without further enlargement for at least thirteen years, when the surplus revenues can be applied without resorting to taxation.

The present system of repairs has proved a great disappointment to its early advocates, and, as an experiment, wholly failed in protecting the interests of the State, and in preserving and maintaining our public works. It has proved to be anything but economical to the State or beneficial to navigation, and its repeal is earnestly desired by all directly interested in the navigation of the canals, and strongly recommended by all the present and retiring canal officials.

CHENANGO CANAL EXTENSION.

The total length of this improvement, from Binghamton to the Pennsylvania State line, near Athens, is 40½ miles, of which 10 miles is completed, 20 miles partially completed and under contract, leaving 10½ miles yet to be placed under contract. The following is the estimated cost to complete this work:

Estimated cost to complete work under contract.....		$382,077 50
Estimated cost to complete work not under contract ..		571,895 00
		$953,972 50
Deduct balance of unexpended appropriations:		
By act, chap. 185, Laws 1865.....	$550,000 00	
By act, chap. 649, Laws 1866.....	275,000 00	
By act, chap. 715, Laws 1868.....	281,800 00	
Total appropriated.....	$1,106,800 00	
Total expended up to Oct. 1st, 1868..	875,800 00	
		231,000 00
		722,972 50
Add for engineering and the usual contingencies		102,027 50
Total additional appropriations required to complete.		$825,000 00

The extension, when completed, will connect with the North Branch canal, and by the latter with the whole canal system of Pennsylvania and the coal fields, from which coal and iron can be brought into this State and along the Erie canal without breaking bulk. The shortest distance from the coal mines, via this route, to the Erie canal, at Utica, is as follows: Utica to Binghamton, 97 miles; Binghamton to the State line, 40½ miles; State line to Pittston, 95 miles; making a total of 232½ miles. The shortest distance now by canal from the coal mines to Utica, via Seneca lake, is as follows: Pittston to State line, 95 miles; Junction canal to Elmira, 18 miles; Chemung canal to Watkins, 23 miles; Seneca lake to Geneva, 35 miles; Cayuga and Seneca to Montezuma, 21 miles; Erie to Syracuse, 33 miles; Erie canal to Utica, 56; making a total distance of 281 miles, an excess over the Chenango route of 49½ miles.

From Pittston, the North Branch and Wyoming canals pass through the remaining portion of this great coal basin, 74 miles, to Northumberland, and by the Susquehanna canal to tide-water at

Havre de Grace, 206 miles from Pittston and 398 miles from the Erie canal at Montezuma. Wilkesbarre lies upon the canal about 8½ miles below Pittston.

The following statement shows the length of all the routes from the mines at Pittston to the several cities along the line of the Erie canal. (See map.)

NAME, OR ROUTE TAKEN.	MILES IN ROUTE OF—			Total distance.
	Railroad.	Canal.	River & Bay.	
From Pittston mines:				
Buffalo via N. Branch, Junction and N. Y. S. canals	....	315	35	345
Buffalo via N. Branch, Chenango extension	....	473	....	473
Buffalo via N. Branch canal and Erie railroad	150	113	....	263
Rochester via N. Branch, Junction and N. Y. S. canals	....	217	35	252
Rochester via N. Branch, Chenango extension	....	380	....	380
Rochester via N. Branch, Junction and Erie and Central railroads	99	113	....	212
Syracuse via N. Branch, Junction and N. Y. S. canals	....	190	35	225
Syracuse via N. Branch, Chenango extension	....	287	....	287
Syracuse via Del., L. and W. R. R., Cayuga Lake and canals	120	40	40	200
Syracuse via N. Branch and Junction canals, S. and Bing. railroad	138	113	....	251
Utica via N. Branch and Junction and N. Y. S. canals	....	246	35	281
Utica via N. Branch, Chenango extension	....	231	....	231
Utica via Pennsylvania Railroad, Delaware and Hudson canal	47	209	64	320
Utica from Carhondale via Delaware and Hudson canal	13	218	64	295
Utica via Delaware L. and W. Erie Railroad and Chenango canal	63	97	....	160
Utica via N. Branch canal, Erie Railroad and Chenango canal	42	197	....	239
Albany via N. Branch, Junction and Erie canals	....	356	35	391
Albany via N. Branch, Chenango extension	....	341	....	341
Albany via Delaware and Hudson canal	47	99	64	210
Albany (From Carhondale) Hudson canal	13	108	64	185

The following statement shows capacity, dimensions of the Pennsylvania State canals; also those connecting with the same in the State of New York, embracing the Chenango extension:

NAME OF CANAL.	Size of Canal.				Size of Locks.				Burden Boats.	
	Length of main canal.	Width at surface.	Width at bottom.	Depth of water.	No. of locks.	Width of chamber.	Length of chamber.	Amount feet of lockage.	Practical.	Theoretical.
Erie canal	350½	70	56	7	71	18	110	655	210	240
Chenango canal (present)	97	40	24	3-9-12	116	15	90	1015	70	76
Chenango canal with extension	135½	40	24	4	135	15	90	1086	76	80
Cayuga and Seneca	21	70	56	7	11	18	110	76½	210	240
Chemung	23	42	26	5	49	15	90	491	85	90
Junction	18	42	26	4½	11	17	90	70	85	100
North Branch	105	42	26	4½	} 37	17	90	280	85	100
Wyoming	64	40	28	4½	}					
W. Br. Susquehanna division	41	40	28	4½	....	17	90	86½	85	100
Penn., Susquehanna division	46	40	28	4½	....	17	90	116	85	100
Susquehanna and Tide-water	45	40	28	4½	....	17	90	235	85	100
West Branch	76	40	28	4½	....	17	90	138½	85	100
Delaware and Hudson	108	48	30	6	107	15	100	1028	120	130
Lehigh, Navigation and canal	72	60	45	6	81	22	100	955	74	195
Morris canal	101	40	25	5	*23	11	95	1674	74	76
Union canal	77⅜	43	28	4½	95	17	90	395	85	100
Schuylkill Navigation canal	108¼	60	40	6	71	18	110	618½	170	186
Delaware and Raritan	43	75	47	7	18	24	110	116	270	230
Penn. Delaware division	60	44	26	6½	32	11	90	166½	90	100
Chesapeake and Delaware	13½	66	46	9½	4	24	220	.....	250	300
Chesapeake and Ohio	184	70	58	6	....	15	100	600	120	142
Penn. Juniata division	127	42	26	4	....	15	90	516	76	80

From the foregoing statement, by the construction of the Chenango Canal extension, we practically unite a canal system with that of this State of an aggregate length of 823 miles, making a total united canal communication of 1,716 miles, and including our lakes connected therewith, 2,100 miles.

EXTENT OF COAL RESOURCES OF PENNSYLVANIA.

Regions from which Western New York is Supplied, and Lines to Market.

The anthracite coal fields of Pennsylvania are divided into three great districts, viz: The 1st, Southern or Schuylkill district, embracing the Lehigh and Lykens Valley coal; the 2d, Middle district, embracing the Beaver Meadow, Shamokin and Trevorton coal; the 3d, Northern or Wyoming and Lackawanna, embracing the Scranton, Pittston and Lackawanna.

The following statement shows the area of each and the tons of anthracite coal mined and sent to market in 1866; also, from 1820 to 1866, both inclusive from each region:

* 23 planes, 23 locks.

NAME OF REGION OR BASIN.	Area in acres.	Yield in 1866.	Total yield from 1820 to 1866 inclusive.
1st. Southern, or Schnylkill basin	104,040	4,633,487	85,609,824
2d. Middle, or Lehigh region	81,000	3,029,644	34,780,127
3d. Northern, or Wyoming and Lackawanna.	200,000	4,736,616	46,788,786
Total anthracite or hard coal	385,040	12,399,747	168,178,737

The following statement shows the areas of semi-bituminous and bituminous or *soft coal basins* in Pennsylvania, and the tons of coal mined from each during the year of 1866, also the total quantity mined since earliest development.

(This statement embraces quantities exclusive of anthracite coal.)

Name of Region.	Yield in 1866.	Total yield.
Pittsburg mines (Western Pa.)	2,120,000	*13,000,000
Lower regions:		
Lykens Valley	36,950	1,121,917
Short Mountain	112,851	926,495
Dauphin County	70,112	216,751
Trevorton	53,648	816,891
Broad Top	265,720	2,444,059
Northerly regions:		
Blossburg	411,759	2,101,457
Barclay	99,453	395,458
Total soft coal	3,170,493	21,023,028
Total hard coal	12,399,747	167,178,737
Total tons mined in Pennsylvania.	15,570,240	188,201,765

The quantity of coal mined in 1866 was 26 per cent greater than for 1865.

The following statement shows the inexhaustible coal resources of the several coal regions of Pennsylvania:

Name of Region.	Thickness coal in feet.	Contents per acre, tons.	Resources, in tons.
Schuylkill region	100	150,000	17,280,000,000
Middle Lehigh and Shamokin	60	30,000	5,472,000,000
Wyoming and Lackawanna	80	63,000	14,768,000,000
Total resources			37,500,000,000
Total available—⅓ lost in mining			25,000,000,000

Taking the quantities mined in 1866 as a basis, the Schuylkill region would be exhausted in..... 2,300 years.
Middle region would be exhausted in..... 1,216 years.
Wyoming and Lackawanna region would be exhausted in 1,969 years.

*Since 1845.

The above calculation is not a correct showing, as the average annual rate of increase of comsumption is from 15 to 20 per cent; but it serves to convey an idea of the magnitude of the coal resources of Pennsylvania.

Regions from which New York is Supplied.

The New York markets are mainly supplied from the most northerly regions, viz: Wyoming and Lackawanna, Blossburg and Barclay; the two latter being soft, and the former hard coals.

The Wyoming and Lackawanna region extends from eight miles west of Carbondale to Shickshinny, a distance of about 55 miles, with an average width of about 3½ miles. The total length of railroads within the limits of the basin is 140 miles, and 30 miles of canal. This basin has an area of 20,000 acres, with an average depth of 80 feet of coal, and, at the rate of production or yield in 1866, will take nearly 2,000 years to exhaust it, The Sullivan Company, anthracite coal field now being developed, lies 60 miles southeast of Elmira, embracing an area of nearly 40,000 acres. A vein of 12 feet in thickness is now being worked, and the coal is a very pure quality, containing 90 per cent of carbon. This recently discovered mine lies 50 miles nearer our State line than the most northerly anthracite coal.

Of bituminous coal, the Blossburg region sent to market over 400,000 tons, and the Barclay region nearly 100,000 tons. Both of these mines furnish the main supply of bituminous coal to western New York.

There are three lines of transportation leading directly into western New York from the anthracite coal region, and two lines from the bituminous mines. Those from the anthracite mines are "Delaware, Lackawanna and Western railroad," "North Branch canal," and the "Northern Central railroad." Those from the bituminous mines are "North Branch canal," and "Blossburg railroad." The distance from Pittston to Syracuse via the Delaware, Lackawanna and Western railroad is 152¾ miles, and from Pittston to its intersection with the Erie railroad at Great Bend 52¾ miles, thence by the latter 14½ miles to Binghamton. The distance from Pittston to Elmira via North Branch and Junction canal is 113 miles, or 95 miles from the mines to the State line, and the total distance by this route and the New York State canals to Syracuse 225 miles. The distance via the Northern Central railroad from the Shamokin mines to the State line is 123 miles, and to Elmira 138 miles, to Buffalo 296 miles. The distance from the Barclay mines to the State line via Barclay

railroad and North Branch canal is 32 miles, and to Elmira via Junction canal 50 miles. The distance from the Blossburg mines to the State line is 29 miles, and to Corning 40 miles, to Elmira 57 miles. Another line, a first class railroad, is now under construction along the route, and directly on the bank of the North Branch canal, making an additional outlet from the anthracite mines at Pittston, the Barclay and Sullivan county mines. The ruling grades of this railroad are below 10 feet per mile, which will make this route the main outlet from the anthracite coal fields.

The Delaware, Lackawanna and Western railroad leaves the coal valley with grades of about 75 feet per mile for 6 or 7 miles; thence ruling grades to Syracuse of from 30 to 45 feet per mile. The Northern Central has ruling grades against the trade of from 40 to 65 feet per mile. The North Branch canal from Pittston to the State line overcomes grades of $2\frac{1}{3}$ feet per mile, and from the State line to Elmira about $3\frac{8}{10}\frac{0}{0}$ feet per mile. The original size of this canal was 42 feet wide at surface, 26 feet at bottom, and $4\frac{1}{2}$ feet depth of water, and the locks 90 feet in length between quoins, and 17 feet wide, capable of passing boats of 100 tons burden; but from long use and frequent freshets the size is reduced to about 35 feet width at top, 24 feet at bottom, and 4 feet depth of water, capable of passing boats of only from 80 to 85 tons. The condition of this canal, and a current of not less than one mile an hour against the trade, greatly increases the cost of transportation over that of the ordinary canals of same capacity. The average actual cost of railroad transportation of coal over level grades does not exceed $4\frac{4}{10}\frac{1}{0}$ mills per ton per mile; and over canal lines of capacity to pass boats of 85 tons burden, the average actual cost, upon same basis as railroad, does not exceed $6\frac{1}{2}$ mills per ton per mile, both lines exclusive of profits to owners.

The following calculation shows the net load in tons of coal a first class engine will haul over the following grades at a speed of 15 miles an hour, also the cost per ton transporting the same:

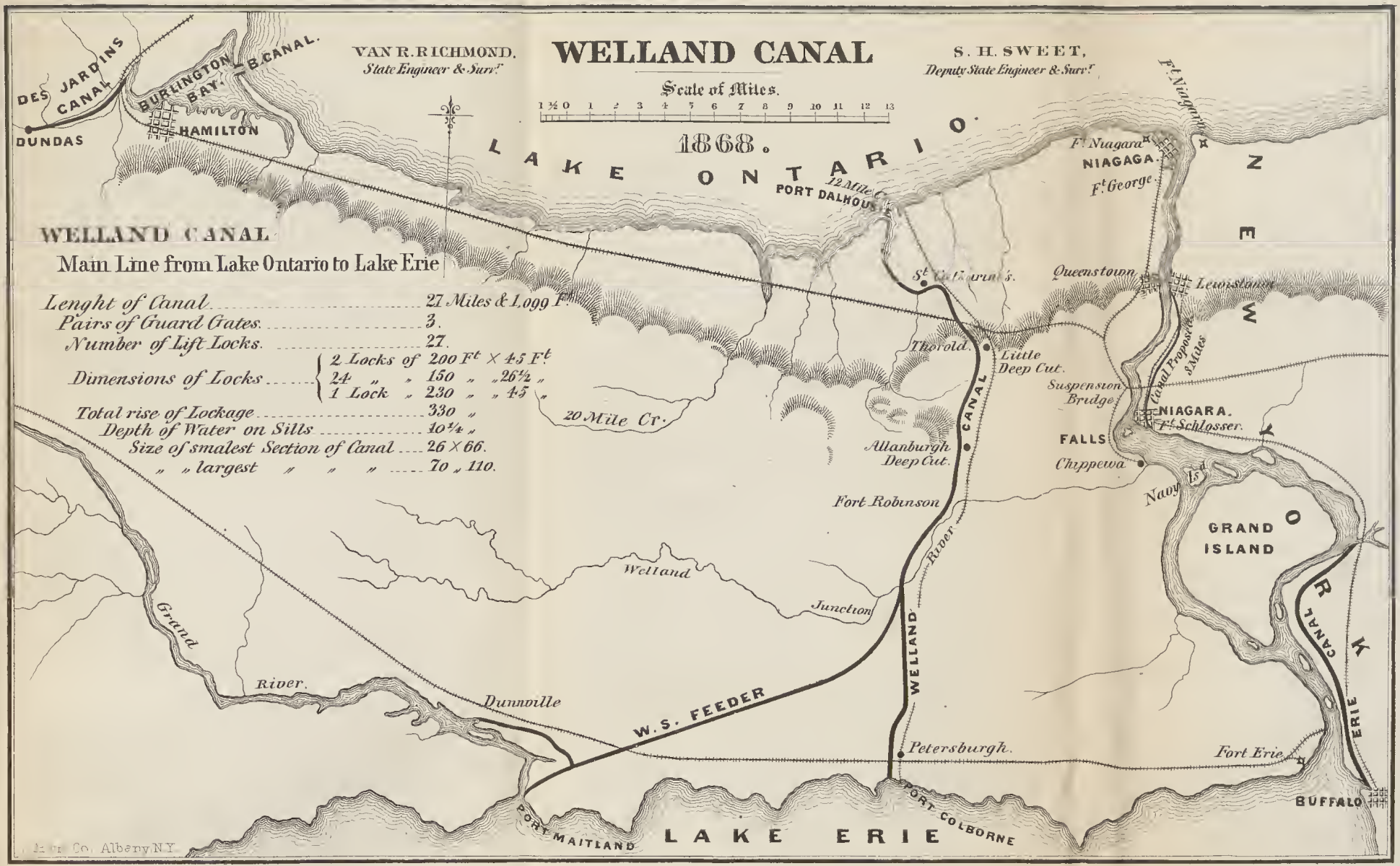
	Net load in tons (2,240 lbs.)	Number of cars.	Cost in mills per ton per mile.
On a level	690	69	4.40
Grade 10 feet per mile	480	48	6.40
Grade 20 feet per mile	350	35	8.70
Grade 30 feet per mile	250	25	12.10
Grade 40 feet per mile	230	23	13.40
Grade 50 feet per mile	200	20	15.60
Grade 60 feet per mile	170	17	18.30
Grade 70 feet per mile	154	15	20.20
Grade 80 feet per mile	130	13	24.00

From the foregoing statements, the actual cost of railroad transportation, with ruling grades of ten feet per mile, is equal to canal transportation with boats of 85 tons burden. It is believed fair to call the ruling grades of the Delaware, Lackawanna and Western railroad 30 feet per mile, and the Northern Central 40 feet per mile, and the North Branch Company's railroad 10 feet per mile. This will make the cost of transportation over the North Branch railroad 47 per cent less than over the Delaware, Lackawanna and Western, and 52 per cent less than over the Northern Central, and equal to the actual cost over their canal. Their relative capacities will be nearly in the same proportion. It shows, also, that when this road is completed, the great outlet for western New York from the anthracite region will pass over this route. The following statement shows the number of tons of anthracite and bituminous coal over the lines described during the year 1866, and delivered directly to the markets of western New York:

	Tons.
Over the Delaware, Lackawanna and Western railroad..	433,570
Over the North Branch canal.....	105,943
Over the Northern Central railroad.....	100,000
Total anthracite	639,513
Over the Tioga and Blossburg railroad.....	411,000
Over the Barclay railroad and Junction canal.....	100,000
Total anthracite and bituminous	1,150,513

This is equal to one-quarter of the entire yield or production from the entire Wyoming and Lackawanna region, nearly, if not quite, all of which is consumed in western New York. Of this quantity over 700,000 tons concentrate at, and distribute from, Elmira over different railroad lines to market.

Until the markets of western New York require more than the capacity of the lines mentioned, which is equal to the delivery of over one-half the present yield of all the mines in Pennsylvania, it is not very probable that any new lines of communication will be opened to the coal mines from that section of the State. There is no route over which new lines (except that now projected along the North Branch canal) can be projected with as favorable grades as those now in existence. If another line should be selected, it would, from the easy grades met with, be along and parallel with the road now being constructed by the North Branch Canal Company, through the Susquehanna valley, and terminating at or near Elmira. As


WELLAND CANAL
VAN R. RICHMOND, State Engineer & Surv.t
S. H. SWEET, Deputy State Engineer & Surv.t
Scale of Miles.
1 ½ 0 1 2 3 4 5 6 7 8 9 10 11 12 13
1868.
WELLAND CANAL
Main Line from Lake Ontario to Lake Erie
Lenght of Canal ..... 27 Miles & 1,099 Ft.
Pairs of Guard Gates ..... 3.
Number of Lift Locks ..... 27.
Dimensions of Locks ..... 2 Locks of 200 Ft × 45 Ft
24 " " 150 " " 26½ "
1 Lock " 230 " " 45 "
Total rise of Lockage ..... 330 "
Depth of Water on Sills ..... 10¼ "
Size of smalest Section of Canal .... 26 × 66.
" " largest " " " .... 70 " 110.
DES JARDINS CANAL
BURLINGTON BAY
B. CANAL.
DUNDAS
HAMILTON
LAKE ONTARIO
PORT DALHOUSIE
12 Mile Cr.
St. Catharines.
Thorold.
20 Mile Cr.
Allanburgh Deep Cut.
Fort Robinson
Welland Junction
Grand River.
Dunnville
W. S. FEEDER
WELLAND CANAL
Little Deep Cut.
Queenston
Lewiston
Canal Proposed 3 Miles
Suspension Bridge
NIAGARA FALLS
Ft. Schlosser.
Chippewa
Navy Is.d
GRAND ISLAND
NIAGARA RIVER
NIAGARA CANAL
Ft. Niagara
NIAGARA
Ft. George
Petersburgh.
Fort Erie
BUFFALO
ERIE
PORT MAITLAND
PORT COLBORNE
LAKE ERIE

regards grades, this is the most feasible route, and the natural outlet from the anthracite coal fields into western New York.

The actual cost of transportation of a ton of coal over the present water channels from the State line, a distance of 220 miles (the average distance transported, of all freight received upon the Chemung), over the Junction, Chemung, Cayuga and Seneca, and Erie canals, with present size boats of 85 tons burden, is as follows:

Junction canal	18 miles, tolls and freight	$0	33
Chemung canal.....	23 miles, tolls and freight		34
Seneca Lake canal	35 miles, tolls and freight		28
Cayuga and Seneca canal	21 miles, tolls and freight		15
Erie canal.....	103 miles, tolls and freight		56
Total distance	200 miles, and total actual cost.....	$1	66

Equal to eight mills per ton per mile.

