ANNUAL REPORT

OF THE

CHIEF ENGINEER AND GENERAL SUPERINTENDENT

OF THE

WASHINGTON AQUEDUCT.

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE WASHINGTON AQUEDUCT,
Washington, D. C., October 1, 1864.

SIR: In conformity with the "regulations for the government of persons employed upon the Washington aqueduct," I have the honor to submit the following annual report of operations upon the Washington aqueduct during the past year.

I.—CONDITION OF THE WORK.

Since the date of the last annual report the portions of the conduit then unfinished have been completed. At the Great Falls a temporary dam, composed of cribs filled with stones and puddled on the upper side, was thrown across a portion of the Maryland channel of the Potomac, which raised the water sufficiently to give a depth of two and a half feet in the conduit and a daily supply of about fifteen million gallons at the lowest stage of the river.

On the 3d of December, 1863, the water from the Potomac was first introduced into the conduit, and on the 5th it was allowed to flow into the receiving reservoir.

On December 15 it was shut off to complete the pointing of a portion of the conduit; on January 14 it was again introduced, and the reservoir was fed from the river until February 24, when several leaks were discovered at Cabin John bridge, and on the high embankments between that point and the reservoir, which would endanger the further use of the conduit. The balance of appropriation then on hand not being sufficient to warrant any expenditure on repairs, the water from the Potomac was again shut off, and the supply for the city was drawn entirely from the receiving reservoir.

At the time the leaks were discovered there was from seven to eight feet of water in the conduit. Examination showed that the ring had cracked longitudinally at top and bottom, owing, probably, to the insufficient depth of the earth covering.

After the passage of the appropriation bill, in July, the leaks were repaired, and the lower half of the conduit through Cabin John bridge was thoroughly plastered. Since these repairs no leakage has occurred. It is probable, however, that if the conduit was filled again to the same depth as when the leaks occurred, the same result would ensue. For this reason the water in the receiving reservoir has been kept at a low level since the 29th of July, when the supply from the Potomac was resumed.

The consumption of water in the city during the dry season was from seven to ten million gallons per day.

The spring rains raised the water in the receiving reservoir to the height of the dam built across the waste channel in 1863. Between the first of June, when the drought began, and the first of August, when the supply from the Potomac began, the reservoir was lowered thirteen feet, and had not the conduit repairs been completed just at the time they were the supply to the city would have failed.

During the whole of the winter, and for more than a month after the cessation of the rains, the water was exceedingly turbid, but during the drought in June and July the sediment was gradually precipitated, and the water is now very pure.

Cabin John bridge has been completed, with the exception of the coping, and the scaffolding taken down; no work is now being done on it or any of the other unfinished bridges.

The work on the distributing reservoir at Drovers' Rest was prosecuted until about one-third of the slope facings in the western division was laid, when it was stopped by the cold weather. The work was resumed in the spring, and an expenditure of $8,356 made upon it before the adjournment of Congress, when, there being no appropriation available for it, it was again suspended.

It is very important that at least one section of the distributing reservoir should be completed so as to hold a supply of water in case of accident, or when the Potomac is rendered muddy by freshets.

The pipe line is in good condition. The pumping engine in Rock Creek bridge is taxed to its utmost capacity, but continues to work well. Twice during the year it has been necessary to stop it for slight repairs. A small expenditure on the high service reservoir has rendered it available for storage in case of a heavy draught caused by fires.

Congress having made an appropriation on July 2 for the construction of the solid masonry dam across the Maryland channel of the Potomac near the Great Falls, and for constructing the conduit around the receiving reservoir, proposals were invited by advertisement for the construction of these works, and were publicly opened on July 25.

Nine proposals were received for the dam, of which one was withdrawn before the award was made. The contract was awarded to James McDonald, he being the lowest bidder; he declined to enter into contract, however, and it was therefore awarded to the next lowest bidders, Messrs. Dunbar, Sherrill and Bangs, with whom a contract was concluded on July 30, and they immediately entered upon the work. Great difficulty has been experienced in obtaining laborers, owing to the high prices paid for substitutes to enter the army, and the fear of incursions from guerilla parties, but considerable progress has been made, and there is every prospect of the completion of the dam during the summer of 1865.

For the construction of the conduit around the receiving reservoir six proposals were received, and, under your direction, a contract was entered into at the lowest prices offered, with Messrs. Dunbar, Sherrill and Bangs, in consideration of their having a large amount of tools, shanties, and other fixtures on hand with which to commence and carry on the work, and which would otherwise be sacrificed to a great extent by reason of the suspension of the other work upon which they had been engaged.

The difficulty of obtaining laborers has somewhat retarded this work also, but it is expected that the conduit will be completed within the time specified in the contract.