The average annual rate of increase of the consumption of coal in western New York has been from 15 to 20 per cent. Calling it 15 per cent, the following shows the yearly increase by enlarging the channels suggested:

YEARS.	Total quantity coal sent into western New York.	Legitimate canal coal, tonnage each year.
	Tons.	Tons.
For 1866	1,150,000	700,000
1867	1,322,500	805,000
1868	1,520,870	925,750
1869	1,749,006	1,064,612
1870	2,011,356	1,224,303
1871	2,313,060	1,407,948
1872	2,660,019	1,613,140
1873	3,059,021	1,855,110
1874	3,517,850	2,133,370

From this statement the total coal tonnage sent over lines into western New York in 1874 will be 3,517,850 tons, and the legitimate canal coal tonnage, 2,133,370 tons.

CHAMPLAIN CANAL IMPROVEMENT.

The several laws, authorizing improvements of this canal, were to rebuild the locks of the same size as those upon the Erie canal, and to improve the prism by making it 35 feet in width at the bottom, and five feet depth of water; and that no part of the moneys thus

appropriated should be otherwise expended. These improvements were rendered imperative from the rapid increase in the tonnage of this canal, and were well, so far as they extended; but the enlargement of its prism without provision for rebuilding the slope walls and docking where required, to conform to the enlarged dimensions, and lining the top of the towing path with suitable heavy material instead of making it a line of deposits of the muck and clay from the excavations, was a serious mistake. But a partial benefit can be realized of the money already expended, without further legislation, for these additional improvements. The condition or capacity of the canal, where the new work has been completed, is but slightly improved, as the old walls and dockings are sliding into the prism, and the towing path rendered almost impassable during nearly one-third the season of navigation from the character of material deposited upon it from the excavation.

The cost of these additional improvements, exclusive of work authorized and under contract, will, upon the estimate of the Division Engineer, amount to $30,000.

The following statement shows the condition of the improvement of this canal of work authorized and under contract, &c.:

The total expenditures for improvement, are as follows:

Total expended by Superintendents for improvement, 1864 to 1867, both inclusive		$72,485 25
Total expended by repair contractors for improvement, 1865 to 1866, both inclusive		35,456 05
Total expended on contracts for improvement, 1865 to 1868, both in inclusive		412,450 89
Total expended for engineering for improvement, 1864 to 1868, both inclusive		38,486 72
Total expended for miscellaneous, up to Sept. 30, 1867		326 85
Total expended		$559,205 76
Estimated cost to complete work under contract		115,507 00
Estimated cost to complete work not under contract		30,000 00
Engineering expenses		12,795 19
Total cost of improvement		$717,507 95
Deduct amount of appropriations made:		
By act, chap. 186, Laws of 1864	$295,000 00	
By act, chap. 156, Laws of 1866	247,500 00	
By act, chap. 715, Laws of 1868	95,700 00	
		638,200 00
Deficiency, or amount of appropriations required to complete		$79,307 95

The direct connection of this canal with those of Canada and its commeree, its steady and rapid inerease in tonnage, the immense mineral resources of the regions around its souree, are faets which will be duly appreeiated in conneetion with the improvement of this canal.

The following statement shows the total tons of all property coming from other States over the canals via Buffalo, Oswego and Whitehall, from 1852 to 1867, both inclusive:

YEARS.	TOTAL TONS FROM OTHER STATES.		
	Via Buffalo.	Via Rome and Oswego.	Via Whitehall.
1852	768,877	381,104	107,941
1853	718,493	495,197	131,268
1854	756,880	324,511	108,848
1855	751,708	382,755	102,928
1856	698,774	513,776	91,254
1857	640,906	378,196	92,207
1858	786,286	481,322	93,069
1859	632,017	403,700	122,917
1860	1,195,466	700,860	104,150
1861	1,597,893	559,790	53,093
1862	2,001,669	592,739	72,601
1863	1,727,082	448,422	198,116
1864	1,469,808	435,284	192,532
1865	1,365,776	536,071	202,331
1866	1,619,272	509,332	220,888
1867	1,473,035	656,367	206,634

From the foregoing the inerease of 1867 over 1852 is, from Buffalo, equal to 91 6-10 per cent; from Rome, 72 1-10 per cent; and from Whitehall, 91 4-10 per cent.

The following statement shows the total amount of tolls received per mile, from the Erie, Oswego and Champlain canals, each year:

YEARS.	RECEIPTS FROM TOLLS PER MILE.		
	Erie. Length 350½ miles.	Champlain. Length 66 miles.	Oswego. Length 38 miles.
1860	$7,556 00	$1,895 00	$3,548 00
1861	10,240 00	1,391 00	3,564 00
1862	13,675 00	1,793 00	4,155 00
1863	12,093 00	2,324 00	3,922 00
1864	10,226 00	2,471 00	3,155 00
1865	9,839 00	2,551 00	3,496 00
1866	11,316 00	2,933 00	3,983 00
1867	10,364 00	3,000 00	4,058 00

The following statements are submitted, showing the extent and capaeity of the provineial eanals and water eommunieations of Canada that are brought in eonneetion with the Champlain canal. (See map.)

The total length of canal navigation between Montreal and New York, on this route, is 85 miles, and the total lockage, upwards and downwards, is 283 feet.

Table of distances in statute miles.

SECTIONS OF NAVIGATION.	Intermediate distances.	Total distances from Montreal.
Montreal to Sorel	46	.....
Sorel to St. Ours lock	14	60
St. Ours lock	.....	60
St. Onrs lock to Chambly canal	32	92
Chambly canal	12	104
Chambly canal to Province line	23	127
Boundary line to Champlain canal	111	238
Champlain canal to junction with Erie canal	64	302
Erie canal from Junction to Albany	9	311
Albany to New York	145	456

Table showing the size of the smallest locks on the canals of the St. Lawrence line of navigation; also, the dimensions of the largest vessels which may pass through them.

NAME OF CANAL.	DIMENSIONS OF LOCKS.			DIMENSIONS OF VESSEL.			
	Length	Breadth.	Depth of water on sill.	Length.	Breadth.	Dranght of water when loaded.	Tonnage.
St. Lawrence canals	200	45	9	186	44¾	9	600
Welland	150	26½	10¼	142½	26¼	10	400
Sault Ste. Marie	350	70 top / 61 bottom	12	.....	.....	.....	2,000
Carillon and Granville	106⅔	19¼	5½	95	18½	5	100
Rideau	134	32	5	110	31½	4½	250

Table showing the size of the smallest locks on the canals of the Richelieu and Lake Champlain line of navigation to New York; also, the dimensions of the largest vessel which may pass through them.

NAME OF CANAL.	DIMENSIONS OF LOCK.			DIMENSIONS OF VESSEL.			
	Length.	Breadth.	Depth of water on sill.	Length.	Breadth.	Dranght of water when loaded.	Tonnage.
Erie	110	18	7	98	17½	6½	210
Champlain	97	14	5	89	13½	3½	100
Chambly	122	23½	7	114	23	6½	230

ST. LAWRENCE NAVIGATION.

The St. Lawrence navigation extends from the straits of Belle Isle to Fond du Lac, at the head of Lake Superior, a distance of 2,385 statute miles.

The Canadian canals on this route are the Lachine, the Beauharnois, the Cornwall, the Farran's Point, the Rapide Plat, the Galops and the Welland. Their united length is 72⅝ miles, and the total lockage is 536½ feet, through 54 locks.

The Sault Ste. Marie canal 1 1/17 mile in length and 18 feet lockage, avoiding the Sault Ste. Marie, and uniting Lake Huron and Lake Superior, is an American work. Lake Superior is about 600 feet above the highest tidal flow of the St. Lawrence at Three Rivers.

Table of Distances.

SECTIONS OF NAVIGATION.	STATUTE MILES.	
	Intermediate distances.	Total distance from Belle Isle.
From the Straits of Belle Isle to the head of tide-water (Three Rivers)	900	.....
From head of tide-water (Three Rivers) to the Lachine canal	86	986
The Lachine canal	8½	994½
From Lachine canal to Beauharnois canal.....	15¼	1009¾
The Beauharnois canal.....	11¼	1021
From the Beauharnois canal to the Cornwall canal.....	32¾	1053¾
The Cornwall canal	11½	1065¼
From the Cornwall canal to Farran's Point canal.....	5	1070¼
The Farran's Point canal.....	¾	1071
From Farran's Point canal to Rapide Plat canal.....	10½	1081½
The Rapide Plat canal.....	4	1085½
From Rapide Plat canal to the Iroquois and Galops canal.....	4½	1090
The Iroquois and Galops canal.....	7⅜	1097⅜
From Iroqnois and Galops canal to the Welland canal.....	236⅝	1334
The Welland canal	28	1362
From the Welland canal to Sault Ste. Marie canal.....	625	1987
The Sault Ste. Marie canal	1	1988
From Sault Ste. Marie canal to Fond du Lac, head of Lake Superior.	397	2385

The straits of Belle Isle to Liverpool is 1,942 geographical or 2,234 statute miles. Total distance from Quebec to Liverpool, via Belle Isle and Malin Head, North Ireland, 2,661 geographical or 3,060 statute miles.

FINAL MAPS AND SURVEYS OF THE CANALS.

The work upon the final maps and surveys of the Erie canal is rapidly approaching completion. This work is of great importance since the completion of the enlargement, as there are many portions of the canal of which there are no maps in existence, and many made of an early date do not correctly show the changes that were subsequently made during the progress of the construction of the enlargement. A complete set of maps, showing the correct position of the lands appropriated for the canals by the State and the true locaiton of the enlarged canal, is the object to be obtained in this work.

In conclusion, I would most respectfuly call the attention of the Legislature to the reports of the Division Engineers herewith submitted. They show, in detail, the extent and character of work done and to be done upon repairs under the supervision of this department, also the condition of navigation the past season.

Respectfully submitted.

VAN R. RICHMOND,
State Engineer and Surveyor.

EASTERN DIVISION.

ANNUAL REPORT OF E. H. CROCKER, DIVISION ENGINEER FOR 1868.

DIVISION ENGINEER'S OFFICE,
ALBANY, October 1, 1868.

HON. VAN R. RICHMOND, *State Engineer and Surveyor:*

SIR—In accordance with the regulations established under act, chapter 169, Laws of 1862, I have the honor to present for your consideration my Annual Report, giving the condition of all work in progress, and the number and compensation of all persons who, during the fiscal year ending September 30th, 1868, have been employed in this department, on the Eastern Division of the New York State canals.

The navigable canals, river improvements and feeders remain the same as last year, and are as follows:

	Miles.
Erie canal, from Albany to east bank of Oneida Lake canal..	133.58
Albany basin (called 1 mile, for tolls, chap. 200, Laws of 1849)	.77
Port Schuyler and West Troy side cuts	.35
Pond above Troy dam	3.00
Champlain canal and Waterford side cut	66.00
Glen's Falls feeder and pond above	12.00
Black River canal	35.33
Black River feeder and pond above dam	12.09
Delta feeder	1.38
Black River improvement	42.50
Total Eastern Division	307.00

FEEDERS NOT NAVIGABLE.

Mohawk river at Rexford Flats	0.39
Schoharie creek	0.63
Mohawk at Rocky Rift	3.92
Mohawk, south side, at Little Falls	0.19
Mohawk, north side, at Little Falls, partly navigable	0.50
Mohawk at Rome	0.05
Total length	5.68

RESERVOIRS.

NAMES.	Area of surface. Acres.	Average area. Acres.	Depth. Feet.	Capacity. Cubic feet.
Woodhull	1,326	1,118	18	876,550,000
North Branch (can be filled twice yearly)	423	277	28	310,000,000
South Branch	518	372	26	421,190,000
Totals	2,177	1,767	..	1,607,740,000

SUPPLY OF WATER FOR ERIE CANAL.

		Distance to be supplied in miles.	Quantity furnished in cub. ft. per min.
Champlain canal from Mohawk river at Cohoes		7	6,570
Mohawk river at Rexford Falls		20	10,979
Schoharie creek		25	6,800
Mohawk river at Rocky Rift		27	10,602
Mohawk river at Little Falls		9	12,643
Ilion creek	800		
Chenango canal	911		
Butts' creek, 2½ miles east of Rome	1,400	48	16,296
Mohawk and Black river at Rome	11,766		
Black River canal	1,294		
Wood creek at Rome	125		
Total		136	63,890

SUPPLY OF WATER FOR CHAMPLAIN CANAL.

From the junction with Erie canal, at West Troy, to a point one mile north of Waterford, a distance of five miles, the supply is from the Mohawk river at Cohoes; from one mile north of Waterford to the crossing of the Hudson river, two and a quarter miles south of Fort Miller, a distance of twenty-five miles, the supply is from the Hudson river at Saratoga dam; from that point to Whitehall, a distance of thirty-five miles, the supply is from Glen's Falls feeder and Wood creek.

SUPPLY OF WATER FOR BLACK RIVER CANAL.

From the junction with Erie canal at Rome to lock No. 9, seven miles, the supply is from the Delta feeder, taken from Mohawk river; from lock No. 9 to lock No. 34, ten miles, the supply is from Lansing

Kill feeder; from lock No. 34 to lock No. 102, seventeen miles, the supply is from the Black River feeder; from lock No. 102 to lock No. 109, one and a third miles, the supply is from the pond above dam at Lyon's Falls.

The water furnished by the reservoirs is drawn only in the very dry season, and passed down through the natural channels of Black River and Woodhull, about twenty miles each, to the pond above dam, at head of Black River feeder; thence the necessary quantity is taken into said feeder and passed to the summit level at Booneville. From this point, the canal is supplied both ways; and the balance, designed for the use of the Erie canal, is passed off by a waste-wier into the Lansing Kill at the south end of the summit, thence into the Mohawk river, from which it enters the Erie canal by the feeder at Rome.

ENGINEER DEPARTMENT.

On the last day of the fiscal year, the number of persons employed in this department, was twenty-one, exclusive of the Division and Resident Engineers. Of these, nine were assigned to the repairs of the Erie and Champlain canals, two to the improvement of the Black River, and the balance to the improvement of the Champlain canal, including the dredging of the Whitehall basin.

The annexed table, No. 1, exhibits the name, rank, period of service, and compensation of all persons employed, and the amount expended for engineering during the fiscal year.

Act, chapter 169, Laws of 1862, places the extraordinary repairs of the canals under the general supervision of the engineers appointed by the Canal Board, and the expenditures for engineering under this head, were for the fiscal year as follows:

Repairs of Erie canal	$5,442 44
Repairs of Champlain canal	4,531 60
Repairs of Black river	249 48
Total	$10,223 52

The improvement of the Champlain canal, under act, chapter 184, Laws of 1864, and the construction of lock and dam on Black River, act, chapter 151, Laws of 1864, have been in progress, under the supervision of this department, and the expenditures for engineering during the fiscal year, were as follows:

Improvement of Champlain canal	$10,045 50
Improvement of Black River canal	2,744 01
Total	$12,789 51

The work on extraordinary repairs, ordered by the Canal Board, and authorized by special laws, has been under the supervision of the Engineer Department, and the expenditures for engineering were paid by the Canal Commissioner up to, and including February 20th, but subsequent to that time, such expenditures were paid by this department, and are included in the foregoing amount on extraordinary repairs.

The payments thus made by the Commissioner, are as follows:

Extraordinary repairs, Erie canal	$585 00
Improvement Champlain and Black River	1,155 00
Total	$1,740 00
Ordinary repairs	10,223 52
Improvement Champlain and Black River	12,789 51
Total for fiscal year	$24,753 03

WORK ON THE DIFFERENT CANALS.

During the fiscal year the amount of work done on all the canals under the immediate supervision of this department was as follows:

Erie Canal.		
Ordinary repairs under contract	$25,794 02	
Extraordinary repairs	18,142 36	
Total		$43,936 38
Champlain Canal.		
Ordinary repairs under contract	$17,051 32	
Extraordinary repairs under contract	46,218 63	
Extraordinary repairs, not under contract	1,758 88	
Improvement Champlain canal	50,673 50	
Total		115,702 33
Black River Canal.		
Lock and dam on Black River	$18,800 00	
Extraordinary repairs	1,280 00	
Total		20,080 00
Total work done		$179,718 71

Work done on ordinary repairs by repair contractors, subject to the advice and direction of this department, was as follows:

ERIE CANAL.

Section No. 1	$70,000 00	
Section No. 2	32,450 00	
Section No. 3	19,945 00	
Section No. 4	23,417 50	
Section No. 5	12,625 00	
Total		$158,437 50

CHAMPLAIN CANAL.

Section No. 1	$23,600 00	
Section No. 2	21,399 75	
Section No. 3	17,750 00	
Total		62,749 75

BLACK RIVER CANAL.

Section No. 1	$16,440 00	
Section No. 2	7,980 00	
Section No. 3	9,750 00	
Total		34,170 00
Total for division		$255,357 25

DESCRIPTION OF WORK DONE DURING THE YEAR—ERIE CANAL.

ORDINARY REPAIRS.

On the 24th of July, an examination of the State dam at Troy having been made, it was found to be in such a condition as to require prompt attention to have time to repair it this season, as seemed necessary; and as act, chapter 231, Laws of 1868 appropriated $12,000 for its repairs, it was immediately placed under contract and the work commenced. Owing to the great amount of rain and the frequent freshets, it has not progressed as was desirable, and cannot be completed this fall; but the worst portion of it has been overhauled and put in a safe and substantial condition.

The draw bridge, authorized by act, chapter 681, Laws of 1868, has been built, and on the 1st of September the dredging of the Albany basin was resumed by the contractor for repairs of section No. 1. The following were the breaks and detentions of the past year: On the 16th of March a great flood and breaking away of the ice occurred in the Mohawk river, which, by damming up, set the water back over the adjacent country, thereby injuring much of section No. 2, Erie canal, and in one place, about two miles above the lower Mohawk aqueduct, causing a heavy breach through the towing path

bank, which, with several minor breaches, was repaired and made ready by the opening on the 23d of April. On the 27th of May a break occurred at the old dry dock on the berme side just below lock No. 46 at Utica. This was caused by the imperfect condition of gate and side banks to dry dock, and navigation was consequently interrupted for nearly five days. September 18th, it became necessary to draw off the water to repair the foundation of lock No. 41. This also caused five days' delay. There have been other detentions, chiefly from a scarcity of water but these will be mentioned in another part of this report.

Extraordinary Repairs.

The following work, authorized by act, chapter 579, Laws of 1867, has been completed:

Vertical wall along the berme bank in the village of Fort Plain; vertical wall on berme side, and raising guard bank in the city of Utica, and east of the village of Rome; and vertical wall to protect aquednct and feeder at Little Falls.

The following work authorized by general and special acts of 1868 has been placed under contract by the Board of Canal Commissioners, and most of it is in a fair state of progress:

Removing iron bridge from Washington street to George street, in the village of Rome, and building iron bridge with two roadways and sidewalks at Washington street; removing slope wall and wall bench, and constructing 900 lineal feet of docking on the berme side in the same village; iron bridge at Port Jackson; removing slope wall and wall bench, and constructing slope and pavement wall from lock No. 20 to a point one mile above the upper Mohawk aqueduct; removing slope wall and wall bench, and constructing slope and pavement wall from lock No. 2 to Port Schuyler; rebuilding lock No. 2.

Act, chapter 422, Laws of 1868, provides for the construction of "a suitable highway bridge on the Erie canal in the town of Watervliet, county of Albany, from the Ireland's Corners road on the west of said canal, to Island Park on the east of said canal," and appropriates $4,000. A detailed estimate of the cost of this bridge is $6,700, and on account of the insufficiency of the appropriation, this bridge was not let.

CHAMPLAIN CANAL.

Ordinary Repairs.

Aside from the repair contracts, no special items of ordinary repairs have occurred, except the rebuilding of Fort Miller lock. This structure was built on the enlarged size, the difference in cost between that and the old plan being provided for by act, chapter 579, Laws of 1867.

The breaks and detentions on this canal were as follows: On the 3d of July, the sluice around the five combined locks gave way, and the water passing under the foundation at head, carried out the greater portion of the earth from beneath the trunk, which consequently dropped down a shapeless mass. It required four days to repair it and restore navigation on the feeder, but in the mean time, by passing water through the locks, the passage of boats on the main canal was but slightly interrupted.

On the 13th of May, the lower gates of the combined side-cut locks at Waterford were carried out and replaced with an entirely new set, after eight days' delay. Navigation, however, was but partially impeded, as boats could go by the way of Cohoes, and into the river at West Troy.

During the day and night of September 12th, an unusual rain storm prevailed along the line of canal, the banks of which, by overflowing in several places, caused four heavy breaches; one, two miles south of Fort Ann, one at Dunham's basin, one at Fort Edward, where Bond's creek passes under the canal, and one, two miles south of Schuylerville. In addition to these, a number of lesser breaches occurred, and navigation was not fully re-established until October 2d, after a suspension of twenty days.

IMPROVEMENT OF CHAMPLAIN CANAL.

According to the last annual report of the late Division Engineer, all of this work, with the exception of about ten miles of the canal proper, and some five miles of Wood creek, was pronounced to be in a state of completion last fall.

The following table shows the state of improvement at the end of this fiscal year:

Work Completed.	Miles.
Waterford level	2.28
From first lock north of Waterford to Hewitt's lock	4.60
From Hewitt's lock to Becker's lock	4.20
Section No. 1, 16 mile level	4.00
Section No. 2, 16 mile level	4.00
Section No. 3, 16 mile level	3.78
Section No. 4, 16 mile level	4.22
Section No. 1, 12 mile level	4.00
Raising towing path on Wood creek	1.55
Whitehall level	5.50
Glen's Falls feeder	7.00
Total miles	45.13

Not Completed. (*See table No. 2.*)	Miles.
From Saratoga lock to Fort Miller lock	2.60
From Fort Miller lock to Moses Kill lock	2.65
From Moses Kill lock to Fort Edward lock	5.50
Section No. 2, 12 mile level	4.08
Section No. 3, 12 mile level	3.50
Raising towing path on Wood creek	4.60
Total miles	22.93

Last winter, in cutting away the towing path to get the required width at a point about one mile below Fort Edward, most of the face of the old bank was removed, in some places as much as ten feet being cut off. A vertical wall, laid partly with and without cement, was then built to protect the bank, which at that point is some twenty-five feet in height, the rear slope extending to the river. In the spring, after the water was let in, about eight hundred feet of this bank began to slide bodily into the river, in some places breaking down to within a few feet of the water's edge. Thorough soundings showed a stratum of hardpan from six to ten feet beneath the surface of ground, and upon this the vast volume of earth seemed to slide. Piling being useless upon a hard material so near the surface, directions were given to put in a number of timber cribs filled with stone, after excavating pits to the hard material for them, a certain distance from and parallel to the canal. This was done and with apparent success, as no further indications of sliding have been perceptible. In my judgment the widening should have been done on the berme side, as was originally designed, and the high bank below canal and river kept intact.

Under act, chapter 715, Laws of 1868, the following work was let by the Canal Commissioners, after the maps, plans and estimates had been examined and approved by the Canal Board:

Raising and paving towing path on Wood creek from Parish lock to the guard lock; also from lower creek at Fort Ann to the Narrows. This work is making reasonable progress.

In estimating the amount required to complete the improvement, the raising of the banks and graveling the towing path, and the building of docking and vertical or slope walls, where absolutely necessary, have been included. This work should be done on that portion of the canal from Fort Miller bridge to Fort Ann, a distance of twenty-two miles, and on the Whitehall level, a distance of five and one-half miles; also on about two miles of the Glen's Falls feeder which have never been widened and deepened as contemplated by the law, in all twenty-nine and one-half miles, of which eighteen miles are under contract. I have also included the cost of the much needed improvement at the "Narrows" on Wood creek.

The account of the work, including the raising and paving of the towing path on Wood creek, and the funds thus far appropriated will stand as follows:

Work done by Superintendent in 1864 ..	$8,268 27	
" " 1865 ..	22,959 61	
" " 1866 ..	39,617 39	
" " 1867 ..	1,639 98	
		$72,485 25
Work done by repair contractors in 1865..	$10,066 33	
" " 1866..	25,389 72	
		35,456 05
Work done on contract in 1865.....	$46,909 74	
" " 1866.....	94,965 87	
" " 1867.....	219,901 78	
" " 1868.....	50,673 50	
		412,450 89
Engineering in 1864.....	$491 55	
" 1865.....	2,266 79	
" 1866.....	10,030 12	
" 1867.....	15,652 76	
" 1868.....	10,045 50	
		38,486 72
Miscellaneous expenses up to Sept. 30, 1867.....		326 85
Total expended.....		$559,205 76
Estimated cost to complete work under contract	$115,507 00	

Estimated cost to complete work not under contract	$30,000 00	
Amount required for engineering	12,795 19	
		$158,302 19
		$717,507 95

APPROPRIATIONS.

By act, chap. 186, Laws of 1864	$295,000 00	
" " 156, " 1866	247,500 00	
" " 715, " 1868	95,700 00	
		$638,200 00
Deficiency		$79,307 95

The present appearance of this canal does not indicate that, during the past few years, so large an amount had been expended on it, in addition to the sum spent for repairs. Aside from bottoming out and widening it, and that, too, in many places imperfectly, the canal has not received any substantial benefit from this large outlay. With the exception of some of the bridges and their abutments, the mechanical structures remain untouched, and are generally in a dilapidated condition. It seems that this improvement of the canal proper is claimed to be about complete, although very much of it has the appearance of never having been commenced. The outlay has not accomplished the purposes designed by the advocates of the improvement, nor has it placed the canal in a condition to accommodate the great and constantly increasing business of that section of the country. From the Hudson river at Fort Miller bridge to Whitehall, the greater portion of this canal is in a very poor condition, literally worn out, and it will require an immense expenditure of money to put it in good repair, while the same amount, if properly and judiciously applied, would go a great way towards enlarging it. Notwithstanding all the unfavorable circumstances under which, for several years past, this canal has been placed, the amount of business done on it has been constantly increasing. The gain in tonnage from 1837 to 1847, was 20 per cent; for the next ten years, 74 per cent; and for the next ten years up to and including the year 1867, 91 per cent. The tonnage for 1867 was 1,047,440, an increase of nearly 46,000 tons over that of the previous year. It is greater by 57 per cent than was that of the Erie in 1857, at the commencement of the enlargement, and 55 per cent greater than that of the Oswego in 1851, the time of the commencement of its enlargement. The

amount of tolls received on the Champlain canal for the fiscal year ending September 30th, 1868, was $204,118.00. In view of these facts, it is quite evident that, at the earliest possible period, this canal should be enlarged to the size of the Erie. The increasing business and consequent accruing benefits to the State demand it.

Of the 24 locks on this canal, 17 have been constructed to correspond in size with those on the Erie. One is under contract to be rebuilt on the enlarged size, leaving 5 lift, and one guard lock, to be similarly constructed. Provision should be made for rebuilding these, and for enlarging the prism to a corresponding size, in order that, at the earliest date, the benefit of the whole work may be fully realized.

EXTRAORDINARY REPAIRS.

Fort Miller lock, rebuilt on the enlarged plan, was completed and ready for navigation last spring. This work was executed in good style, and much credit is due to the contractor for his active efforts in pushing it forward to a timely completion. A tumble gate, with further improvement in the gearing, was also inserted in this lock, and works admirably.

The improvement above sloop lock at Troy, pier at Whitehall, sluices around locks Nos. 2, 4, 5, 8, and 12, Glen's Falls feeder, and the highway bridge at Saratoga street, Schuylerville, have all been completed.

The following work, authorized by general and special laws, has been put under contract:

Dam across the Mohawk river at Cohoes (to be built of stone); Becker's lock, to be rebuilt on the enlarged size; iron bridge at Schuylerville; iron bridge at Fort Edward; iron bridge of George F. Dudley at Fort Ann; and dredging Whitehall basin. Act, chapter 715, Laws of 1868, appropriated $2,640.00 for cutting big bevels out of the locks on the Glen's Falls feeder. By resolution of the Canal Board, the Commissioner in charge was authorized to do this work at a cost not exceeding the appropriation, and on the 1st of April it was commenced under the direction of this department. At first the bevels were removed from both sides of the locks, but on finding that the cost would exceed the amount appropriated, it was determined to remove them from one side only, and out of the twelve locks eight of them have been thus partially completed. Act, chap. 424, Laws of 1868, authorized the Canal Commissioner to construct and

maintain on the farm of Lydia Ann Weaver, in the town of Waterford, Saratoga county, a wooden bridge with stone abutments, to be paid for out of any money appropriated, or to be appropriated, for the repairs of the canals; and act, chap. 438, Laws of 1868, authorizes the construction of a highway bridge at William street, in the village of Mechanicsville. Both these bridges were advertised and let on the 1st of September.

BLACK RIVER CANAL.

Ordinary Repairs.

Aside from the repair contracts, no special items of extraordinary repairs have occurred.

Extraordinary Repairs.

With the exception of materials furnished, nothing of consequence has been done under the contract for enlarging, widening and deepening the first level of the Black River canal at Rome, authorized and let under act, chap. 579, Laws of 1867. This work was to have been completed on the 1st of May last, and probably it would have been done but for keeping the water in the Erie canal during last winter, and thus depriving the contractor of that time to perform the work.

Act, chap. 519, Laws of 1868, authorized the construction of an iron bridge over the Black River canal in the village of Port Leyden, and appropriated $3,500.00 to pay for the difference between that and a bridge built on the old plan. Under the terms of this contract the repair contractor on that section should do this work and be paid the difference in cost, as the law provides. He has accordingly been notified to proceed with the work.

IMPROVEMENT OF BLACK RIVER.

The construction of the lock and dam about three miles above Beach's bridge, has progressed very satisfactorily, and will be fully completed by the 1st of November. The construction of this work will add much to the facilities of navigation on that river. An additional appropriation of $12,000 will be necessary to settle the final account.

GENERAL IMPROVEMENTS.

Erie Canal.

The construction of the two side cut locks in the village of West Troy, as authorized by act, chap. 354, Laws of 1864, and the cost of construction provided for by act, chap. 579, Laws of 1867, is much needed as a means of the more rapid passage of boats from the canal, at that place, into the river. The latter act specifies that neither of these locks shall be constructed of the size contemplated by the former act, if it shall be authoritatively determined to build the locks on the Erie canal of a larger size than those now in use. The project of enlarging one tier of the Erie locks, as advocated a few years ago, seems to have entirely died away; nor is it likely that it will be again revived; hence, the necessity for early action, with the view of having the required structures speedily completed.

In addition to the work covered by existing contracts, some sixty-one miles of the old wall benches still remain in the canal on this division, and are a great impediment to free navigation. They are distributed as follows:

	Miles.
Between locks Nos. 3 and 18	3.30
" lock No. 18 and Schenectady	9.90
" lock No. 23 and Fultonville	5.80
" Spraker's and Little Falls	18.30
" Little Falls and Utica	21.40
" Newville and Wood creek, through Rome	2.50
Total	61.20

These benches should be removed as rapidly as possible, and the work commenced where the banks are lowest and most insecure. Between locks Nos. 40 and 44, a distance of about nine miles, the towing path bank is very low, and in many places subject to overflow at an ordinary stage of level. Here the work would serve the double purpose of improving the prism, and raising and securing the banks. A vertical wall, laid in cement, is very much needed on the berme side of canal in the western part of the city of Utica, from the old dry dock, just below lock No. 46, to a point some five or six hundred feet eastward. The bank is high and apparently weak, and a break there would do much damage to property in the city. Several of the culverts and waste-wiers are in a very unsafe condition, and need attention. The culvert, just west of lock No. 44,

should be lengthened some ten or fifteen feet on the towing path side, and the bank widened and strengthened. The bank is now supported in the rear by heavy timber braces, and is in an unsafe condition. The large waste-wier at Schenectady, although a very important one, has for a long time been entirely closed. It should be taken up and relaid upon a substantial foundation of timber and piling. Those just above locks Nos. 39 and 40 are in a similar condition, and at times render the water on these levels unmanageable. The recent heavy rains have forcibly demonstrated the necessity of constructing spill-ways as a means of preventing breaches and other damage to the banks from overflow. If located at proper points at or a little above water line, and built of suitable paving stone connecting with the slope wall in front, and extending over the bank to toe of rear slope, and made the requisite length, they would, in my opinion, prove of great service in preventing disastrous breaches and delays. The foundations to several of the locks require careful attention to prevent damage to the masonry. Unfortunately, concrete was not used in their original construction, and the earth and gravel have been forced out by the action of the water, leaving, in the absence of piling, no support to the timbers; hence, the floor yields to the heavy pressure of a full lock, allowing communication with the culvert and lock adjacent as they are alternately filled and emptied. It was a case of this kind that at lock No. 41, on the 18th of September, suspended navigation for five days. The removal of the floor planking and the thorough concreting of the foundation, are the chief remedies for these failures. Where small streams flow into the canal on the berme side, the construction of *receivers* to arrest the sand and gravel would prevent the formation of bars in the canal. They could be cleaned out in the spring, and the deposited material, which would generally be washed gravel, could be used to improve the towing path.

Extensive repairs of culverts, waste-wiers and aqueducts are absolutely necessary before the opening next spring. The lock gates in particular are generally very much dilapidated, and a large proportion of them will have to be renewed. Poor, decayed, leaky gates, difficult to operate, are a fruitful source of annoyance and delay. Bills of timber have been ordered with a view to this important item of repairs.

Embarrassments of a very serious nature continue to occur on the long level and between Utica and Little Falls, on account of the

insufficient supply of water. If possible some mode of relief should be devised as soon as practicable; and I am strongly of the opinion that the remedy would be in the early construction of the Fish creek feeder, as proposed and recommended by able engineers and Canal Commissioners heretofore in charge of this division. On the completion of the Oneida Lake canal the demand for an increased supply will still be greater.

CHAMPLAIN CANAL.

The Saratoga dam and the one at the head of Glen's Falls feeder, the former 875 and the latter 800 feet long, are similar in construction to that across the Mohawk river at Cohoes. In the last two annual reports of my predecessor, particular attention is directed to the dilapidated and unsafe condition of these structures, which are recommended to be rebuilt of stone as soon as the means for so doing can be provided. As before stated, the latter is under contract, and the former two I have personally examined and find them in this unsafe condition. The failure of either would completely stop navigation on this canal, and, as early as possible, provision should be made for building new substantial stone structures. There are some six waste-wiers that should be taken up and rebuilt during the coming winter and spring; also two small culverts, one just above Mechanicsville, and the other a mile south of Fort Ann; the latter one has entirely failed. The large stone culvert, for conducting Wood creek under the canal at Fort Edward, was destroyed by the breach on the 13th of September, and must be rebuilt the coming winter. As a matter of economy, all of these structures of a permanent character should be rebuilt with reference to a prism of the enlarged Erie dimension, and it is quite important that provision for this purpose should be made. The guard lock, sluices and bulkhead at the head of the Glen's Falls feeder are in a bad condition and should receive early attention. In 1867 the sum of $20,000 was added to the deficiency bill for this work, but for some unknown reason no definite action has since been taken in reference to it.

I would also recommend the construction of spill-ways on this canal, especially on the sixteen and twelve mile levels. So many small streams empty into it on the west side, and the surface drainage is so great that during excessive rain storms it is difficult to control the water, and the land having been generally cleared of wood and underbrush, the water of late years has been unobstructed, and by accumulating

much more rapidly, floods and damages not only the banks of the canal, but also the farms adjacent. I have no doubt that claims for such damages are now made against the State sufficient in amount to make several times over the required improvements.

The lock gates on this canal are generally much out of repair, and bills of timber have been ordered with a view to the better condition of the work before the opening of next spring.

The wooden sluice around the five combined locks on the Glen's Falls feeder must be rebuilt this winter, as much difficulty and risk have been encountered in making it stand during the season.

BLACK RIVER CANAL.

Of the 109 locks on the canal proper, at least two-thirds of them are in a very leaky condition; the mortar seems to have almost entirely disappeared from the joints of the chamber walls, and when filled, the locks leak profusely, damaging the embankments, and making it very difficult to operate the upper gates. Most of the sluices are also very much out of repair. The east abutment of the dam at Otter creek needs protecting with a heavy rip-rap wall, and the west bank adjacent to lock, and opposite the entrance of Otter creek, is in much need of protection by either rip-rap or slope wall, to prevent the creek from washing away the bank, especially in times of high water. The deposits of bark from the tanneries on the tributary streams, and the saw dust from the saw mills on the river, are getting to be very troublesome, and add largely to the dredging required on that section. I am inclined to think that in order to remedy this evil, some legislation is necessary. Some repairs are needed at the reservoirs; the high docking on each side of the discharge channel at Woodhull is very much decayed and should be renewed. The chute at North branch requires repairing, and the valve gearing at all of the reservoirs needs attention. Owing to the almost impassable condition of the road or trail leading to Woodhull, it is very difficult to gain access to that imporant reservoir, and provision should be made for improving it.

The lock gates like those on the other canals, are generally in a bad condition. So far as this division is concerned, the repairs absolutely necessary to be done before the resumption of navigation next spring, are too numerous to mention in detail, and it will require active efforts, and a vast outlay to do the work. Whether or not it can be done under the present system, remains to be seen, but the past gives

little encouragement to the future. Decay and dilapidation have been rapid, and almost unheeded, in spite of the solemn protestations of eminent canal officials and the immense business interests involved. Whoever advocates the continuance of this system is either profoundly ignorant of the condition of the canals, or unfriendly to their maintenance and prosperity. It touches only to blight and destroy; it impairs confidence and diverts trade; any other would be better; no other could be worse or more destructive.

Respectfully submitted.

E. H. CROCKER,

Division Engineer, Eastern Division.

TABLE No. 1.

Showing the number and compensation of engineers employed on the Eastern Division of the New York State canals, together with incidental expenses from October 1, 1867, *to September* 30, 1868.

REPAIRS ERIE CANAL.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
D. C. Jenne	Division engineer	.....	$2,000 00	$175 00	
D. C. Jenne	Travel	.....	.....	30 00	
O. L. Wetmore	Division engineer	.....	2,000 00	176 00	
O. L. Wetmore	Travel	.....	.....	65 04	
E. H. Crocker	Division engineer	.....	2,000 00	505 58	
E. H. Crocker	Travel	.....	.....	161 04	
O. L. Wetmore	Resident engineer	.....	1,700 00	118 65	
O. L. Wetmore	Travel	.....	.....	39 68	
Peter Hogan	Resident engineer	.....	1,700 00	300 00	
Peter Hogan	Travel	.....	.....	166 50	
John A. Cooper	Assistant engineer	109	5 00	545 00	
W. H. Printup	Assistant engineer	96	5 00	480 00	
F. A. Utter	Assistant engineer	43	5 00	215 00	
G. F. Oliver	Assistant engineer	79	5 00	395 00	
R. J. Cantwell	Assistant engineer	192	4 50	864 00	
John F. McQuade	Rodman	79	2 50	197 50	
H. T. N. Robison	Rodman	78	2 00	156 00	
R. N. Jenne	Assistant in office	10	3 00	30 00	
C. K. Eigabroadt	Inspector	57½	4 00	230 00	
L. M. Clement	Inspector	35	4 00	140 00	
					$4,989 99
	Incidental Expenses.				
	Stationery	.....	.....	$193 47	
	Postage and telegraph	.....	.....	170 99	
	Miscellaneous	.....	.....	87 99	
					452 45
	Total Erie canal	.....	.....	.....	$5,442 44

REPAIRS CHAMPLAIN CANAL.

D. C. Jenne	Division engineer	.....	$2,000 00	$100 00	
D. C. Jenne	Travel	.....	.....	20 00	
O. L. Wetmore	Division engineer	.....	2,000 00	210 66	
O. L. Wetmore	Travel	.....	.....	13 80	
E. H. Crocker	Division engineer	.....	2,000 00	517 35	
E. H. Crocker	Travel	.....	.....	166 54	
O. L. Wetmore	Resident engineer	.....	1,700 00	134 68	
O. L. Wetmore	Travel	.....	.....	15 00	
W. B. Cooper	Resident engineer	.....	1,700 00	565 02	
W. B. Cooper	Travel	.....	.....	122 92	
Peter Hogan	Resident engineer	.....	1,700 00	180 00	
Peter Hogan	Travel	.....	.....	90 90	

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
W. B. Cooper	Assistant engineer	157	$5 00	$785 00	
John A. Cooper	Assistant engineer	24	5 00	120 00	
E. H. Ball	Assistant engineer	27	4 50	121 50	
W. H. Newkirk	Assistant in office	15	3 00	45 00	
Halleck Holbrook	Rodman	78	2 50	195 00	
Halleck Holbrook	Rodman.	79	3 00	237 00	
Joseph Dewey	Axman	26	2 00	52 00	
Dana Reed	Inspector	171	4 00	684 00	
L. M. Clement	Inspector	14	4 00	56 00	
Edward Cunningham	Inspector	13	4 00	52 00	
J. E. Locke	Inspector	6	3 50	21 00	
					$4,505 37
	Incidental Expenses.				
	Postage and telegraph	.....	.....	.....	26 23
	Total Champlain canal	.....	.....	.....	$4,531 60
	REPAIRS BLACK RIVER CANAL.				
D. C. Jenne	Division engineer	.....	$2,000 00	$58 33	
D. C. Jenne	Travel	.....	.....	14 00	
O. L. Wetmore	Division engineer	.....	2,000 00	59 75	
O. L. Wetmore	Travel	.....	.....	10 40	
O. L. Wetmore	Resident engineer	.....	1,700 00	30 00	
O. L. Wetmore	Travel	.....	.....	12 00	
John A. Cooper	Assistant engineer	13	5 00	65 00	
	Total Black River canal	.....	.....		$249 48
	Total repairs	.....	.....	.....	$10,223 52
	IMPROVEMENT CHAMPLAIN CANAL.				
Peter Hogan	Resident engineer	.....	$1,700	$150 00	
Peter Hogan	Travel	.....	.....	31 80	
O. L. Wetmore	Assistant engineer	15	5 00	75 00	
W. H. Printup	Assistant engineer	139	5 00	695 00	
W. B. Cooper	Assistant engineer	27	5 00	135 00	
J. A. Watkins	Assistant engineer	284	5 00	1,420 00	
John A. Cooper	Surveyor and draughtsman	29	5 00	145 00	
John A. Cooper	Assistant engineer	98	5 00	490 00	
F. A. Utter	Assistant engineer	91	5 00	455 00	
M. H. Roberts	Assistant engineer	192	4 00	768 00	
E. H. Ball	Assistant engineer	113	4 00	452 00	
E. H. Ball	Assistant engineer	26	4 50	117 00	
G. F. Oliver	Assistant engineer	92	4 00	368 00	
Thos. L. Dalton	Surveyor and draughtsman	5	4 00	20 00	
M. H. Roberts	Leveler	102	4 00	408 00	
E. H. Ball	Leveler	122	4 00	488 00	
B. H. Brevoort	Leveler	52	3 00	156 00	
A. McLaughlin	Rodman	89	3 00	267 00	
J. E. Locke	Rodman	43	3 50	150 50	
J. W. Ingalls	Rodman	53	3 00	159 00	
H. A. Smith	Rodman	79	2 50	197 50	
W. F. Potter	Rodman	43	2 50	107 50	
Geo. S. Alger	Axman	3	2 00	6 00	
Joseph Dewey	Axman	30	2 00	60 00	
R. N. Jenne	Office assistant	10	3 00	30 00	
David Evans	Office assistant	211	3 00	633 00	
W. W. Smith	Inspector	36	3 50	126 00	
Chas. E. Harris	Inspector	56	3 50	196 00	
Dana Reed	Inspector	12	4 00	48 00	
J. E. Locke	Inspector	74	3 50	259 00	
L. M. Clement	Inspector	21	4 00	84 00	
Hiram Parker	Inspector	21	4 00	192 00	
Owen Carroll	Inspector	31	4 00	124 00	
Robert Coleman	Inspector	52	4 00	208 00	
G. W. Baxter	Inspector	26	3 00	78 00	
M. D. Sherrill	Inspector	52	3 00	156 00	
					$9,455 30
	Incidental Expenses.				
	Stationery	.....	.....	$233 89	
	Fuel	.....	.....	94 75	
	Light	.....	.....	14 25	
	Office rent	.....	.....	136 67	
	Postage and telegraph	.....	.....	79 96	
	Miscellaneous	.....	.....	30 68	
					590 20
	Total improvem't Champlain	.....	.....	.....	$10,045 50

IMPROVEMENT BLACK RIVER.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
E. H. Crocker	Division engineer	.....	$2,000 00	$200 00	
E. H. Crocker	Travel	.....	.....	76 70	
Peter Hogan	Resident engineer	.....	1,700 00	220 00	
Peter Hogan	Travel	.....	.....	105 12	
John A. Cooper	Assistant engineer	11	5 00	55 00	
G. B. Beach	Assistant engineer	314	4 00	1,256 00	
E. H. Ball	Assistant engineer	26	4 50	117 00	
C. L. Sweet	Inspector	141	4 00	564 00	
Chester Ray	Inspector	30	3 50	105 00	
					$2,698 82
	Incidental Expenses.				
	Stationery	.....	.....	$35 60	
	Postage and telegraph	.....	.....	9 59	
					45 19
	Total improvem't Black river.	.....	.....	.....	$2,744 01
	Amount by Canal Commis'er.	.....	.....	.....	1,740 00
	Total expenses for engineer'g.	.....	.....	.....	$24,753 03

SUMMARY OF TABLE No. 1.