Copies of these contracts, together with the accompanying specifications, will be found annexed to this report. The prices named are considered very reasonable, and much lower than those now paid for similar kinds of work in other places. Owing, however, to the increased price of labor and materials during the past year, they are somewhat higher than the prices assumed in computing the cost of these items in the preliminary estimate which was submitted in the

last annual report from this office. The increase in the cost of the dam will be about $2,130, and in the cost of the conduit around the receiving reservoir about $8,522.

The question of land damages and water rights at the Great Falls still remains unsettled, no action having been taken upon it since the last annual report.

The masonry at the head of the conduit, and the gate houses at the Great Falls and the reservoirs, still remains in an unfinished state. The exposure of these structures to the weather in this state is necessarily injurious to them, but, with the limited funds at disposal, it has not been considered expedient to expend any money except where it was absolutely essential to the completion of works required for the supply of the city.

II.—FINANCIAL CONDITION.

The following statement shows the amounts appropriated by Congress and expended during each year since the beginning of the work:

	Appropriation.	Expenditure.
Year ending September 30, 1852	$5,000	$5,000 00
Year ending September 30, 1853	100,000	14,986 70
Year ending September 30, 1854		83,620 41
Year ending September 30, 1855	250,000	103,602 36
Year ending September 30, 1856	250,000	153,156 08
Year ending September 30, 1857	1,000,000	220,209 19
Year ending September 30, 1858	800,000	1,182,292 81
Year ending September 30, 1859		642,130 40
Year ending September 30, 1860	500,000	24,725 37
Year ending September 30, 1861		
Year ending September 30, 1862		260,325 01
Year ending September 30, 1863		137,622 64
Year ending September 30, 1864	150,000	135,670 63
Totals	3,055,000	2,963,341 60

Which leaves a balance of appropriation unexpended up to the present time equal to	91,658 40
The amount of appropriation on hand October 1, 1863, was	$77,329 03
To which was added the proceeds of certain property transferred to the War and Navy Departments during the years 1861 and 1862	3,444 85
Making total amount on hand	80,773 88
To which should now be added amount received from sales of wood, stone, timber, machinery, tools, and fixtures during the past year	10,697 75
Amount of appropriation July 2, 1864	150,000 00
Total	241,471 63
The amount expended during the last year is	135,670 63
Balance on hand October 1, 1864	105,801 00

III.—COST OF COMPLETION.

Estimated cost of completing the Washington aqueduct in accordance with the plans recommended in the last annual report, and the supplemental report, dated February 22, 1864, (see Senate Mis. Doc. No. 83, Thirty-eighth Congress, 1st session.)

Potomac dam	$48,435 00
Feeder masonry	1,415 00
Gate-house at Great Falls	3,480 00
Bridges	24,000 00
Gate-houses and pipe-vaults at distributing reservoir	9,240 00
High service reservoir, Georgetown	8,000 00
Connecting conduit at receiving reservoir	89,311 00
Distributing reservoir	325,878 00
Ventilators	2,800 00
Fencing	20,000 00
Engineering superintendence and repairs	30,000 00
Land and law expenses	5,000 00
	567,559 00
Add 10 per cent. for contingencies	56,755 90
Total amount	624,314 90
Deduct balance on hand October 1, 1864	105,801 00
Appropriation required to complete	518,513 90

No provision is made in the foregoing estimate for the settlement of the land question at Great Falls, nor for the completion of the Potomac dam to its full height entirely across the river.

Inasmuch as the existing contracts provide for the completion of the Potomac dam on or before August 1, 1865, and the conduit around the receiving reservoir on or before May 1, 1865, it will be necessary, if the work is to be continued, that provision be made in the deficiency bill as follows:

Required to complete Potomac dam	$48,435 00
Required to complete connecting conduit	89,311 00
Engineering superintendence, repairs, and office expenses	20,000 00
Total	157,746 00
Deduct amount on hand	105,801 00
Deficiency	51,945 00

If the recommendation to complete the upper section of the distributing reservoir during the present year, for storage and purifying purposes, should meet the approval of Congress, the amount required for that purpose will be $160,421, and at least $25,000 of the amount should be included in the deficiency bill, in order to commence the work as early as the 1st of April next. This will make the amount to be included in the deficiency bill $76,945. In order to complete this section of the distributing reservoir, and provide for other necessary expenses connected with the aqueduct during the ensuing year, it will be necessary that an additional appropriation be made of $150,000.

If the affairs of the country should, in the opinion of Congress, be in a condition to justify a general resumption of the work on the first of April next, with a view to its final completion during the ensuing two years, the additional amount in the annual appropriation bill should be $250,000.

VI.—GENERAL REMARKS.