NAME OF CANAL.	Engineering proper.	Incidental expenses.	Amounts.	Total.
Repairs Erie canal	$4,989 99	$452 45	$5,442 44	
Repairs Champlain canal	4,505 37	26 23	4,531 60	
Repairs Black River canal	249 48	.....	249 48	
				$10,223 52
Improvement Champlain canal	9,455 30	590 20	$10,045 50	10,045 50
Improvement Black River canal	2,698 82	45 19	2,744 01	2,744 01
Amount paid by Division engineer	.....	.....	.....	$23,013 03
Rebuilding Fort Miller lock	615 00	.....	615 00	
Improvement above sloop lock, Troy	393 00	.....	393 00	
Constructing pier at Whitehall	147 00	.....	147 00	
Constructing vertical wall at Utica	380 00	.....	380 00	
Constructing vertical wall at Little Falls	205 00	.....	205 00	
Amount paid by Canal Commissioner	.....	.....	.....	1,740 00
Total expenses for engineering	.....	.....	.....	$24,753 03

TABLE No. 2.

STATEMENT showing the length in miles, number of structures, estimated cost at contract prices, amount of work done for the fiscal year ending September 30th, 1868, whole amount of work done, and work completed or settled, with the characteristic detail of contracts existing upon the Eastern Division of the New York State canals, for the fiscal year ending September 30th, 1868.

WORK LET BY CANAL COMMISSIONER—EXTRAORDINARY REPAIRS—ERIE CANAL.

Work let by Canal Board under act, chap. 579, Laws of 1867.

Length in miles.	Number of structures.	CHARACTER OF WORK.	Estimated cost at contract prices.	Amount done during the fiscal year ending Sept. 30th, 1868.	Whole amount done.	Amount remaining to be done.
0.13	.....	Vertical wall at Fort Plain	$5,320 02	$5,320 02	$5,320 02	Settled.
0.38	.....	Vertical wall at Utica	9,190 34	9,190 34	9,190 34	Settled.
.....	1	Vertical wall to protect aqneduct and feeder at Little Falls	3,632 00	3,632 00	3,632 00	Settled.
		Work let by Canal Commissioners, Laws of 1868.				
0.17	.....	Removing slope wall and wall bench, and constructing docking on berme side at Rome	3,128 00	.....	.....	$3,128 00
.....	1	Removal of iron bridge from Washington street to George street, Rome, and constructing iron bridge at Washington street	11,900 00	.....	.....	11,900 00
.....	1	Iron bridge at Port Jackson	4,900 00	.....	.....	4,900 00
3.75	.....	Removing slope wall and wall bench, and constructing slope wall from lock 20 to a point one mile above npper Mohawk aqneduct	27,680 00	.....	.....	27,680 00
3.30	.....	Removing slope wall and wall bench, and rebnilding slope and pavement wall from lock 2 to Port Schnyler	33,145 00	.....	.....	33,145 00
.....	1	Rebuilding lock 2	30,355 00	.....	.....	30,355 00
		Total	$129,250 36	$18,142 36	$18,142 36	$111,108 00

EXTRAORDINARY REPAIRS—CHAMPLAIN CANAL.

Work let by Canal Board.

.....	1	State dam at Cohoes (difference between stone and wood)	$50,000 00	$19,060 00	$19,060 00	$30,940 00
.....	1	Rebnilding Fort Miller lock (difference between old and new size)	15,000 00	15,000 00	15,000 00	Settled.
.....	1	Improvement above sloop lock at Troy	9,229 00	6,349 00	9,229 00	Settled.
.....	1	Pier at Whitehall	8,742 75	3,742 75	8,742 75	Settled.
.....	.....	Slnices aronnd locks 2, 4, 5, 8 and 12, Glen's Falls feeder	5,129 48	769 48	5,129 48	Settled.
.....	1	Highway bridge at Saratoga street, Schuylerville	1,297 40	1,297 40	1,297 40	Settled.

		Work let by Canal Commissioners.				
.....	1	Rebuilding Becker's lock (difference between old and new size)	$9,578 50	.....	.....	$9,578 50
.....	1	Iron bridge at Schuylerville (difference between old and new plan)	4,100 00	.....	.....	4,100 00
.....	1	Iron bridge at Fort Edward (difference between old and new plan)	3,000 00	.....	.....	3,000 00
.....	1	Bridge at McIntyre street, Fort Edward	2,723 00	.....	.....	2,723 00
.....	1	Farm bridge of G. F. Dudley, Fort Ann	622 00	.....	.....	622 00
.....	.....	Dredging Whitehall basin	4,375 00	.....	.....	4,375 00
		Total	$113,797 13	$46,218 63	$58,458 63	$55,338 50
		Work done by Canal Commissioner.				
.....	.....	Cutting out bevels of Glen's Falls feeder locks	2,640 00	1,758 88	1,758 88	881 12
		Grand total	$116,437 13	$47,977 51	$60,217 51	$56,219 62

EXTRAORDINARY REPAIRS—BLACK RIVER CANAL.

Work let by Canal Board under act, chap. 579, Laws of 1867.

.....	.....	Improvement first level Black River canal, Rome	$4,600 00	$1,280 00	$1,280 00	$3,320 00
.....	1	Iron bridge at Port Leyden (difference between old and new plan)	3,500 00	.....	.....	3,500 00
		Total	$8,100 00	$1,280 00	$1,280 00	$6,820 00

IMPROVEMENT CHAMPLAIN CANAL.

Work let by Canal Commissioners under act, chap. 181, Laws of 1864.

4.60	.....	From first lock north of Waterford to Hewitt's lock	$22,398 50	$7,178 50	$22,398 50	Settled.
4.20	.....	From Hewitt's lock to Becker's lock	23,135 81	135 81	23,135 81	Settled.
4.00	.....	Section No. 1, 16 mile level	21,439 49	4,279 49	21,439 49	Settled.
4.00	.....	Section No. 2, 16 mile level	22,843 76	2,383 76	22,843 76	Settled.
3.78	.....	Section No. 3, 16 mile level	18,250 37	1,890 37	18,250 37	Settled.
4.22	.....	Section No. 4, 16 mile level	22,756 87	4,756 87	22,756 87	Settled.
2.60	.....	From Saratoga lock to Fort Miller lock	20,236 00	120 00	5,380 00	$14,856 00
2.65	.....	From Fort Miller lock to Moses Kill lock	21,395 00	640 00	9,480 00	11,915 00
5.50	.....	From Moses Kill lock to Fort Edward lock	58,344 00	18,520 00	40,920 00	17,424 00
4.00	.....	Section No. 1, 12 mile level	13,166 50	2,046 50	13,166 50	Settled.
4.08	.....	Section No. 2, 12 mile level	28,925 00	2,120 00	15,620 00	$13,305 00
3.50	.....	Section No. 3, 12 mile level	28,088 00	1,260 00	16,160 00	11,928 00
5.50	.....	Whitehall level	35,426 04	.....	35,426 04	Settled.
7.00	.....	Glen's Falls feeder	32,615 17	115 17	32,615 17	Settled.
1.55	.....	Raising towing path on Wood creek	26,047 03	1,987 03	26,047 03	Settled.
.....	1	Stone dam on Wood creek	8,533 98	.....	8,533 98	Settled.

Table No. 2—(Continued).

Length in miles.	Number of structures.	CHARACTER OF WORK.	Estimated cost at contract prices.	Amount done during the fiscal year ending Sept. 30th, 1868.	Whole amount done.	Amount remaining to be done.
		Work let by Canal Commissioners under act, chap. 715, Laws of 1868.				
1.55	.....	Raising towing path on Wood creek from lower lock at Fort Ann to Narrows	$15,054 00	.....	.....	$15,054 00
3.05	.....	Raising towing path on Wood creek from Parish lock to guard lock.....	34,265 00	$3,240 00	$3,240 00	31,025 00
		Total	$452,920 52	$50,673 50	$337,413 52	$115,507 00
		IMPROVEMENT BLACK RIVER.				
		Work let by Canal Commissioners under act, chap. 151, Laws of 1864.				
.....	.....	Lock and dam above Beach's bridge	$58,000 00	$18,800 00	$56,360 00	$1,640 00
		Total	$58,000 00	$18,800 00	$56,360 00	$1,640 00

TABLE No. 3.

STATEMENT showing amount of work done under the supervision of the Engineer Department, on repairs under contract, and on extraordinary and miscellaneous repairs upon the Eastern Division of the New York State canals for the fiscal year ending September 30, 1868.

ORDINARY REPAIRS UNDER CONTRACT—ERIE CANAL.

Length in miles.	Number of structures.	CHARACTER OF WORK.	Estimated cost at contract price.	Amount done during the fiscal year ending Sep. 30, 1868.	Whole amount done.	Amount remaining to be done.
.....	1	Abutments and approaches to White street bridge, Cohoes	$16,926 98	$374 02	$16,926 98	Settled.
		Dredging Albany basin	85,040 00	15,040 00	85,040 00	
.....	1	Draw bridge at Rexford Flats	700 00	700 00	700 00	Settled.
.....	1	Troy dam, act, chap. 231, Laws of 1868, work let by Canal Commissioners	11,200 00	9,680 00	9,680 00	$1,520 00
.....	.....	Total	$113,866 98	$25,794 02	$112,346 98	$1,520 00

CHAMPLAIN CANAL—ORDINARY REPAIRS (UNDER CONTRACT).

.....	1	Stone dam at Cohoes, charged to repairs	$38,262 50	.....	.....	$38,262 50
.....	1	Rebuilding Fort Miller lock (amount chargeable to ordinary repair fund), $32,051.32 — $15,000.00 =	17,051 32	$17,051 32	$17,051 32	Settled.
.....	1	Rebuilding Becker's lock (amount chargeable to ordinary repair fund), $21,500.00 — $9,578.50 =	11,921 50	....	.....	$11,921 50
.....	1	Iron bridge at Schuylerville (cost of old plan chargeable)	600 00	.....	.....	600 00
.....	1	Iron bridge at Fort Edward (cost of old plan chargeable)	748 96	.....	.....	748 96
.....	.....	Total	$68,584 28	$17,051 32	$17,051 32	$51,532 96

BLACK RIVER CANAL.

.....	1	Iron bridge at Port Leyden (cost of old plan chargeable)	$700 00	.....	.....	$700 00
.....	.....	Total	$700 00	.....	.....	$700 00

SUMMARY OF TABLES Nos. 2 AND 3.

NAME OF CANAL.	Estimated cost at contract prices.	Amount done during fiscal year ending Sept. 30th 1868.	Whole amount done.	Amount remaining to be done.
Improvement Champlain canal	$452,920 52	$50,673 50	$337,413 52	$115,507 00
Total	$452,920 52	$50,673 50	$337,413 52	$115,507 00
Extraordinary repairs Erie canal, under contract	$129,250 36	$18,142 36	$18,142 36	$111,108 00
Extraordinary repairs Champlain canal, under contract	113,797 13	46,218 63	58,458 63	55,338 50
Extraordinary repairs Champlain canal, not under contract	2,640 00	1,758 88	1,758 88	881 12
Extraordinary repairs Black River canal, under contract	8,100 00	1,280 00	1,280 00	6,820 00
Total	$253,787 49	$67,399 87	$79,639 87	$174,147 62
Ordinary repairs Erie canal, under contract	$113,866 98	$25,794 02	112,346 98	$1,520 00
Ordinary repairs Champlain canal, under contract	68,584 28	17,051 32	17,051 32	51,532 96
Ordinary repairs Black River canal, under contract	700 00	.....	.....	700 00
Total	$183,151 26	$42,845 34	$129,398 30	$53,752 96
Improvement Black River canal, under contract	$58,000 00	$18,800 00	$56,360 00	$1,640 00
Total	$58,000 00	$18,800 00	$56,360 00	$1,640 00
Grand total	$947,859 27	$179,718 71	$602,811 69	$345,047 58

TABLE No. 4.

STATEMENT showing the number of sections, commencement and expiration of contract, name of contractor, length in miles, amount per annum, and location of repair sections under contract on the Eastern Division of the New York State canals on the 30th day of September, 1868.

ERIE CANAL.

Number of section.	Commencement.	Expiration.	Name of Contractor.	Length in miles.	Price per annum.
Section No. 1	Jannary 1, 1867	December 31, 1871	Thomas Gale, assignee	19	70,000 00
Section No. 2	October 1, 1865	December 31, 1868	Charles A. Donaldson	32	17,740 00
Section No. 3	March 1, 1868	December 31, 1872	D. & A. Neff	33	27,000 00
Section No. 4	January 1, 1868	December 31, 1872	Gilbert Peterson, assignee of W. H. Mapes	24	23,590 00
Section No. 5	March 1, 1868	December 31, 1872	Joseph Bond	34	16,500 00
			Total Erie canal	142	$154,830 00

CHAMPLAIN CANAL.

Section No. 1	March 1, 1868	December 31, 1872	Willard Johnson, assignee of Benj. F. Wells	28	$29,400 00
Section No. 2	March 1, 1868	December 31, 1872	H. S. Pratt	24	24,900 00
Section No. 3	January 1, 1867	December 31, 1871	Willard Johnson, assignee of Ryal G. Briggs	22	17,750 00
			Total Champlain canal	74	$72,050 00

BLACK RIVER CANAL.

Section No. 1	April 1, 1866	December 31, 1869	William McArthur	24	$16,440 00
Section No. 2	April 1, 1866	December 31, 1869	Archibald McArthnr	23	7,980 00
Section No. 3	March 1, 1865	December 31, 1868	Ward & McVickar	42½	9,750 00
			Total Black River	89½	$34,170 00
			Total for division	305½	$261,050 00

NOTE.—Section No. 1, Erie canal, has an additional price of 70 cents per cubic yard for dredging Albany basin.

TABLE No. 4.—(*Continued.*)

Erie Canal.

Description.

Section No. 1.—From Albany to north end of lower aqueduct, including Champlain canal, to a point 200 feet north of south guard lock, and sloop lock and Troy dam.

Section No. 2.—From north end of lower aqueduct to head of lock No. 27, including Rexford Flats dam and feeder.

Section No. 3.—From head of lock No. 27 to foot of lock No. 34, including Schoharie creek and Rocky Rift dam and feeder.

Section No. 4.—From foot of lock No. 34 to head of lock No. 46, including the feeders and dams on both sides of the Mohawk river, at Little Falls.

Section No. 5.—From head of lock No. 46 to east bank of Oneida Lake canal.

Champlain Canal.

Section No. 1.—From a point 200 feet north of south guard lock, at Cohoes, to foot of lock next north of Fort Miller bridge, including Waterford side cut.

Section No. 2.—From foot of lock next north of Fort Miller bridge to Dunham's basin, including Glen's Falls dam.

Section No. 3.—From Dunham's basin to entrance into Lake Champlain at Whitehall.

Black River Canal.

Section No. 1.—From Rome to one thousand feet north of lock No. 70, including Delta feeder.

Section No. 2.—From one thousand feet north of lock No. 70 to three hundred feet north of lock No. 109, including Black River feeder, and North Branch, South Branch, and Woodhull reservoirs.

Section No. 3.—From Lyon's Falls to Carthage.

MIDDLE DIVISION.

ANNUAL REPORT OF M. S. KIMBALL, DIVISION ENGINEER, FOR THE FISCAL YEAR ENDING SEPTEMBER, 30, 1868.

Hon. Van R. Richmond, *State Engineer and Surveyor:*

Sir—I have the honor to present you the following report:

LENGTH OF COMPLETED CANALS.

	Miles.
Erie canal 68.58, navigable feeders 3.35	71.93
Oneida Lake canal and feeder (old)	7.00
Oswego canal	38.00
Oneida river improvement	20.00
Seneca river towing path	5.75
Baldwinsville canal and improvement to Jack's Reef	12.50
Cayuga and Seneca canal	22.77
Crooked Lake canal	8.00
Chemung canal and feeder	39.00
Cayuga inlet	2.00
Chenango canal	97.00
	323.95

RESERVOIRS AND FEEDERS.

For the Erie Canal.—Erieville reservoir, 340 acres, 21½ feet deep; De Ruyter reservoir, 626 acres, 18½ feet deep; Cazenovia lake, 1,778 acres, 4½ feet deep; Skaneateles lake, 8,320 acres, 7 feet deep; and Oneida, Cowassalon, Chittenango, Carpenter Brook, Jordan, Weedsport and Port Byron feeders.

For the Chenango Canal.—Madison brook reservoir, 235 acres, 45 feet deep; Bradley brook reservoir, 134 acres, 25 feet deep; Eaton brook reservoir, 254 acres, 50 feet deep; Hatch's lake, 134 acres, 10 feet deep; Woodman's pond, 148 acres, 11 feet deep; Leland's pond, 173 acres, 8 feet deep; and Kingsley brook reservoir, 113 acres, 20 feet deep.

ENGINEER DEPARTMENT.

The division has been in charge of William H. H. Gere to the 20th of February last, and M. S. Kimball the balance of the year as Division Engineers, and Howard Soule, Jr., Resident. The extension of the Chenango canal was in charge of B. M. Hanks to the 1st of June, and Charles L. McAlpine the balance, as Resident.

TABLE No. 1

Is an exhibit in detail of the expenditures.

The following statement shows the amount of work done in charge of the engineer department, the cost of engineering and the percentage of cost of the same.

CANALS.	Work done.	Engineering.	Percentage.
Erie	$62,126 25	$6,190 83	10.00
Oswego	101,161 65	3,718 10	3.60
Chenango	67,251 78	3,105 40	4.60
Chenango extension	73,953 41	14,205 92	19.20
Chemung	15,404 64	2,475 88	16.00
Crooked Lake	24,984 97	2,449 48	10.00
Cayuga and Seneca	.....	1,191 68	.....
Oneida lake (enlargement)	31,560 00	5,720 29	18.00
Otisco Lake survey	.....	623 40	.....
Total	$376,392 70	$39,680 98	10.5-10

The percentage of cost of engineering is increased this year over last. This comes from the expense of making surveys for work upon which little or nothing has been done yet, for instance the Otisco lake survey, the survey of the Owasco lake, both for reservoirs, re-surveying, re-estimating and re-letting work on the Chenango canal extension, all of which had been canceled and the work stopped.

TABLE No. 2.

This table shows the work under contract in detail, the amount done and remaining to be done on all of the canals and works of the Middle Division except certain work authorized by the Canal Board, which is shown in table No. 3.

Erie Canal.

The contracts are all completed except two. One, the culvert at Canastota, will be built some time before the opening next spring, and the other, protecting the channel at Skaneateles, is going on now, to be finished early in the winter.

Oswego Canal.

The berme bank, making a canal level of the pond above the Horse shoe dam, was closed in the early part of September, and relieves so far the difficulties common to all the river levels. The work remaining is principally the stone protection to the banks, which will be complete by the close of navigation. Braddocks' rapids dam will be finished this fall. The cost will exceed the estimate of last year perhaps $10,000 owing to an extensive dip in the rock foundation on the east half, making the height 16½ instead of 10½ as expected.

The Minetto dam will be half built, and then stop over to spring. The dock at Green Point will be put in, ready for the opening.

Surveys, maps, plans, and comparative estimates on different locations for the High Dam, near Oswego, have been made and submitted to the Canal Board, under act, chapter 715, Laws of 1868. But, as no action has yet been taken upon them, nothing more need be said. The Feeder trunk at Fulton is completed, and answers well the purpose for which it was projected.

Chenango Canal.

Five locks have been rebuilt, and there are contracts in existence for three others. They were let in 1865, and there being no money, nothing was done; and now, in war prices, the contractor feels under no obligation to proceed. Every old lock on the canal needs rebuilding, and the Legislature cannot go amiss in making appropriations to do it, say for five or six each year, all the while rebuilding the poorest.

Chemung Canal.

All the work contracted for is completed, except the pier at Watkins, which is to immediately proceed.

Crooked Lake Canal.

Three locks and protecting the banks at certain points have been done. Four other locks have been put under contract, to be built during the suspension of navigation. There are still other locks very soon to need rebuilding.

Cayuga and Seneca Canal.

The construction of a pier at Geneva has been contracted for, and to be commenced next spring.

Oneida Lake Canal.

This is a new enlarged canal, extending from Durhamville, on the Erie canal, to South Bay, on Oneida Lake, $5\frac{3}{10}$ miles. It was put under contract December 18th, 1867, to be completed July 1st, 1869. It will be seen by the table that the work done amounts to $31,560, and the amount remaining $226,440, which is an expenditure of $25,160 total, or $5,032 on each contract per month.

This would be a greater rate of progress for the future than has been made yet; and with the winter intervening, it is quite safe to say that this canal cannot be brought into use as early as July 1st, 1869.

It is quite probable it cannot be brought into use at any time without first adding more water to the long level of the Erie.

Extension of the Chenango Canal.

As reported last year, the work was suspended and the contractors allowed to cancel, for want of money to proceed. Twenty-five contracts were accordingly canceled and nine left running. The Legislature, during the winter, appropriated $281,800 to resume. The work between Binghamton and Owego was re-surveyed and relet, except the locks, aqueducts, dam, and bridges, on the 29th of July last.

By table No. 2, the work under contract, including that completed, is	$1,208,670 75
By table No. 4, the work not under contract, is	571,895 00
Total cost	$1,780,565 75
Deduct the total work done	826,593 25
Work remaining	$953,972 50
Or cost to complete to Owego	536,527 50
Or cost to complete below to State line	$417,445 00

By comparing the total cost of the canal now with the report of last year, there is an increase of $109,036.67. $45,000 of this is made up of the authorized raising of the banks along the river, by the Canal Board, upon the recommendation of the Division and Resident Engineers, the high water of the last two years having demonstrated its necessity. The capacity of the Choconut, Tracy and Apalachin creek aqueducts were found to be quite too small, and upon a like recommendation, authority was also given by the Canal Board to increase

the width of water way, costing $25,000 more. There remains now $39,000 to be accounted for. Part of this comes from damage to the banks by the flood of last spring, and the remainder from the never varying rule, that you cannot suspend work, settle up, relet and go on, without an increased cost.

To ascertain the further appropriation necessary to complete this canal, set down the work remaining to be done	$953,972 50
And from it deduct the money on hand, after paying the monthly estimates of October 1st, last past.....	231,000 00
Balance	$722,972 50
Then to this should be added a certain percentage for engineering, and the usual contingencies.....	72,297 25
Leaves the appropriation to be made.....	$795,269 75

Following is the report of Charles L. McAlpine, Resident Engineer in charge, to which you are respectfully referred for a detailed statement of the condition of the work.

OWEGO, *November* 1, 1868.

M. S. KIMBALL, Esq., *Division Engineer:*

In the last annual report which was made by my predecessor, it is mentioned that on September 1, 1867, notice was served by the Canal Commissioner (as the law provides in such cases), upon each of the contractors then at work upon the extension of the Chenango Canal, to the effect that he "should issue no more drafts on account of work done by them, as the fund for that purpose was exhausted."

This notice caused an immediate suspension of operations, and on October 10th, following, the Canal Board passed resolutions that upon application, the contracts should be canceled, and the Canal Commissioner authorized to make the final payments upon them.

At the time the notice was served (September 1st), work had been commenced on all of the sections from No. 1 to No. 30, inclusive, except upon sections Nos. 20 and 28.

Sections Nos. 31 to 39, inclusive, which embraces the remainder of the extension up to the State line, has never yet been placed under contract.

All of the mechanical structures between Binghamton and Owego, except the dam across the Susquehanna, and guard lock at Binghamton, lock No. 6, on section No. 22, and bridges on sections Nos. 11 to 23, inclusive, were under contract, and work had been commenced.

At the time mentioned, several of the sections had been completed and the final accounts rendered, and some others were nearly finished. Among the completed sections, were Nos. 7, 8, 9, 11, 12, 13, 16, 19, 22 and 23; all embraced in that portion of the canal between Binghamton and Owego.

All of the culverts between the same points were built, excepting two, of six and eight feet chord respectively, on section No. 5; one composite culvert, three feet span, and one arch of four feet chord, on section No. 20; one four, and one six feet chord, on section No. 21; and two culverts of four feet chord each, on section No. 22.

Work was progressing upon the three aqueducts over Choconut, Tracy, and Apalachin, and upon bridges from sections 1 to 10, inclusive.

During the past fiscal year, applications were made for cancelment of contracts, and final payments, on section Nos. 1, 2, 3, 4, 5, 6, 10, 14, 15, 17, 18, 21, 25, 26, 27, 29 and 30; also upon locks Nos. 4 and 5; Choconut and Apalachin aqueducts; culverts on sections 1 to 20, inclusive; and bridges on sections 1 to 5. The payments have been made, and these contracts closed.

The contracts which, up to September 30th, 1868, had not been canceled, and still remained in force, were those for sections Nos. 20, 24 and 28; locks Nos. 1, 2 and 3; Tracy aqueduct; culverts on sections Nos. 21 to 30, inclusive; and bridges on section 6 to 10. None of the structures below section 23 (opposite Owego), except culverts to section No. 30, have yet been commenced or put under contract; nor the section work between sections Nos. 30 and 39, the latter terminating at the State line. None of the locks below No. 5, on section No. 18, have been put under contract.

This statement will show briefly the material progress that had been made on the work at the time of the suspension on September 1st, 1687.

By reference to "Table No. 2" of the last report, it will be seen that work to the amount of over three-quarters of a million of dollars ($757,622.08) had been accomplished, or, according to the then estimates, nearly half the amount necessary to complete the canal, to the State line of Pennsylvania, by which a connection is made with the entire system of canals of that State.

Towards the close of the last session of the Legislature, a further appropriation of two hundred and eighty-one thousand eight hundred dollars was made for this canal, and by resolution of the Canal Board, passed May 28th, 1868, work was ordered to be resumed, and C. L. McAlpine was appointed Resident Engineer from June 1st.

A re-measurement of all, except the completed sections, was made of that portion between Binghamton and Owego, and advertised to be let on July 29th, the new contractors generally getting at work within the following two months. Two of the uncanceled contracts, namely, for section 20, and culverts from section 21 to 30, were also commenced. The locks, culverts, and aqueducts, not already under contract, and the dam and guard lock at Binghamton, and work below Owego, also bridges, were not let, it being deemed advisable by those who controlled, not to exceed the amount of the appropriation.

On August 25th, a report was made by the Resident Engineer, which was concurred in by the Division Engineer, and presented to the Canal Board by the Commissioner, recommending certain changes in the plans of the work; and on September 3d, the changes were authorized and adopted. This consisted in a large increase of water way, under Choconut, Tracy and Apalachin aqueducts; the raising of the towing path bank an additional height, where necessary, to prevent the floods of the Susquehanna from overflowing it, and the change of material for constructing locks Nos. 4, 5 and 6, and the abutments of farm and road bridges from stone to wood; the whole cost of the changes designed, being estimated at the sum of seventy thousand dollars.

The water way of the aqueducts named, seemed entirely insufficient to permit a free passage of the streams they spanned, thereby endangering the safety and permanency of those structures. The additional height of the bank on the river side of the canal, was required against such floods as occur in the Susquehanna, and were so destructive in the spring of 1865, and the present year.

The change in the locks and bridges was recommended, owing to the scarcity of suitable stone for these and all of the structures, and the great cost of importing them from a distance.

The sections relet July 29th, and now under contract, are Nos. 1 to 6 inclusive, 10, 14, 15, 17, 18 and 21; also remaining culverts on sections 1 to 20.

The cost of the remaining work on these sections and culverts, at contract prices, on July 29th, was	$237,215 50
Section 20 (uncanceled and work resumed).....	22,000 00
Culverts, sections 21 to 23 (uncanceled and work resumed)	14,500 00
The portion of the increased cost authorized by the Canal Board on sections that were let July 29th....	24,620 00
Total, or amount of appropriation, nearly	$298,335 50

The remaining uncanceled contracts between Binghamton and Owego, will, when work is resumed on them, increase the amount as follows:		
Lock No. 1	$9,236 00	
Lock No. 2	8,535 00	
Lock No. 3	10,171 00	
Tracy aqueduct, including $11,800 increase by Canal Board	22,320 00	
Bridges on sections 6 to 10	9,800 00	
		$60,062 00
Total amount of work between Binghamton and Owego, under contract July 29th, 1868, together with increase on same, authorized by Canal Board, was at that date,		$358,397 50
The work, not under contract and remaining to be done, between Binghamton and Owego, is as follows:		
Locks Nos. 4, 5 and 6	$33,030 00	
Dam and guard lock at Binghamton	50,000 00	
Choconut and Apalachin aqueducts, including $13,200 increase by Canal Board,	34,300 00	
Bridges, sections 1 to 5 and 11 to 23	64,400 00	
Remainder of increase authorized by Canal Board	$20,380 00	
		202,110 00
Amount required on July 29th, 1868 (the date of the letting), to complete the canal from Binghamton to Owego		$560,507 50

No work has been relet below section 23, opposite Owego. The amount of work done below Owego, up to July 29th, 1868, was found to be $148,266.25, which was entirely for section work on sections 24 to 30 inclusive.

Sections 31 to 39, inclusive (the latter reaching the State line), have never been under contract. An estimate of the remaining work required to complete the canal from Owego to the State line, amounts to $417,445.00, giving an aggregate cost between these two points of $565,711.25, which, added to the total estimated cost between Binghamton and Owego, is $1,780,565.75.

It may be here mentioned, that in preparing "Table No. 2," and the accompanying statements, the estimates of cost have been revised on all of the work that was prepared for the letting of July 29. No remeasurements have been made of the work not now under contract, and on such work the estimates of last year are used. These, when revised, will undoubtedly be increased, as a portion of them were made several years since, when, apparently from the lower rates

of labor, materials, &c., and other causes, they were stated in some cases considerably below the probable amount. This is indicated where, as stated, the former estimates have been revised.

Table No. 1 embraces the engineering and incidental expenses, both of my predecessor and myself. The suspension and the applications for cancelment of contracts required a final measurement and computation of nearly thirty miles of the work; and in June and July last, it became necessary to prepare the first twenty-three miles for letting. Comparatively very little contract work was done during this time, so that the engineering and incidental expenses bear a higher ratio as compared with the whole work, than would otherwise occur. If the appropriations permit a vigorous prosecution of the work during the coming season this ratio will be materially reduced.

Detailed tables of the cost of the work accompany this report, showing the amount done and to be done at the close of the fiscal year ending Semptember 30, 1868, between the present terminus of the completed Chenango canal and Owego, and from Owego to the State line.

Previous reports have dwelt sufficiently upon the advantages to the State, and to the people living in this section, that are expected to result from the construction of this connection with the Pennsylvania system of canals, and the coal fields lying in that State. The subject is now so well understood, and so large a proportion of the necessary amount has been already expended, that the policy and determination to incur no further delay, like that of the past year, in the completion of the work, is regarded as a settled one.

To ascertain that such delays are costly it is only necessary to examine the reports made in the early stages of the enterprise, when labor, materials, etc., were very low, compared to those of the present time. The delay of last year in the progress of the work has also added considerably to the cost of making certain temporary structures and arrangements necessary; by occasioning an almost entire remeasurement and computation of the work; by the preparation required for a reletting, and by the fact that the work had to be relet at advanced rates; and that the unfinished work, left to the action of rains, and spring freshets in the Susquehanna and smaller streams, incurred considerable damage and depreciation.

It is considered a matter of great regret that the dam across the Susquehanna at Binghamton, the guard lock at the same place, and the aqueducts and bridges between Binghamton and Owego could not have been put under contract this season, so that the large amount

of materials required, stone, timber, etc., could have been delivered this winter, ready for use as soon as the season opened in the spring.

Those having control, however, considered that it was better to pursue the policy of only contracting so much of the work as could be covered by the present appropriation, and the work in question now waits for the necessary funds.

If the amount appropriated had been sufficient for the prosecution of the work mentioned, simultaneously with that now in progress, it is thought the canal could have been opened to Owego at least a year earlier.

Very respectfully,

C. L. McALPINE,

Resident Engineer.

TABLE NO. 3.

This table shows in detail the work authorized by the Canal Board from time to time during the year, as circumstances arise making it necessary. It is authorized upon the estimates of the Division or Resident Engineers, and paid by the Canal Commissioners upon their sworn certificates. The work is all done and the accounts settled.

IMPROVEMENTS NECESSARY.

Jordan Level.

Notwithstanding the navigation is reported good this season, after all it has been only comparatively so. By this, I mean that although boats have moved along all the while, they are not moved, however, without an undue expenditure of "muscle" both of man and beast. This comes from the "bench" or rather from the material that once composed the "bench," the bench proper having slid down and out on to the bottom of the canal, in many places carrying the slope wall with it. There is eleven miles of this "bench" on this level and five near Syracuse, which is all there is on the Middle Division. Much has been said about it in former reports. I will only add what is patent. It ought to come out, and slope wall both sides from the bottom up, be put in.

Chittenango Aqueduct.

This aqueduct was built for the enlargement several rods up the creek from the site of the old one, the route of the canal having been changed. It is alleged by the farmers here that at every con-

siderable rain their farms are drowned out from the damming of the water at this aqueduct much more than they otherwise would be, and much more than they used to be by the old aqueduct.

I think much relief would be afforded by cutting a new channel below, down to a level with the bottom of the old aqueduct, straightening and widening it at the same time.

Cowassalon Creek.

This creek runs under the canal about two miles west of Durhamville. It is passed by what is known as a "diving culvert" of 10 apertures each 4 feet wide by 2½ feet high. The stream is very powerful above and sluggish below. The canal is in danger at every rain storm, and much land above is flooded from the want of capacity in the culvert to discharge the water. Claims for damages have also now sprung up. The plan of a ditch reaching to the Oneida creek at Durhamville, heretofore proposed, I regard as very unfeasable both from its great cost, as well as liability to soon fill up. Any attempt to settle the question, simply by opening and deepening the outlet below, would doubtless prove a failure. I think nothing short of changing the culvert to an aqueduct (which would increase the area of the waterway from 100 to 180 feet), and open a channel below for a short distance, would give the needed relief. The change should be made the coming winter.

Cayuga and Seneca Canal.

The locks are all composite except one; the others begin now to fail in the linings, and, when rebuilt on so important a lateral as this, should be of stone like those on the Chenango. The dam at Waterloo although owned by the State, yet individuals have means of drawing water around one end, and do it in low water to the detriment of navigation. A new dam should doubtless be soon built by the State in such a manner as to control navigation, giving mill owners only the surplus water.

NAVIGATION AND REPAIRS.

Erie Canal.

On or about the 16th of March last, the contractors for repair section No. 9 set the State dredge at work in the vicinity of Memphis and Newport, on the Jordan level, and kept it running, down to the open-

ing. No trouble of any account has been felt there since, while the year before the grounding of boats was of almost daily occurrence. This level, however, has also been better supplied with water this year, and doubtless has had something to do with the improved navigation.

Crane brook aqueduct was overhauled before the opening, the broken pier and abutment rebuilt, and 84 bolts, 1½ inch round, put through the bottom of the trunk and screwed into the foundation, with a view to preventing the trunk being raised again from an outside flood, even with the canal empty.

Locks 47, 48 and 49, were also overhauled last spring. The walls of lock 48 were found to have settled, and a communication opened into the culvert from the berme lock. This comes from there being no "cut-off" parallel to and between the locks. The moment the planking is sufficiently worn on the foundations, or if any get off, there is a circulation formed between the locks, running backward and forward, as the case may be, whenever one lock is filled and the other empty. This in time wears until the walls are undermined and let down, as in this case, and as was the case with lock 47 several years ago. It is only a question of time, when all double locks built in this way, unless on rock, will become undermined, without particular pains is taken to keep the planking perfect. Lock 48 was repaired by concreting up the entire aperture and replanking, and putting in binders across on top of the floor at every seven feet, to more effectually secure it. The binders were also put in at lock 47 and 49. At lock 47 it is alleged that they interfere with the drawing in of boats by taking up the room under, preventing the freer escape of water. This is true, and ought to be changed by laying down flat straps of iron. On the 3d of September a plate was broken on the Centreport aqueduct, detaining navigation 48 hours. With this exception there has been no delay, except now and then a little from the crowd of boats about the weigh lock at Syracuse.

Oswego Canal.

On the 3d of October both lower gates of lock No. 11 were carried away, stopping navigation until the evening of the 5th. Twice during the summer a toe post on the lower tow path gate of lock No. 12 has been broken, both times making a delay of 24 hours. At the breaking up of the ice last spring two breaches were made in the Phœnix canal level, one at the west end of the Van Buren dam, and one large one at the head of lock 14. The ice dammed up half a mile above, pouring over the bank and coming down to lock 14, broke out into the river.

At the stone dam at Oswego the coping of the east abutment was shoved off into the river below. These were the main items. There was much other damage to the towing path in numerous places; all was repaired, however, in time for the opening; the State paying in excess of the $5,000 stipulated in the contract.

Chenango Canal.

The bulkhead at the Stratton feeder broke down last spring in the high water, sweeping down the feeder and canal, breaking out in various places, doing considerable damage. At one point for several hundred feet through a thorough cut, it simply widened the canal to an enlargement width, which has been left so in repairing. At Chenango Forks the water broke into the canal, ran down, breaking out variously to Port Dickinson. The work was repaired, but not without delaying navigation a few days. The State paid the excess of cost over and above the $5,000 stipulated in the contract.

Navigation has been suspended two or three times for broken lock gates, and once from earth running down the hill above lock 111, from the new railroad banks; otherwise it has been good.

Chemung, Crooked Lake and Cayuga and Seneca Canals.

There was a break through the berme on the feeder of the Chemung at Big Flats, lasting a day and a half, and one 3½ days at Pine Valley aqueduct, above lock 36. There was a delay of two days on the Crooked Lake, to replace the lining of lock 17 and bottom out accumulations from rains.

The navigation has been good on the Cayuga and Seneca, except that the low water and conflicting interests on the dam at Waterloo have given some trouble.

SUPPLY OF WATER.

Beginning west, the feeder at Port Byron will be increased another year by the completion of the Owasco lake, work soon to be commenced, when no fears need be entertained of a wantage. This will flow westward, meeting the western division at the Wayne county line.

The reservoir to be constructed by the opening at Otisco lake, will come into the Jordan level at Camillus near the east end. The Skaneateles lake with its deepened channel enters at Jordan at the west end. The Jordan is a summit level discharging both ways; still, with these additions, it is certain that no future trouble need be appre-

hended for want of water, assuming always, of course, that the reservoirs can be filled during the suspension of navigation.

There has been no examination as yet for an additional reservoir for the long level east of Syracuse. It has been delayed so far for want of time to take hold of it. Aside from the alleged necessity for more reservoir capacity, however, there is another improvement to the canal I wish to recommend; one, I think, equally as necessary with or without additional water. My plan is to bottom down the long level say twelve inches at Lodi, grading out to present canal bottom, say at the Limestone feeder. My observation and inquiries bring me to the conclusion that during and after the prevalence of a westerly wind (and almost all the winds unless directly from the east, owing to the peculiar conformation of the entering valleys, become westerly at Lodi), the water is blown east so far and so much as to lower it at Lodi from 8 to 12 inches. The consequence, of course, is that boats are either aground or dragging bottom; farther east the canal is too full. Now supposing you had water to immediately supply this depression, this supply would at once be blown east and overlay the already too high water there. My conclusion, then, is to recommend this bottoming out first, as capable of affording considerable relief to this difficulty.

Respectfully submitted.

M. S. KIMBALL,
Division Engineer.

TABLE No. 1.

STATEMENT of engineering upon repairs of Middle Division of New York State canals, together with incidental expenses for the fiscal year ending September 30th, 1868.

ERIE CANAL.

NAME.	Rank.	No. of Days.	Rate of compensation.	Amounts.	Totals.
W. H. H. Gere	Division Engineer	Salary	$2,000	$390 00	
W. H. H. Gere	Division Engineer	Travel	.....	38 40	
M. S. Kimball	Division Engineer	Salary	2,000	390 00	
M. S. Kimball	Division Engineer	Travel	.....	160 40	
Howard Soule, Jr.	Resident Engineer	Salary	1,700	565 00	
Howard Soule, Jr.	Resident Engineer	Travel	.....	184 62	
W. D. Dunning	Assistant and clerk	44	5	220 00	
E. L. Luddington	Rodman	44	3	132 00	
					$3,080 42
Incidental Expenses.					
Stationery				$110 15	
Postage, telegraph and express				126 39	
Fuel and light				100 90	
Miscellaneous				174 10	
					$511 54
Total for Erie				.....	$3,591 96

CAYUGA AND SENECA CANAL.

NAME.	Rank.	No. of days.	Rate of compensation.	Amounts.	Totals.
M. S. Kimball	Division Engineer	Salary	$2,000	80 00	
M. S. Kimball	Division Engineer	Travel	.....	26 22	
Howard Soule, Jr.	Resident Engineer	Salary	1,700	195 00	
Howard Soule, Jr.	Resident Engineer	Travel	.....	69 52	
					370 74
Incidental Expenses.					
Stationery				18 22	
Telegraph				13 84	
					32 06
Total for Cayuga and Seneca				.....	$402 80

CROOKED LAKE CANAL.