The causes of the increased cost of the Washington aqueduct as provided for in the present estimate, over and above the amount originally estimated, are fully explained in the last annual report, and the supplemental report of the 22d of February, 1864, and it is therefore deemed unnecessary to recapitulate them here.

The departures that have been made from the original plans, and provided for in the present estimate, may be briefly stated as follows:

1. A dam of solid masonry at Great Falls instead of an embankment of broken stone.
2. A connecting conduit around the lower end of the receiving reservoir, so as to prevent the adulteration of the Potomac water with the surface drainage collected in the receiving reservoir.
3. Slope-wall facing for the inner slopes of the distributing reservoir instead of facings of small broken stone.
4. Raising the dividing bank in the distributing reservoir to the full height of the outer banks, and the constructing of a central gate-house therein, so as to allow of the independent use of either section for purposes of storage, supply, and repairs.
5. Excavating the bottom of the distributing reservoir to an additional depth of thirteen feet, so as to increase the purity of the water, and afford twice the amount of storage capacity.

The first and second changes have been fully indorsed by Congress in the bill appropriating $150,000 for the work at the last session, and it is confidently believed that the other changes will be approved whenever an appropriation is made for the resumption of work upon the distributing reservoir.

Attention was called in the last annual report to the importance of providing additional facilities for the sewerage and drainage of the city of Washington in connexion with the discharge of water from the aqueduct, and also to the improvement of the Washington canal and the channel of the Potomac river, so as to prevent the accumulation of the filth and excrement of the city in the canal which passes through the heart of the city, and upon the flats in the bed of the river immediately in front of the city. A resolution was passed during the last session of Congress by the House of Representatives providing for an examination of this subject under the direction of the Secretary of the Interior, but no action was taken upon the subject by the Senate. It is to be hoped that some decisive and concurrent action will soon be taken by Congress and the authorities of the city upon a subject so vitally important to the capital of the nation.

The annexed map of the line of the aqueduct and of the cities of Georgetown and Washington will serve to illustrate many of the matters referred to in this report.

Respectfully submitted.

SILAS SEYMOUR,
Chief Engineer and General Superintendent.

Hon. JOHN P. USHER,
Secretary of the Interior.

WASHINGTON AQUEDUCT.

CONTRACT FOR CONSTRUCTION OF MASONRY DAM ACROSS THE MARYLAND CHANNEL OF THE POTOMAC RIVER.

Articles of agreement, made and concluded this thirtieth day of July, in the year one thousand eight hundred and sixty-four, between Richard Dunbar, of Washington city, Charles H. Sherrill, of New York, and Anson Bangs, of New York, contractors, of the first part, and Silas Seymour, acting for and in behalf of the United States of America, under the authority and subject to the approval of the Secretary of the Interior, as chief engineer and general superintendent of the Washington aqueduct, of the second part; whereby it is covenanted and agreed as follows, to wit:

The said party of the first part, in consideration of the payments and conditions hereinafter agreed to be made and performed by the party of the second part, hereby covenants and agrees to furnish all the materials and do all the work required for the construction of a masonry dam across the Maryland channel of the Potomac river near the Great Falls, as the same is described and referred to in the specifications hereunto annexed, and which are to be considered as forming part of this contract; and, also, in accordance with the directions that may from time to time be given by the engineer in charge of the work.

The work shall be commenced as soon as practicable after the execution of these presents, and shall be fully completed, as herein provided, on or before the first day of August, eighteen hundred and sixty-five, with the understanding, however, that if the progress of the work is delayed or suspended by any act, failure, or omission, on the part of the government, or by reason of any direct interference therewith growing out of wars, insurrections, or civil commotions, no advantage shall be taken of that circumstance by the party of the second part to the injury of the party of the first part, but the time shall be extended to correspond with such delays as may from their nature be beyond the control of the party of the first part.

Whenever the term *engineer*, or *chief engineer*, is used or referred to in this contract, or the annexed specifications, in connexion with the proper execution of the work, it is understood to apply to the chief engineer, for the time being, in charge of the Washington aqueduct; and, also, when said chief engineer is not personally present, to his assistants and inspectors employed upon the work and acting under his directions.

The work must be commenced at such points, and carried forward at such times and seasons, and in such order and rates of progress, as the chief engineer may direct, and shall, during its progress, be subjected to his constant supervision and direction; and the whole must be executed in the most substantial and workmanlike manner, and to the entire satisfaction of said engineer.