W. H. H. Gere	Division Engineer	Salary	$2,000	190 00	
W. H. H. Gere	Division Engineer	Travel	.....	28 76	
M. S. Kimball	Division Engineer	Salary	2,000	75 00	
M. S. Kimball	Division Engineer	Travel	.....	17 84	
Howard Soule, Jr.	Resident Engineer	Salary	1,700	216 11	
Howard Soule, Jr.	Resident Engineer	Travel	.....	68 30	
					$596 01
Incidental Expenses.					
Stationery				7 71	
Telegraph				9 26	
					16 97
Total for Crooked Lake				.....	612 98

CHEMUNG CANAL.

W. H. H. Gere	Division Engineer	Salary	$2,000	125 00	
W. H. H. Gere	Division Engineer	Travel	.....	26 32	
M. S. Kimball	Division Engineer	Salary	2,000	100 23	
M. S. Kimball	Division Engineer	Travel	.....	26 58	
Howard Soule, Jr.	Resident Engineer	Salary	1,700	225 89	
Howard Soule, Jr	Resident Engineer	Travel	.....	94 16	
					598 18
Incidental Expenses.					
Stationery				5 25	
Telegraph				35 95	
					41 20
Total for Chemung				.....	$639 38

OSWEGO CANAL.

W. H. H. Gere	Division Engineer	Salary	$2,000	100 00	
W. H. H. Gere	Division Engineer	Travel	.....	11 04	
M. S. Kimball	Division Engineer	Salary	2,000	400 00	
M. S. Kimball	Division Engineer	Travel	.....	116 44	
Howard Soule, Jr.	Resident Engineer	Salary	1,700	100 00	
Howard Soule, Jr.	Resident Engineer	Travel	.....	26 20	
C. E. Smith	Rodman	29	3	87 00	
					$840 68
Incidental Expenses.					
Stationery				10 95	
Telegraph				24 47	
Office rent and fuel				28 50	
					63 92
Total for Oswego				.....	$904 60

CHENANGO CANAL.

W. H. H. Gere	Division Engineer	Salary	$2,000	187 77	
W. H. H. Gere	Division Engineer	Travel	.....	21 84	
M. S. Kimball	Division Engineer	Salary	2,000	177 00	
M. S. Kimball	Division Engineer	Travel	.....	66 46	
Howard Soule, Jr.	Resident Engineer	Salary	1,700	183 00	
Howard Soule, Jr.	Resident Engineer	Travel	.....	61 68	
					$697 75

Incidental Expenses.	Amounts.	Totals.
Stationery	44 16	
Telegraph	18 99	
		63 15
Total for Chenango		$760 90
Total repairs Middle Division		$5,912 62

TABLE No. 1—(*Continued*).

STATEMENT of engineering upon construction of Oneida Lake canal, together with incidental expenses for fiscal year ending September 30, 1868.

NAME.	Rank.	No. of days.	Rate of compensation.	Amounts.	Totals.
Thomas Goodsell	Assistant Engineer	314	$5 50	$1,727 00	
Chas. A. Sweet	Assistant Engineer	204	5 00	1,020 00	
Jnlins C. Laass	Draftsman	43	5 50	236 50	
Denison Richmond	Draftsman	22	5 00	110 00	
W. D. Dunning	Clerk	15	5 00	75 00	
Charles Truesdell	Leveler	14	5 00	70 00	
H. D. Brockway	Surveyor	13	4 50	58 50	
H. D. Brockway	Surveyor	129	4 00	516 00	
E. L. Luddington	Assistant leveler	32	3 50	112 00	
F. G. Kelscy	Rodman	143	3 50	500 50	
F. G. Kelsey	Rodman	13	2 75	35 75	
Daniel Wade	Tapeman	129	3 00	387 00	
Robert Green	Chainman	12	2 50	30 00	
W. E. Collins	Chainman	12	2 50	30 00	
Joseph Newton	Axman	12	2 75	33 00	
George E. Forbes	Axman	6	2 50	15 00	
S. A. Burnett	Axman	½	2 00	1 00	
Noah Hess	Axman	12	2 50	30 00	
Simon Briggs	Axman	145	2 50	362 50	
Henry Lower	Inspector	74	3 00	222 00	
					$5,571 75
Incidental Expenses.					
Stationery				$73 04	
Postage				2 22	
Office rent and fuel				21 57	
Miscellaneous				51 71	
					148 54
Total Oneida Lake Canal					$5,720 29

TABLE No. 1—(*Continued*).

STATEMENT of engineering upon survey of Otisco lake, as authorized by act, chapter 715 *Laws of* 1868.

NAME.	Rank.	No. of days.	Rate of compensation.	Amounts.	Totals.
Charles A. Sweet	Assistant Engineer	36	$5 50	$143 00	
M. E. Williams	Surveyor	26	5 00	130 00	
E. L. Luddington	Rodman	26	4 00	104 00	
John Marshall	Chainman.	18	3 00	54 00	
Thomas Lawler	Chainman	18	3 00	54 00	
James Geary	Axman	18	3 00	54 00	
C. O. Kellogg	Axman	17	2 50	42 50	
Ira Sherman	Axman	11	2 50	27 50	
					$609 00
Incidental Expenses.					
Stationery				$14 40	14 40
Total					$623 40

TABLE No. 1—(*Continued*).

STATEMENT of assistants employed upon ordinary and extraordinary repairs during the fiscal year ending September 30*th*, 1868, *and paid by Canal Commissioner, under act, chapter* 447, *Laws of* 1865.

NAME.	Canal.	No. of days.	Rate of compensation.	Amounts.	Totals.
W. D. Dunning	Erie	270	$5 00	$1,350 00	
Denison Richmond	Erie	292	5 00	1,460 00	
E. L. Luddington	Erie and Caynga and Seneca	47	2 75	129 25	
E. L. Luddington	Erie and Cayuga and Seneca	34	3 00	102 00	
E. L. Luddington	Erie and Cayuga and Seneca	131	3 50	458 50	
B. L. Higgins	Erie and Cayuga and Seneca	222	4 00	888 00	
					$4,387 75
M. S. Kimball	Oswego	123	5 00	615 00	
Joseph Wilbur	Oswego	71	3 00	213 00	
Joseph Wilbur	Oswego	157	3 50	549 50	
H. H. Coats	Oswego	123	3 00	369 00	
G. D. Ball	Oswego	95	3 00	285 00	
Patrick Murphy	Oswego	170	2 25	382 50	
C. O. Breed	Oswego	65	2 50	162 50	
Issac Thorp	Oswego	79	3 00	237 00	
					2,813 50
D. E. Whitford	Chemung and Crooked Lake	314	5 00	1,570 00	
O. M. Claugharty	Chemung and Crooked Lake	314	3 75	1,177 50	
T. W. Amsbury	Chemung and Crooked Lake	222	3 50	777 00	
J. C. Laass	Chemung and Crooked Lake	27	5 50	148 50	
					3,673 00
W. V. Van Rensselaer	Chenango	314	5 00	1,570 00	
Chas. H. Smith	Chenango	147	3 50	514 50	
Chas. H. Smith	Chenango	65	4 00	260 00	
					2,344 50
Total		.....	.....	.....	$13,218 75

TABLE No. 1—(*Continued*).

STATEMENT of engineering and incidental expenses upon extension of Chenango canal, for the fiscal year ending September 30th, 1868, as authorized by act, chapter 185, Laws of 1864.

NAME.	Rank.	No. of days.	Rate of compensation.	Amounts.	Totals.
Byron M. Hanks	Resident Engineer	Salary	$2,000 00	$1,333 32	
Byron M. Hanks	Resident Engineer	Travel	.....	341 40	
Chas. L. McAlpine	Resident Engineer	Salary	2,000 00	666 67	
Chas. L. McAlpine	Resident Engineer	Travel	.....	257 30	
John Evans	Assistant Engineer	106	5 00	530 00	
Chas. A. Beach	Assistant Engineer	225	5 00	1,125 00	
Thos. M. Sherman	Assistant Engineer	260	5 00	1,300 00	
C. Q. Newcombe	Assistant Engineer	91	5 00	455 00	
R. A. Hartwell	Leveler	53	4 00	212 00	
M. E. McEntee	Leveler	126	4 00	504 00	
O. F. Whitford	Leveler	15	4 00	60 00	
O. F. Whitford	Leveler	103	4 50	463 50	
A. P. Marshall	Leveler	157	4 50	706 50	
J. J. Lamon	Leveler	99	4 50	445 50	
L. F. Olney	Draftsman	289	4 50	1,300 50	
D. S. Walton	Assistant and inspector	54	5 00	270 00	
F. Leach, Jr.	Rodman	98	4 00	392 00	
G. D. Ball	Rodman	99	4 00	396 00	
C. S. Hanks	Tapeman	168	3 25	546 00	
L. E. Post	Tapeman	98	3 25	318 50	
Horace Griswold	Tapeman	223	3 25	724 75	
J. Beach	Axman	10	2 50	25 00	
C. B. Able	Axman	74	2 75	203 50	
S. M. Morse	Axman	1	2 00	2 00	
F. Crocker	Axman	2	2 00	4 00	
D. Foster	Axman	1	1 50	1 50	
H. P. Bartle	Axman	96	2 75	264 00	
Orrin Kellum	Axman	26	2 75	71 50	
					$12,919 44
Incidental Expenses.					
Superintending and inspecting				$24 00	
Labor				76 00	
Stationery				358 31	
Fuel				74 15	
Light				84 60	
Office rent				301 99	
Postage, telegraph and express				72 14	
Miscellaneons				295 29	
					$1,286 48
Total					$14,205 92

Summary of Table No. 1.

Repairs proper	$5,912 62
Repairs, ordinary and extraordinary	13,218 75
Construction of Oneida Lake canal	5,720 29
Construction of extension of Chenango canal	14,205 92
Survey of Otisco lake	623 40
Total	$39,680 98

TABLE No. 2.

STATEMENT of work under contract upon the Middle Division of the New York State canals, for the fiscal year ending September 30th, 1868.

ERIE CANAL.

CHARACTER OF WORK.	Engineers' estimate.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.
Vertical wall on mile level at Syracuse	$29,000 00	$27,369 73	$27,369 73	$27,369 73	Settled.
Culvert under Erie canal at Canastota	4,000 00	3,318 50	.....	.....	$3,318 50
Protecting banks of De Ruyter reservoir	10,250 00	8,449 06	5,049 06	8,449 06	Settled.
Protecting towing path bank east of Montezuma	7,380 00	3,012 82	1,635 82	3,012 82	Settled.
Protecting foundation of Butternut Creek aqueduct	745 00	670 87	670 87	670 87	Settled.
Closing Creek channel at Centreport	800 00	784 24	784 24	784 24	Settled.
Swing bridge over feeder near Fayetteville	2,400 00	2,398 92	2,398 92	3,398 92	Settled.
Protecting channel in Skaneateles lake outlet	7,000 00	4,349 00	.....	.....	$4,349 00
Iron bridge across State ditch at Jack's Reef	4,000 00	3,535 05	3,535 05	3,535 05	Settled.
Iron bridge across outlet of Onondaga lake	3,000 00	3,000 00	3,000 00	3,000 00	Settled.
Total	$68,575 00	$56,888 19	$44,443 69	$49,220 69	$7,667 50

OSWEGO CANAL.

Stone dam at Braddock's Rapids, Oswego river	$80,500 00	$70,000 00	$31,620 00	$58,120 00	$11,880 00
Stone dam at Minetto, Oswego river	94,400 00	64,865 00	24,840 00	24,840 00	40,025 00
Berme bank in Oswego river	180,000 00	180,000 00	38,110 00	163,620 00	16,380 00
Feeder trunk below guard lock at Fulton	700 00	620 08	620 08	620 08	Settled.
Building 400 feet of dock at Green Point	2,100 00	1,676 00	.....	.....	1,676 00
Total	$357,700 00	$317,161 08	$95,190 08	$247,200 08	$69,961 00

CHENANGO CANAL.

Rebuilding lock No. 52	$12,500 00	$15,879 64	$15,519 64	$15,879 64	Settled.
Rebuilding lock No. 55	12,500 00	15,923 00	15,563 00	15,923 00	Settled.
Rebuilding lock No. 65	12,500 00	14,689 33	14,329 23	14,689 33	Settled.
Rebuilding lock No. 80	11,000 00	8,944 46	8,944 46	8,944 46	Settled.
Rebuilding lock No. 81	11,000 00	7,942 03	7,942 03	7,942 03	Settled.
Rebuilding lock No. 105	10,000 00	6,701 00	.....	.....	$6,701 00
Rebuilding lock No. 106	9,000 00	5,747 00	.....	.....	5,747 00
Rebuilding lock No. 107	12,500 00	9,669 00	.....	.....	9,669 00
Total	$91,000 00	$85,495 46	$62,298 36	$63,378 46	$22,117 00

Table No. 2—(Continued).

CHEMUNG CANAL.

CHARACTER OF WORK.	Engineers' estimate.	Estimated cost at contract prices.	Amonnt done during fiscal year.	Total amount done.	Amount remaining to be done.
Work in Chemung river at Corning at old contract prices	$70,000 00	$65,832 24	$3,652 24	$65,832 24	Settled.
Work in Chemung river at Corning at additional prices authorized by act, chap. 495, Laws of 1865	45,000 00	39,254 47	3,154 47	39,254 47	Settled.
Repairs or partial reconstruction of lock No. 1	22,000 00	22,546 53	4,766 53	22,546 53	Settled.
Selser swing bridge at Watkins	3,775 00	3,131 40	3,131 40	3,131 40	Settled.
Bridge over feeder on farm of M. P. and L. Fitch	700 00	700 00	700 00	700 00	Settled.
Constructing pier at Watkins	30,000 00	19,460 00	.....	.....	$19,460 00
Total	$171,475 00	$150,924 64	$15,404 64	$131,464 64	$19,460 00

CROOKED LAKE CANAL.

Repairing lock No. 15	$7,222 00	$6,700 00	$6,300 00	$6,300 00	$400 00
Repairing lock No. 16	7,222 00	7,600 00	7,220 00	7,220 00	380 00
Repairing lock No. 17	7,222 00	6,700 00	6,100 00	6,100 00	600 00
Repairing locks Nos. 12, 13, 24 and 27	40,000 00	34,448 00	.....	.....	34,448 00
Protecting banks of Crooked Lake canal	6,000 00	5,314 97	5,314 97	5,314 97	Settled.
Total	$67,666 00	$60,762 97	$24,934 97	$24,934 97	$35,828 00

CAYUGA AND SENECA CANAL.

Constructing pier at Geneva	$20,000 00	$13,961 00	.....	.....	$13,961 00
Total	$20,000 00	$13,961 00	.....	.....	$13,961 00

ONEIDA LAKE CANAL.

Section No. 1	$306,000 00	$32,500 00	$11,700 00	$11,700 00	$20,800 00
Section No. 2		46,000 00	4,140 00	4,140 00	41,860 00
Section No. 3		56,000 00	3,100 00	3,100 00	52,900 00
Section No. 4		55,500 00	7,900 00	7,900 00	47,600 00
Section No. 5		68,000 00	4,720 00	4,720 00	63,280 00
Total	$306,000 00	$258,000 00	$31,560 00	$31,560 00	$226,440 00

Table No. 2—(Continued).

EXTENSION OF CHENANGO CANAL.

Length in Chains.	CHARACTER OF WORK.	Engineer's estimate.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.	Remarks.
62	Section No 1	$7,878 89	$7,878 89	$418 89	$7,878 89	.....	Canceled October, 1867.
.....	Section No. 1	14,690 00	9,487 50	.....	.....	$9,487 50	Relet.
71	Section No. 2	29,086 37	29,086 37	1,886 37	29,086 37	.....	Canceled October, 1867.
.....	Section No. 2	43,980 00	37,537 50	.....	.....	37,537 50	Relet.
80	Section No. 3	30,385 72	30,385 72	685 72	30,385 72	.....	Canceled October. 1867.
.....	Section No. 3	28,000 00	23,257 50	.....	.....	23,257 50	Relet.
80	Section No. 4	40,523 61	40,523 61	1,943 61	40,523 61	.....	Canceled October, 1867.
.....	Section No. 4	44,720 00	39,345 00	2,780 00	2,780 00	36,565 00	Relet.
90	Section No. 5	57,485 02	57,485 02	1,585 02	57,485 02	.....	Canceled October, 1867.
.....	Section No. 5	29,900 00	18,400 00	2,000 00	2,000 00	16,400 00	Relet.
90	Section No. 6	39,227 81	39,227 81	1,307 81	39,227 81	.....	Canceled October, 1867.
.....	Section No. 6	22,320 00	19,320 00	.....	.....	19,320 00	Relet.
80	Section No. 7	43,095 00	31,726 85	.....	31,726 85	.....	Completed.
80	Section No. 8	21,185 00	29,626 93	.....	29,626 93	.....	Completed.
80	Section No. 9	12,745 00	19,427 52	81 52	19,427 52	.....	Completed.
80	Section No. 10	6,692 62	6,692 62	1,212 62	6,692 62	.....	Canceled October, 1867.
.....	Section No. 10	13,100 00	10,954 00	.....	.....	10,954 00	Relet.
76	Section No. 11	30,650 00	28,048 89	2,608 89	28,048 89	.....	Completed.
81	Section No. 12	17,050 00	18,500 86	20 86	18,500 86	.....	Completed.
80	Section No. 13	12,130 00	8,284 47	.....	8,284 47	.....	Completed.
80	Section No. 14	13,080 16	13,080 16	.....	13,080 16	.....	Canceled October, 1867.
.....	Section No. 14	10,210 00	9,105 00	2,120 00	2,120 00	6,985.00	Relet.
80	Section No. 15	9,008 86	9,008 86	.....	9,008 86	.....	Canceled October, 1867.
.....	Section No. 15	10,850 00	9,425 00	.....	.....	9,425 00	Relet.
80	Section No. 16	22,650 00	13,455 68	.....	13,455 68	.....	Completed.
82	Section No. 17	18,430 45	18,430 45	4,030 45	18,430 45	.....	Canceled October, 1867.
.....	Section No. 17	25,700 00	17,840 00	240 00	240 00	17,600 00	Relet.
88	Section No. 18	36,311 34	36,311 34	.....	36,311 34	.....	Canceled October, 1867.
.....	Section No. 18	39,000 00	26,280 00	.....	.....	26,280 00	Relet.
80	Section No. 19	10,650 00	11,280 50	240 50	11,280 50	.....	Completed.
80	Section No. 20	23,700 00	22,000 00	10,900 00	10,900 00	11,100 00	Old contract running.
80	Section No. 21	10,830 46	10,830 46	550 46	10,830 46	.....	Canceled October, 1867.
.....	Section No. 21	36,700 00	28,200 00	3,260 00	3,260 00	24,940 00	Relet.
79	Section No. 22	65,100 00	76,271 86	22,211 86	76,271 86	.....	Completed.
85	Section No. 23	12,050 00	29,219 55	.....	29,219 55	.....	Completed.
79	Section No. 24	24,300 00	34,117 00	.....	9,940 00	24,177 00	Old contract running.
82	Section No. 25	3,426 79	3,426 79	766 79	3,426 79	.....	Canceled October, 1867.
84	Section No. 26	108,455 66	108,455 66	2,315 66	108,455 66	.....	Canceled October, 1867.
80	Section No. 27	10,528 51	10,528 51	1,188 51	10,528 51	.....	Canceled October, 1867.
85	Section No. 28	16,700 00	16,520 00	.....	.....	16,520 00	Old contract running.

Table No. 2—(Continued).

Length in Chains.	CHARACTER OF WORK.	Engineers' estimate.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.	Remarks.
85	Section No. 29	$10,910 01	$10,910 01	$1,770 01	$10,910 01	.....	Canceled October, 1867.
87	Section No. 30	5,005 28	5,005 28	645 28	5,005 28	.....	Canceled October, 1867.
.....	Lock No. 1	12,247 00	11,236 00	.....	2,000 00	$9,236 00	Old contract running.
.....	Lock No. 2	11,872 00	10,775 00	.....	2,240 00	8,535 00	Old contract running.
.....	Lock No. 3	12,822 00	12,031 00	.....	1,860 00	10,171 00	Old contract running.
.....	Lock No. 4	4,457 34	4,457 34	487 34	4,457 34	.....	Canceled October. 1867.
.....	Lock No. 5	3,230 84	3,230 84	250 84	3,230 84	.....	Canceled October, 1867.
.....	Choconut creek aqueduct	17,007 16	17,007 16	1,367 16	17,007 16	.....	Canceled October, 1867.
.....	Tracy creek aqueduct	20,936 00	25,700 00	.....	3,380 00	22,320 00	Old contract running.
.....	Apalachin creek aqueduct	13,879 15	13,879 15	579 15	13,879 15	.....	Canceled October, 1867.
.....	Culverts on sections 1 to 5	444 44	444 44	44 44	444 44	.....	Canceled October, 1867.
.....	Culverts on sections 6 to 10	12,511 40	12,511 40	671 40	12,511 40	.....	Canceled October. 1867.
.....	Culverts on sections 11 to 20	17,738 85	17,738 85	998 85	17,738 85	.....	Canceled October, 1867.
.....	Culverts on (the above) sections 1 to 20	18,250 00	12,684 00	1,720 00	1,720 00	10,964 00	Relet.
.....	Culverts on sections 21 to 30	16,695 00	23,863 00	960 00	3,360 00	20,503 00	Old contract running.
.....	Bridges on sections 1 to 5	4,113 40	4,113 40	213 40	4,113 40	.....	Canceled.
.....	Bridges on sections 6 to 10	18,934 00	14,100 00	.....	4,300 00	9,800 00	Old contract running.
	Totals	$1,253,581 14	$1,208,670 75	$73,953 41	$826,593 25	$382,077 50	

TABLE No. 3.

STATEMENT of work upon miscellaneous repairs authorized by the Canal Board, and under supervision of the engineer department, for the fiscal year ending September 30th, 1868.

ERIE CANAL.

CHARACTER OF WORK.	Amount appropriated.	Amount done.	Amount paid.
Stone dam across outlet of Skaneateles lake	$13,060 48	$13,060 48	$13,060 48
Repairs of foundation to locks 47. 48 and 49	1,903 49	1,903 49	1,903 49
Repairs of Crane Brook aqueduct	1,675 42	1,675 42	1,675 42
Stone fence with iron rail, near weigh lock, Syracuse,	320 00	320 00	320 00
Protecting waste-wier on Camillus feeder	242 34	242 34	242 34
Farm bridge over Limestone creek feeder	302 87	302 87	302 87
Protecting over-fall below waste-wier at De Ruyter reservoir	199 50	177 96	177 96
Total	$17,704 10	$17,682 56	$17,682 56

CHENANGO CANAL.

Iron bridge at College street, Clinton	$2,651 00	$2,584 83	$2,584 83
Iron bridge at Water street, Clinton	2,295 00	2,259 01	2,259 01
Repairs of aqueduct at Greene	109 58	109 58	109 58
Total	$5,055 58	$4,953 42	$4,953 42

OSWEGO CANAL.

Iron bridge at Broadway street, Fulton	$5,992 50	$5,971 57	$5,971 57
Total	$5,992 50	$5,971 57	$5,971 57

TABLE No. 4.

STATEMENT showing the work not under contract, whether from having been not yet let or from having been canceled.

EXTENSION OF THE CHENANGO CANAL.

Length in chains.	CHARACTER OF WORK.	Engineer's estimate.	
81	Section No. 12	$2,300 00	River bank to be raised.
80	Section No. 13	4,800 00	River bank to be raised.
80	Section No. 16	4,000 00	River bank to be raised.
79	Section No. 22	3,700 00	River bank to be raised.
85	Section No. 23	5,580 00	River bank to be raised.
82	Section No. 25	9,334 00	Canceled October, 1867.
84	Section No. 26	37,700 00	Canceled October, 1867.
84	Section No. 27	1,000 00	Canceled October, 1867.
85	Section No. 29	1,600 00	Canceled October, 1867.
87	Section No. 30	5,700 00	Canceled October, 1867.
.....	Lift lock No. 4	10,860 00	Canceled October, 1867.
.....	Lift lock No. 5	9,765 00	Canceled October, 1867.
.....	Choconut creek aqueduct	18,000 00	Canceled Ociober, 1867.
.....	Apalachin creek aqueduct	16,300 00	Canceled October, 1867.
.....	Bridges on sections 1 to 5	16,400 00	Canceled October, 1867.
80	Section No. 31	15,250 00	Never let.
80	Section No. 32	20,200 00	Never let.
80	Section No. 33	19,250 00	Never let.
80	Section No. 34	18,000 00	Never let.
80	Section No. 35	24,000 00	Never let.
80	Section No. 36	21,750 00	Never let.
84	Section No. 37	20,300 00	Never let.
80	Section No. 38	13,650 00	Never let.
62	Section No. 39	10,250 00	Never let.
74	Dam and guard lock section	50,000 00	Never let.
.....	Lift lock No. 6	12,405 00	Never let.
.....	Lift lock No. 7	12,805 00	Never let.
.....	Lift lock No. 8	14,030 00	Never let.
.....	Lift lock No. 9	13,295 00	Never let.
.....	Lift lock No. 10	18,725 00	Never let.
.....	Lift lock No. 11	12,995 00	Never let.
.....	Archibald creek aqueduct	10,662 00	Never let.
.....	Wappasena creek aqueduct	13,391 00	Never let.
.....	Little Wappasena creek aqueduct	10,662 00	Never let.
.....	Park's creek aqueduct	9,136 00	Never let.
.....	Five waste-wiers	10,000 00	Never let.
.....	Bridges on sections 11 to 30	74,100 00	Never let.
	Total	$571,895 00	

SUMMARY.

Amount of work done in fiscal year.

CANAL.	Work under contract.	Work upon miscellaneous repairs.	Total.
Erie	$44,443 69	$17,682 56	$62,126 25
Oswego	95,190 08	5,971 57	101,161 65
Chenango	62,298 36	4,953 42	67,251 78
Chemung	15,404 64	.....	15,404 64
Crooked Lake	24,934 97	.....	24,934 97
Cayuga and Seneca	.....	.....	.....
Onelda Lake	31,560 00	.....	31,560 00
Extension of Chenango	73,953 41	.....	73,953 41
	$347,785 15	$28,607 55	$376,392 70

WESTERN DIVISION.

ANNUAL REPORT OF DANIEL RICHMOND, DIVISION ENGINEER WESTERN DIVISION NEW YORK STATE CANALS, FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1868.

DIVISION ENGINEER'S OFFICE, WESTERN DIVISION,
ROCHESTER, *Sept. 30th*, 1868.

Hon. VAN R. RICHMOND, *State Engineer and Surveyor.*

Sir—In pursuance of the regulations of the Engineer Department under act, chapter 169, Laws of 1862, I herewith submit my annual report of the Western Division of the New York State canals for the fiscal year ending September 30th, 1868. The canals embraced on this division are as follows, viz:

	Miles.
Erie canal, from east line of Wayne county to Buffalo	148½
Genesee Valley canal from Rochester to Millgrove	113½
Dansville branch of Genesee Valley canal	11
Total	273

The navigable feeders are as follows:

	Miles.
Genesee river feeder at Rochester	2¼
Genesee river feeder at Oramel	¾
Total	3

The canals on this division are supplied with water from the following sources:

ERIE CANAL.

Lake Erie.
Tonawanda creek at Pendleton.
Oak Orchard and Tonawanda creek at Medina.
Genesee Valley canal at Rochester.
Genesee river at Rochester.

GENESEE VALLEY CANAL.

Allen's creek at Scottsville.
Genesee river at Mount Morris.
Canasaraga creek feeder, two miles north of Dansville.
Mill creek at Dansville.
Wiscoy creek feeder.
Genesee river at Oramel.
Rockville reservoir near Belfast.
Two branches of Black creek on Summit level.
Oil creek reservoir on Summit, two miles north of Cuba.
Champlain and Griffin creeks at Cuba.
Ischua feeder from Ischua creek at south end of Summit.
Haskell creek on extension.
Dodge creek on extension at Portville.
Oswayo creek on extension south of Portville.
Allegany river at head of canal at Millgrove.

ENGINEER DEPARTMENT.

The Western Division was under the charge of W. W. Jerome as Resident and Acting Division Engineer from the commencement of the fiscal year up to the 20th day of February last, since which time the undersigned has been employed as Division Engineer. On the 1st day of July last, Mr. Jerome resigned his position as Resident Engineer, since which time no resident has been employed on this Division. In table No. 1 hereto annexed will be found a list of Engineers employed for the fiscal year, together with the time and rate of compensation of each. Table No. 2 hereto attached shows the character and condition of the work under contract during the year; and table No. 3 the character and condition of work of a miscellaneous character done under the supervision of this department.

ERIE CANAL.

Ordinary Repairs.

There have been no detentions to navigation on this division, except one of a few hours in consequence of the breaking of some of the floor timbers in the trunk of Palmyra aqueduct. The break at this point occurred at 5 A. M. August 21st., and was repaired at 10½ P. M. the same day.

On the 19th of March a break occurred at the State ditch culvert at Tonawanda, but was temporarily repaired previous to May 4th, the day appointed for opening navigation. This structure is a very large and expensive one, and carries the drainage water from quite a large extent of country into Niagara river. The repairs were temporarily made by stopping up the culvert and pumping the drainage water into Tonawanda creek. At the close of this season's navigation it will be necessary to take up and rebuild the structure. The expense of this break to the State to this date, over and above the amount which has been expended by the repair contractor under his contract, amounts to $8,059.09.

During the year a large number of new road and farm bridges have been constructed, and quite a large amount of new docking placed upon vertical walls, and the repairs generally so performed that navigation has been kept up the entire season, although some difficulty on account of the dry weather. During the dryest part of the season it was found necessary to divert the water from the Genesee river through the Genesee river feeder to keep up the supply at the east end of the long level. It was also found necessary to put flush boards on the waste-wier overflows on this level, to secure an increased volume of water from Lake Erie. The necessity for these measures was due to a considerable extent to the fact that for a series of years the canal has not been thoroughly and systematically bottomed out each season; and as a consequence the prism is gradually filling up, and as this continues it is found necessary to raise the surface of the water correspondingly to maintain navigation.

The large amount of deposit which has been allowed to accumulate from year to year in the prism of the canal, added to a considerable amount of original material remaining above bottom, has been fast destroying its utility and vastly increasing the difficulties of navigation, and although every effort was made last spring to obtain laborers, and a large force actually engaged in improving the canal on this division in this particular, yet with the present scarcity of labor, it was found impossible to do all that was desired, and although sufficient was accomplished to prevent any serious delay to navigation, there yet remains a very large amount of work of this kind to do, and more than can possibly be done in any one season; but it must be the result of several seasons of energetic and systematic labor.

The undersigned is of the opinion that two steam dredges should be constructed for this division; one for the Erie, and one for the Genesee Valley canal, and kept energetically at work until the canal

is restored to its original depth and width. This course is recommended from the following considerations: For the short period in the spring, previous to the opening of navigation, a sufficient force of laborers cannot be obtained to accomplish the results desired, especially so, while it is the interest of the contractor for repairs to delay and thus reduce the expense to the smallest minimum. On the other hand, a dredge could be in use all the season through, and would accommodate itself to the present scarcity of labor, as a large force would not be required to operate it. Again, in case of low water and detention during navigation at any point in consequence of bars, a dredge can be moved to that point and the material removed without drawing the water from the canal.

The undersigned believes that a few seasons' energetic work of this kind, added to the labor which could be obtained during the suspension of navigation in the winter and spring, would restore the canal to more than its original capacity and utility.

The undersigned feels that he should not perform his duty did he fail in pointing to the almost obvious conclusions to be drawn from the facts above stated, and that is, that as under the present system of letting the repairs of the canals by contract, such a depreciation in their value and utility has followed, it is manifest that some other system, or a modification of the present system should be tried, in which it shall not be the interest of those making the repairs, to *do the least possible amount of work for the greatest possible amount of money*, but rather the canals placed and kept in the highest possible state of efficiency that an energetic superintendence and a judicious and liberal expenditure can effect.

In letting the work for keeping superintendent section No. 14 in repair, the repairing the towing path on construction section No. 368, was reserved from the contract. On page 204, of State Engineer's report of last year, the condition of this towing path is set forth at large. On the 22d day of July last, the contract for repairing a portion of this towing path was let to Clark & Douglas at an estimated cost of $15,000, to be completed on or before the first day of April, 1869.

Extraordinary Repairs.

Act, chapter 715, Laws of 1868, provided for a large amount of work on this division in the way of improving the canal at different points. Under this act, the following contracts have been made:

Dredging Ohio basin; constructing Pile Jetty pier at Black Rock; extending Black Rock pier; improving Main and Hamburgh Street

canal in the city of Buffalo; dredging channel below ship lock at Black Rock; rebuilding west abutment and approach to change bridge section 367; rebuilding towing path on section No. 368; completing Clark and Skinner canal in the city of Buffalo; building vertical walls at Middleport and Port Gibson; an iron bridge at Medina. Under act, chapter 350, Laws of 1868, a vertical wall has been constructed at Albion, at a cost of $3,001.56, and under authority of the same act, a contract has been executed for the construction of a vertical wall at Medina, to be finished next spring.

Full information in reference to the above work, as well as other work in progress during the year, will be found in Table No. 2, hereto attached.

Under authority of act, chapter 715, Laws of 1868, the work of constructing the abutments for an iron bridge to connect Perry and Smith streets, in the village of Brockport, is advertised for letting on the 1st day of October next. Under a former act, $7,500 was appropriated for the construction of this bridge, its abutments and necessary approaches, but no action was had on the part of the Canal Commissioners, on the ground that the appropriation was not sufficient to complete the work. This sum should be re-appropriated at the next session of the Legislature, which sum, added to the appropriation of last winter, it is believed, will complete the work.

Work Recommended to be Done.

I would respectfully recommend an appropriation of $24,000, for the purpose of deepening the east end of the long level, from first lock east of Rochester to Lyell street, and including the cutting down the bottom of Rochester aqueduct.

The Erie canal is supplied with water, mostly obtained from Lake Erie, from Black Rock to Montezuma, and in dry seasons a portion of the Cayuga and Seneca canal is supplied from same source. As a consequence, the draft of water from the long level at the first lock east of Rochester, is very large, and under these circumstances, unless the wind is in a favorable direction, the surface of the water is drawn down, rendering it very difficult to maintain navigation. By the deepening above recommended, it is intended to increase the grade on bottom from the lock west for about three miles, and thus also to deepen the channel. An appropriation of $16,000 is also required for constructing vertical walls, in place of the timber and plank facing on towing path, from Rochester aqueduct to Griffith

street, and for straightening berme line and building vertical wall from Rochester weigh lock to Griffith street.

The timber and plank facing above mentioned, is nearly worn out, and has never been a permanent work, as the frosts every spring press it out of line and into the canal; it should be made permanent by replacing with a heavy vertical wall.

The straightening the berme line of canal from weigh lock to Griffith street, has been recommended as a much needed improvement by my predecessors for many years. The weigh lock is located almost entirely outside the general line of the canal, thus rendering the channel for entrance to, and egress from, the lock tortuous and difficult; in addition to this the berme bank between the points named, is lined with coal and lumber yards, at which, during a large portion of the season of navigation, boats are unloading, still further increasing the difficulties of navigation, occasionally resulting in jams and the sinking of boats. I would also respectfully urge the necessity for the construction of a stop dam near the mouth of Genesee river feeder, at Rochester. In times of heavy floods, the Genesee river flows over the feeder banks and passes a vast volume of water down the feeder and into the canal, and during the spring of 1865, the canal soon filled and flowed over into the city, causing great damage. A guard bank is being constructed along the river, to cut off the water from finding its way into the Erie by overflowing the Genesee Valley canal banks, and the improvement now named, will prevent the river from again filling the Erie canal, except over the top of the aqueduct. The estimated cost is $2,000.

There are still remaining about three miles of old earth bench on this division, extending from Lyon's lock west. As the slope walls were originally constructed on a bench of earth, and the earth has since washed down in many places, the prism has become filled up to some extent by the same, and the slope walls have been let down and very much out of shape, the earth bench, where still remaining, in case of low water from any cause, obstructs the passage of boats, and in any case diminishes the capacity of the canal. I therefore recommend that this bench wall be taken out and slope walls, starting at the bottom of canal, be constructed similar to other portions of the canal. The estimated expense is $55,000.

I would also urgently recommend the construction of a receiver for White's creek, where it enters the canal at Wayneport, at an

estimated expense of $3,000. The creek now flows down the bed of the old canal, and carries into the present canal at every freshet a large amount of earth, a portion of which is carried down for a long distance and deposited in the bottom, while the balance accumulates near the mouth of the creek, forming bars over which boats cannot pass until the water is drawn down and the material removed. The plan of the proposed receiver contemplates the construction of a breast or overflow wall, the top of which shall be something higher than the bed of the creek, and also a well to retain such material as may pass over the breast wall under these conditions, thus preventing the earth, which is washed down the creek, from entering the canal and obstructing the prism.

I also respectfully recommend the lengthening of the abutments of the road and change bridge east of Upper Macedon locks, and the construction of an additional roadway for the use of the towing path. The estimated expense is $2,000. This recommendation is made on the ground that canal teams and the traveling public mutually discommode each other in being obliged to use the same track, and further, that, in consequence of its being used as a tow path bridge, it is necessary to keep the track much higher than would be required for a road bridge alone, thus rendering it difficult for the passage of loaded teams.

The timber bridges now in use on the canal have to be renewed on an average in eight or nine years. I would recommend that when rebuilt, iron should be substituted in towns and villages, and on great thoroughfares, and in all other cases where it is not thought advisable at present to reconstruct entirely of iron, that iron chords and shoes be substituted for the present plan of timber chords, and also that when timber bridges are rebuilt they should be ceiled to protect them from the weather, which, in my opinion, will at least double the duration of those structures. I have therefore estimated as necessary for such change of plan on this division, $30,000.

The State ditch culvert at Tonawanda has been found insufficient to pass the surface water accumulating in that locality. I therefore recommend that an additional culvert be constructed a short distance west of the present culvert, at a point where one was formerly located. The estimated cost is $7,000.

I also recommend the dredging of a new channel at north end of Erie breakwater, 900 feet long and 300 feet wide at an estimated cost of $17,500. This recommendation was also made by my prede-

cessor, on the ground that the entrance to Erie basin at south end of breakwater alone is not considered of sufficient capacity to accommodate the navigation. I also recommend an appropriation of $15,000, for the further improvement of the Main and Hamburgh Street canal, from west side of Hamburgh street to Washington street.

A contract has been executed under act, chapter 715, Laws of 1868, and work commenced for the improvement of a portion of this canal, but as the same necessity for the improvement exists for the whole distance indicated above, to make the canal fully available and of increased value to the State, I believe the work should not stop short of completion.

By act, chapter 715, Laws of 1868, the Canal Commissioners were directed to cause the Ohio basin in the city of Buffalo to be dredged to a depth three feet below the base or bottom heretofore established. By this improvement it was intended that lake vessels should be enabled to discharge their cargoes in this basin; it is also considered important that the Ohio canal, which is connected with the basin, should be dredged to the same depth as far up as Elk street, so that vessels may also have facilities for unloading on this canal.

In the prosecution of the work of dredging the basin it has been found that about 3,100 lineal feet of piles will have to be driven in front of the present docking to prevent its being undermined and destroyed by the increased depth to which the basin is being excavated, and which carries it below the bottom of the docking. The estimated cost of these two additional items of work is $5,000.

An appropriation of $14,600 is required to remove the division wall between towing path of section No. 370 and berme of old canal, between railroad bridge and Ferry street, in Black Rock; and also the foundation of an old warehouse on section No. 368, opposite Bird avenue; and also the graveling a portion of the tow path on section No. 368, reserved from repair contract.

The object of the improvement is to so widen the channel as to reduce the velocity of the flow of water, and render the navigation less difficult. With the present contracted channel the flow is from 2½ to 3 miles per hour, causing great resistance to upward bound boats, and rendering the passage at these points slow and laborious. The graveling mentioned is necessary from the fact that the material of which the embankment is composed is clay, and entirely unfit for the finishing of the top of towing path bank.

DOUBLING THE LOCKS ON WESTERN DIVISION.

I would again call the attention of the department to the fact that on this division the locks are all single, except the combined locks at Lockport and the upper lock at Macedon, while the locks on the other divisions are double.

The result of this state of things is that, during the busy season of navigation, and in cases of slight detention during any part of the season, much difficulty and serious delay is experienced in passing the boats as they accumulate, and at the same time sufficient water to supply so long a distance as has to be supplied from Lake Erie to Port Byron, and at times a considerable portion also of the Cayuga and Seneca canal. Another difficulty which often arises from this state of things is that in cases of detention east of us, when the embargo is removed, they are able with their double locks to force large numbers of upward bound boats upon our already crowded levels very much faster than with our single locks we can dispose of them, thus transferring and extending the detention to this division, and producing jams, vexatious delays and large loss to boatmen and forwarders. That the present single locks on this division are not equal to the wants of the canal, and that they bear no comparison to the facilities possessed by the other divisions, is admitted in all quarters. No further argument seems necessary from me as to the necessity of this improvement, as it has been repeatedly urged by my predecessors, as also the different Canal Commissioners of this division in years past, and also by several State Engineers. The estimated cost of the work it $425,000.

GENESEE VALLEY CANAL.

Ordinary Repairs.

Navigation on the summit level of this canal was suspended last year on the 20th day of August, for lack of water, and was not again resumed until the opening of navigation this spring. As a consequence, large quantities of lumber which had been shipped remained on the canal during the winter, as also a vast quantity which was ready for shipment and had in many cases been contracted for, could not be shipped until the opening of navigation, thus entailing heavy loss on manufacturers, lumber dealers and boatmen.

Sections 1 and 3 were opened for this season's navigation on the 4th day of May, and section 2 on the 20th day of June, succeeding.

The delay in opening section 2, was caused in the first instance by the failure of the contractor to finish the necessary repairs, and finally by a break on the mile level, east of Nunda, which occurred on the 27th day of May. The break occurred by reason of a heavy storm in that locality, which threw a large amount of surface water into the canal faster than it could be disposed of through the waste-wiers and overflows, and finally carried out a waste-wier and a heavy towing path embankment. Since the opening this spring, the detentions have been comparatively slight. Navigation has been maintained on the summit level until this date, although the season has been extremely dry, and there still remains in Oil creek reservoir a supply which it is estimated will still keep up navigation for several weeks without much rain. The general remarks in regard to the condition of the repairs on the Erie canal, will equally apply to the Genesee Valley, in addition to which, it may be stated, that a large outlay is now, or very soon will be, required to repair, rebuild, improve the locks, aqueducts and other structures, which in many cases are very much dilapidated, as the result of imperfect construction, wear, neglect and decay.

The work on the contract for rebuilding north trunk at Portage, has been completed, as is also the work of building earth bank and prism in place of south trunk at Portage, although the finals are not yet rendered.

Under a resolution of the Board of Canal Commissioners, the work of rebuilding in part four groups of locks, viz: Nos. 12, 16, 18 and 19, and 29, 32, 36, 30 and 37, and 49, 39 and 40, and 65, and guard lock at Oramel, are advertised to be let on the first day of October next, to be completed previous to the opening of navigation next season.

Extraordinary Repairs.

Table No. 2, hereto attached, contains a full description of the condition of the work in progress during the fiscal year, as also of work let, under provisions of act, chapter 715, Laws of 1868, consisting of the following: Deepening, widening and improving canal from junction to guard lock in the city of Rochester; dam, bulkhead and feeder at Smith's Mills; slide bank at Portage; rebuilding seven spans of Ischua feeder aqueduct, and raising Oil creek reservoir. Under the provisions of the same act, the work of improving Ischua feeder, and building Ischua reservoir is advertised to be let on the first day of October next.

SUPPLY OF WATER FOR SUMMIT LEVEL.

For the past nine years there has been but three seasons during which the supply of water has been sufficient to maintain navigation on the summit, while for the remaining six years, the detention from failure of water has been from one to three months each season. The attention of the Legislature having been repeatedly, in years past, called to this deficiency, both by this department and through petitions of those interested in the navigation of the Genesee Valley canal, that body at its last session made the requisite appropriations to meet this demand. After a careful examination of the sources of supply, and the amount of supply required, I became convinced that by raising the surface of Oil creek reservoir at Cuba six feet, the building of a reservoir on Ischua creek, and a dam, bulkhead and feeder at Smith's Mills, the object desired could be most thoroughly accomplished, and at the smallest outlay.

The basis of my judgment in determining, as to the best means to meet the water demand of the summit, will be best developed by the following statements in brief:

Statement of amount of water required to supply summit of Genesee Valley canal for a period of 210 days, from May 1st:

	Cubic feet.
Evaporation and filtration, estimated at 66 cubic feet per minute per mile for 26 miles	1,716
Leakage at end locks, 500 cubic feet each per minute	1,000
Leakage at 7 waste-wiers, 30 cubic feet each per minute	210
Leakage at Olean creek aqueduct per minute	53
Leakage at Ischua feeder aqueduct	75
2 locks full of water per boat for passing the summit, and 27 boats each way per day, per minute	1,194
Total cubic feet per minute required	4,248
Amount required to fill 26 miles of canal	18,670,080
Deficiency in Rockville reservoir to be supplied	19,602,727
Evaporation, filtration, leakage and lockage as above, at the rate of 4,248 cubic feet per minute	1,284,595,200
Total water required	1,322,868,007

Amount of water that will be furnished by Oil creek reservoir, raised six feet as contemplated.

	Cubic feet.
Reservoir now contains when full	390,000,000
Add 6 feet depth on mean area of 525 acres	137,214,000

	Cubic feet.
Supply from drainage for 7 months, on a surface of 16,827 acres, at the rate of $\frac{5}{10}\frac{6}{0}$ inches per month,	239,464,912
Amount	766,678,912

Deduct

	Inches per day.	
Loss from reservoir by filtration, absorption and leakage	0.3647	
Loss from reservoir by evaporation	0.1965	
Total loss per day	0.5612	
Loss as above for 210 days		224,116,200
Total estimated supply from Oil creek reservoir, raised 6 feet		542,562,712

Statement of supply to be obtained from Ischua reservoir, flowing 200 acres.

	Cubic feet.
Reservoir will contain	101,000,000
Add for drainage for 7 months on a drainage surface of 67,734 acres, at the rate 0.56 inches per month,	962,590,000
Amount	1,063,590,000
Deduct loss from filtration, leakage and evaporation,	76,734,000
Total that can be obtained from Ischua reservoir,	986,856,000

RECAPITULATION.

		Cubic feet.
Total estimated amount required for summit		1,322,868,007
Amount to be obtained from Oil creek reservoir raised 6 feet	542,562,712	
Amount to be obtained from Ischua reservoir	986,856,000	
		1,529,418,712
Leaving a surplus for contingencies		206,550,705

The expenditure to render this additional water available, estimated at contract prices, including engineering and contingencies, and exclusive of land damages, is as follows:

Raising Oil creek reservoir 6 feet	$50,000
Building Ischua reservoir	70,000
Improving Ischua feeder	7,500
	$127,500

In addition to the above estimated surplus, is the no inconsiderable amount to be obtained from Oil creek by the construction of dam, bulkhead and feeder at Smith's mills at a cost including contingencies and engineering, and exclusive of land damages, estimating at contract prices $4,500. To this estimated surplus is also to be added the supply now obtained from Griffin and Champlain creeks at Cuba. With these sources of supply made completely available, and with the locks and other structures made reasonably tight and the water properly husbanded, I have no hesitation in stating it as my deliberate opinion that navigation can be fully maintained upon the summit during the whole of the dryest season, and, if no accident supervenes, leave a surplus equal to at least two months full supply.

When, in addition to these improvements, the canal shall be thoroughly bottomed out to its original dimensions and the mechanical structures put in complete order, the undersigned believes there is a bright future in store for this canal, not only from its becoming still more surely the avenue to a market for the still immense timber products at its southern end, but also of the immense coal deposits of Pennsylvania.

WORK RECOMMENDED TO BE DONE.

To increase the efficiency of the other improvements already provided for the summit, I would respectfully recommend an appropriation of $10,000 for the purpose of depressing the north end of the summit level one foot. The object of the suggested improvement will be seen when it is stated that this level is 12 miles long, and that the sources of water supply are at Cuba, near the middle of the level and at the extreme south end. The difficulty of forcing a supply through a long, narrow and crooked channel without flooding the banks is obvious. The improvement suggested will make a grade in the bottom from Cuba to north end, increase the depth of water near the lock, where the water fluctuates soonest in locking, and passing water to supply the levels below.

Ever since the construction of the Rockville reservoir it has been found very difficult to maintain an overflow or outlet for the same. Large expenditures have been made almost every year, and the location of the outlet channel changed at least once to prevent the entire washing away of the dam embankment at lower end. Notwithstanding these efforts, the reservoir is again in imminent danger of being destroyed, from the wearing away of the material below to a great

depth at the foot of slope of the embankment. The material in that locality is composed of clay intermixed with quicksand, and entirely unfit to withstand the wash of the discharge water from the reservoir until the level of the valley is reached. I therefore propose the construction of a stone overflow wall and wings, connected with a series of overfall platforms of timber, supported on piles and filled in with trees, brush and stone, the same to be extended until the bed of the stream below is reached and all danger of the wearing away of the material obviated. The estimated expense of this improvement is $10,000.

I also recommend that provision be made for excavating a new channel from the Genesee river to the Murray Mill canal, at Mount Morris, at an expense of $1,500. The present channel to the Mill canal is identical with the channel used for towing boats from the canal and across to the pond in the Genesee river above the dam. The strong current from the river to the Mill canal brings in and deposits large quantities of material, which renders it very difficult to keep an open channel for boats during the summer. With this proposed improvement made, it is believed there would be no further trouble from this cause, as the current through the canal channel would be outward toward the deeper water.

FINAL MAPS AND SURVEYS OF THE CANAL.

In pursuance of act, chapter 715, Laws of 1868, a force was organized on this division, on the 5th of September, to complete the final survey of the canal. The party in the field is under the direction of Byron Holley, Esq., and very commendable progress has been made up to the date of this report. The work was commenced at Guard lock, at Black Rock, and extended eastward. It is intended to make the surveys in Buffalo and Black Rock harbor during the suspension of navigation this winter, as the stir and activity among craft of all descriptions render it next to impossible to do the work during the season of navigation.

The surveys are to include all the canal from Brockport to, and including, the city of Buffalo, a distance of 73 miles; they are also to include about 20 miles of State ditches.

In this distance is included several large villages as smaller canal towns, as well as the cities of Buffalo, Black Rock and Lockport, at which places much time will be required for accurate surveys, such as

are necessary. From observations of the difficulties attending the survey and the rate of progress which can be made, I am convinced that a further appropriation of $3,000, will be necessary to complete the survey and maps for this division.

RECAPITULATION OF WORK RECOMMENDED TO BE DONE.

Erie Canal.

Iron bridge, to connect Perry and Smith streets, in village of Brockport (re-appropriation)	$7,500
Deepening canal from first lock east of Rochester to Lyell street, including lowering of bottom of Rochester aqueduct	24,000
Vertical wall in place of timber and plank facing from Rochester aqueduct to Griffith street, and straightening berme line and building vertical wall from weigh lock to Griffith street	16,000
Stop dam in Genesee river feeder at Rochester	2,000
Taking out bench walls from Lyon's locks, west three miles,	55,000
Receiver at entrance of White's creek into canal at Wayneport	3,000
Additional track to road and change bridge near Macedon	2,000
Changing plans of bridges	30,000
Final maps and surveys (Western Division)	3,000
Doubling locks (Western Division)	425,000
Dredging new channel north end Erie breakwater at Buffalo,	17,500
For further improving the Main and Hamburgh Street canal, from west side of Hamburgh street to Washington street, Buffalo	15,000
Piling 3,100 lineal feet of Ohio basin and deepening Ohio canal to Elk street	5,000
Removing 800 lineal feet division wall, between towing path of section 370 and berme of old canal; also foundation of old warehouse opposite Bird avenue, on section No. 368, and graveling tow path on section 368, reserved from repair contract	14,600
New iron culvert on section No. 360 (Tonawanda)	7,000

Genesee Valley Canal.

Deepening summit level from north end to Cuba	10,000
Changing plans of bridges	20,000
Outlet overflow for Rockville reservoir	10,000
New channel to entrance Murray Mill canal	1,500

Respectfully submitted.

DANIEL RICHMOND,

Division Engineer.

TABLE No. 1.

STATEMENT showing name, number of days and compensation of engineers upon the repairs of the Western Division of the New York State canals, together with incidental expenses during the fiscal year ending September 30, 1868, *under act, chap.* 169, *Laws of* 1863.

ERIE CANAL—REPAIRS.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amount.	Total.
Daniel Richmond	Division engineer	.....	$2,000 00	$814 81	
Daniel Richmond	Division engineer, travel	.....	.....	328 30	
W. W. Jerome	Resident engineer and act'g division engineer	.....	1,700 00	1,177 34	
W. W. Jerome	Resident engineer and act'g division engineer, travel	.....	.....	437 82	
George Arnoldt	Assistant engineer	34	5 50	187 00	
J. Nelson Tubbs	Assistant engineer	13	5 50	71 50	
Charles Truesdell	Assistant engineer	27	5 00	135 00	
					$3,151 77
	Incidental Expenses.				
Stationery				$206 13	
Fuel, light and office rent				396 25	
Postage and telegraph				110 43	
Miscellaneous				128 79	
					841 60
Total for Erie canal				.....	$3,993 37

GENESEE VALLEY CANAL—REPAIRS.

Daniel Richmond	Division engineer	.....	$2,000 00	$407 41	
Daniel Richmond	Division engineer, travel	.....	.....	199 00	
W. W. Jerome	Resident engineer and act'g division engineer	.....	1,700 00	588 66	
W. W. Jerome	Resident engineer and act'g division engineer, travel	.....	.....	70 68	
George Arnoldt	Assistant engineer	22	5 50	121 00	
J. Nelson Tubbs	Assistant engineer	7	5 50	38 50	
Charles Truesdell	Assistant engineer	14	5 00	70 00	
					$1,495 25
	Incidental Expenses.				
Stationery				$115 37	
Fuel, light and office rent				223 26	
Postage and telegraph				84 40	
Miscellaneous				84 84	
					507 87
Total for Genesee Valley canal				.....	$2,003 12

RECAPITULATION.

Erie canal	$3,993 37
Genesee Valley canal	2,003 12
Total	$5,996 49

TABLE No. 1—(*Continued*).

STATEMENT showing the assistants temporarily employed on ordinary repairs during the fiscal year ending September 30, 1868, *and paid by Canal Commissioner.*

ERIE CANAL—ORDINARY REPAIRS.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amount.	Total.
J. Nelson Tuhhs	Assistant engineer	80	$5 50	$440 00	
George Arnoldt	Assistant engineer	50	5 50	275 00	
J. Fredrick Behn	Assistant engineer	130	5 50	715 00	
Stephen Goodlng	Assistant engineer	30	5 50	165 00	
L. Gardner	Surveyor	33	4 00	132 00	
N. E. Story	Rodman	34	2 50	85 00	
Chester F. Shelley	Inspector	75	5 00	375 00	
W. Hollister	Inspector	25	4 00	100 00	
Andrew Spalding	Inspector	45	2 00	90 00	
					$2,377 00
GENESEE VALLEY CANAL.					
Byron Holley	Assistant engineer	23	$5 00	$ 115 00	
Byron Holley	Assistant engineer	174	5 50	957 00	
George Arnoldt	Assistant engineer	13	5 00	65 00	
George Arnoldt	Assistant engineer	20	5 50	110 00	
H. V. B. Barker	Assistant engineer	87	5 50	478 50	
N. E. Story	Rodman	5	2 50	12 50	
Gilbert S. Boss	Rodman	79	2 75	217 25	
R. B. McFarlin	Chainman	29	2 75	79 75	
N. H. Briggs	Chainman	79	2 75	217 25	
Perry A. Hibhard	Tapeman	68	2 75	187 00	
George G. Rnssell	Flagman	68	2 75	187 00	
J. R. Smith	Axman	45	2 00	90 00	
L. H. Spencer	Inspector mechanical struct'rs	14	4 00	56 00	
L. H. Spencer	Inspector mechanical struct'rs	78	4 50	351 00	
					3,123 25
					$5,500 25

Table No. 1—(*Continued*).

STATEMENT showing the assistants temporarily employed on extraordinary repairs paid by Canal Commissioner during the fiscal year ending September 30, 1868.

ERIE CANAL—EXTRAORDINARY REPAIRS.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amount.	Total.
J. Nelson Tubbs	Assistant engineer	109	$5 50	$599 50	
George Arnoldt	Assistant engineer	78	5 50	429 00	
George Arnoldt	Assistant engineer	27	5 00	135 00	
J. Frederick Behn	Assistant engineer	79	5 00	395 00	
J. Frederick Behn	Assistant engineer	105	5 50	577 50	
John A. Ditto	Surveyor	2	5 00	10 00	
Leman Gardner	Surveyor and leveler	67	4 50	301 50	
N. E. Story	Rodman	15	3 00	45 00	
Camillus Weiss	Rodman	42	2 00	84 00	
F. E. Richmond	Chainman	18	2 75	49 50	
John Z. Quackenhush	Inspector	47	3 00	141 00	
Darwin G. Bronson	Inspector	15	3 00	45 00	
Charles Emerick	Inspector	39	3 00	117 00	
					$2,929 00

Table No. 1—(Continued).

GENESEE VALLEY CANAL.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amount.	Total.
J. Nelson Tubbs	Assistant engineer	26	$5 50	$143 00	
Byron Holley	Assistant engineer	56	5 00	280 00	
Byron Holley	Assistant engineer	40	5 50	220 00	
George Arnoldt	Assistant engineer	41	5 00	205 00	
George Arnoldt	Assistant engineer	27	5 50	148 50	
L. Gardner	Surveyor and leveler	26	4 50	117 00	
John Bisgood	Draftsman	43	4 50	193 50	
E. Knechling	Leveler	43	4 00	172 00	
N. E. Story	Rodman	40	2 50	100 00	
N. E. Story	Rodman	43	3 00	129 00	
John Kiley	Rodman	4	2 50	10 00	
F. E. Richmond	Tapeman	26	2 25	58 50	
F. E. Richmond	Tapeman	40	2 75	110 00	
R. B. McFarlin	Chainman	26	2 25	58 50	
R. B. McFarlin	Chainman	29	2 75	79 75	
Byron Holley, Jr	Flagman	10	2 00	20 00	
L. H. Spencer	Inspec'r mechanic'l structures	79	4 50	355 50	
					$2,400 25
					$5,329 25

SUMMARY OF TABLE No. 1,

Showing engineering expenses for fiscal year ending Sept. 30, 1868.

NAME OF CANAL.	Engineering proper.	Incidental expenses.	Amount.	Total.
Repairs proper, Erie canal	$3,151 77	$841 60	$3,993 37	
Repairs proper, Genesee Valley canal	1,495 25	507 87	2,003 12	
				$5,996 49
Repairs ordinary, Erie canal	2,377 00	.....	$2,377 00	
Repairs ordinary, Genesee Valley canal	3,123 25	.....	3,123 25	
				5,500 25
Repairs extraordinary, Erie canal	2,929 00	.....	$2,929 00	
Repairs extraordinary, Genesee Valley canal	2,400 25	.....	2,400 25	
				5,329 25
Total				$16,825 99

TABLE No. 2.

STATEMENT showing character of work, estimated cost at engineers' and contract prices, the amount done during the fiscal year ending September 30th, 1868, and the amount remaining to be done on work under contract on the Western Division of the New York State canals.

ERIE CANAL.

CHARACTER OF WORK.	Engineers' estimate with engineering and contingencies added.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.
Improvement of Oak Orchard creek	.....	$51,222 39	$6,057 00	$51,222 39	Settled.
Excavation of Erie basin	$8,000 00	7,500 00	5,900 00	7,500 00	Settled.
Widening entrance Wilkinson slip, Buffalo	1,500 00	1,460 54	1,460 54	1,460 54	Settled.
Sidewalks for Chicago Street bridge, Buffalo	7,154 80	7,154 80	.....	.....	$7,154 80
Wrought iron swing bridge, Ferry street, Buffalo	12,000 00	11,717 65	10,531 00	10,531 00	1,186 65
Composite culvert, section No. 261	2,000 00	1,717 77	1,717 77	1,717 77	Settled.
Cast iron draining pipe at Clyde	2,900 00	2,443 80	2,100 00	2,100 00	$343 80
Cast iron draining pipe on section No. 214	2,700 00	2,628 14	2,120 00	2,120 00	508 14
Iron feed pipe at Pittsford	150 00	98 45	98 45	98 45	Settled.
Iron plate chord bridge at Fairport	1,500 00	1,475 68	1,475 68	1,475 68	Settled.
Vertical wall at Pittsford	3,016 22	3,016 22	3,016 22	3,016 22	Settled.
Vertical wall at Fairport	5,300 00	4,642 82	4,642 82	4,642 82	Settled.
Culvert on section No. 314	2,800 00	2,382 43	2,382 43	2,382 43	Settled.
Constructing eastern abutment and approaches of change bridge, section 367	2,400 00	2,245 95	2,245 95	2,245 95	Settled.
Dredging Ohio basin	12,000 00	11,000 00	2,880 00	2,880 00	$8,120 00
Pile Jetty pier at Black Rock	7,000 00	6,500 00	.....	.....	6,500 00
Extending Black Rock pier	10,000 00	9,000 00	.....	.....	9,000 00
Improving Main and Hamburgh Street canal	15,000 00	14,000 00	940 00	940 00	13,060 00
Dredging channel below ship lock at Black Rock	1,000 00	879 83	879 83	879 83	Settled.
West abutment and approach, change bridge, section 367	1,800 00	1,500 00	.....	.....	$1,500 00
Repairing towing path on section No. 368	15,000 00	14,000 00	.....	.....	14,000 00
Rebuilding towing path on section No. 368	30,000 00	27,000 00	1,920 00	1,920 00	25,080 00
Completing Clark and Skinner canal, Buffalo	20,000 00	19,000 00	3,000 00	3,000 00	16,000 00
Vertical wall at Middleport	5,000 00	4,700 00	.....	.....	4,700 00
Vertical wall at Medina	3,000 00	2,500 00	.....	.....	2,500 00
Vertical wall at Port Gibson	3,000 00	2,500 00	.....	.....	2,500 00
Iron bridge near Medina aquednct	3,900 00	3,000 00	.....	.....	3,000 00
Vertical wall at Albion	4,000 00	3,001 56	3,001 56	3,001 56	Settled.

Table No. 2—(Continued).

GENESEE VALLEY CANAL.

CHARACTER OF WORK.	Engineers' estimate with engineering and contingencies added.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.
Reopening and enlarging ditches near Beard's creek aqueduct	$5,000 00	$4,300 00	$3,580 00	$3,580 00	$720 00
Rebuilding north trunk at Portage	12,500 00	15,228 22	15,140 00	15,140 00	88 22
Earth bank and prism in place of south trunk at Portage	9,200 00	3,344 51	2,940 00	2,940 00	404 51
Removing obstructions at Three Points on repair section No. 2	4,200 00	....	1,630 00	1,630 00	....
Reopening ditches in towns of Groveland and West Sparta	1,000 00	1,000 00	.....	.....	1,000 00
Deepening, widening and improving canal from Junction to Rapids	40,000 00	37,000 00	....	.....	37,000 00
Dam, bulkhead and feeder at Smith's Mills	5,250 00	4,500 00	.....	.....	4,500 00
Slide bank at Portage	19,000 00	19,000 00	1,420 00	1,420 00	17,580 00
Rebuilding seven spans, Ischua Feeder aqueduct	23,000 00	16,000 00	....	....	16,000 00
Raising Oil creek reservoir	54,500 00	50,000 00	2,000 00	2,000 00	48,000 00

TABLE No. 3.

STATEMENT showing the amount of work done under the supervision of the Engineer Department on miscellaneous repairs, authorized by the Canal Board and the Canal Commissioners, and amount paid thereon during the fiscal year ending September 30, 1868.

ERIE CANAL.

DESCRIPTION OF WORK.	Amount appropriated.	Total amount done.	Amount paid during year.
Constructing Ellicott creek draw bridge	$1,627 49	$1,627 49	$1,627 49
Break in State ditch culvert	8,059 09	8,059 09	8,059 09
Protecting tow path bank east Pittsford lock (done in 1866)	250 00	250 00	250 00
Docking near Hawley's bridge (done in 1865)	192 25	192 25	192 25
Building warehouse at Lockport	1,500 00	1,500 00	1,500 00
GENESEE VALLEY CANAL.			
Rebuilding two spans Ischua aqueduct	$8,316 31	$8,316 31	$651 31
Rebuilding in part locks 14, 17, 18 and 30	16,181 19	16,181 19	16,181 19
Iron bridge on Main street, Mount Morris	2,488 35	2,488 35	2,488 35
Iron Bridge at Nunda	4,000 00	3,299 63	3,299 63
Temporary dam across Genesee river at Oramel	150 00	150 00	150 00
Securing southwest wing Canaseraga aqueduct	414 00	414 00	414 00
Slide near north trunk at Portage	6,835 80	6,835 80	6,835 80

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