For the purpose of avoiding all cause of difference or dispute between the parties to this agreement relative to its true intent and meaning, and for the purpose of adjusting, in an amicable manner, any difference that may arise relative thereto, it is hereby mutually understood and agreed by and between the parties, that the chief engineer shall determine the amount or quantity of the several kinds of work herein contracted to be done and materials furnished, and shall have full power to reject or condemn all work or materials which, in his opinion, do not fully conform to the spirit of this contract, and shall also decide every question which can or may arise between the parties relative to the execution thereof, and his decision shall be final and conclusive.

Changes in the location of the work, or in the plans and specifications of the same, which do not materially affect its cost, shall not be deemed to constitute any claim for extra compensation. But if any changes be made which, in the

opinion of the chief engineer, materially increase or diminish the cost or difficulties of performing the work, it shall be his duty to add to or deduct from the contract prices, in proportion to said increase or diminution; and if any work be done, or materials furnished, which are not now contemplated or provided for in this contract, the said engineer shall allow the contractors such prices for the same as he may consider just and equitable.

If the contractors shall refuse or unreasonably neglect to remedy any imperfection in the materials or workmanship which may be pointed out by the engineer, or shall in any manner violate the conditions of this contract, so that, in the judgment of the engineer, there shall be just grounds of apprehension that the work will not be completed in the manner and in the time specified, (unless such delay shall have occurred by reason of causes hereinbefore referred to,) then said engineer shall have power, and it shall be his duty, to declare this contract forfeited by the contractors; and, in case of such forfeiture, the government may proceed to enter into contract with any other person or persons, or may make any other arrangements to complete the work, in the same manner as if this contract had never existed. And the government may thereupon retain for its own use any reserved percentage or estimates which might, under other circumstances, have been due to the contractors, free of any claim thereto by the contractors.

The aforesaid chief engineer shall also have the power, at his option, to employ laborers and furnish materials for the said work, whenever, in his opinion, the more speedy prosecution thereof will be better attained by such means, or the interest of the government better promoted thereby, and to charge the expenses of the same to the contractor in the monthly or final estimates for said work; and the said engineer is further authorized and empowered to require the party of the first part to pay all just demands for labor and materials that may be incurred by him or his agents in connexion with the prosecution of said work and properly chargeable thereto; and for that purpose the said chief engineer may retain from the estimates a sufficient amount to cover said demands, and apply the same to the payment thereof, in case the contractor refuses to liquidate said demands within thirty days after receiving notice from the chief engineer that the same have been satisfactorily verified and left with him for collection. But all such claims must be placed in the hands of the chief engineer, together with proper evidences of their correctness, within thirty days after the date when due.

The contractors shall immediately dismiss from their service any foreman, laborer, or other persons, who are insolent, riotous, or disorderly in their conduct, or disobedient to the directions of the engineer, or who, in the opinion of the engineer, are unskilful or remiss in the performance of their duty; and no person shall be employed upon the work who is not a citizen of the United States, and known to be loyal to the government.

The aforesaid party of the second part, in consideration of the full and faithful performance, by the parties of the first part, of all the conditions and covenants hereinbefore set forth to be by them performed and kept, hereby covenants and agrees to pay to the said parties of the first part, upon the certificate of the chief engineer, as soon after the first day of each month, during the progress of the work, as the estimates can be conveniently prepared, for materials delivered and labor performed under this contract, at the rates and prices named in the following schedule, viz:

Schedule of prices for work and materials required for constructing a dam of solid masonry across the Maryland channel of the Potomac river, near the Great Falls.

For clearing and grubbing the entire work, one thousand and eight hundred (1,800) dollars.

For excavation in foundations, two (2) dollars and fifty (50) cents per cubic yard.

For concrete and grout in foundations, eight (8) dollars per cubic yard.

For foundation masonry, fourteen (14) dollars per cubic yard.

For superstructure masonry, fourteen (14) dollars per cubic yard.

For coping, twenty (20) dollars per cubic yard.

For wrought iron, in bolts and clamps, fifteen (15) cents per pound.

For back filling, three (3) dollars and fifty (50) cents per cubic yard.

For materials, either delivered, manufactured, or ready for delivery and use in the work, the engineer will make such an allowance in his monthly estimates as, in his opinion, may be fairly proportionate to the value of such materials when placed in the work; and when such allowances are made, and the estimates paid, such materials shall become the property of the government; but the contractors shall be held responsible for their safe-keeping and final use in the work.

The engineer will deduct ten per cent. from all monthly estimates; which amount shall be retained by the government as part security for the full and faithful performance of this contract on the part of the contractors. The per centage thus retained, together with the final estimate of the chief engineer, covering all the work done and materials delivered on the final completion of the work, in accordance with the conditions of this contract, shall become due and be paid to the said party of the first part, their successors or assigns, by the party of the second part, within thirty days after the completion of said work.

It is further understood and agreed by the parties hereto, that this contract, and all the provisions thereof, are subject to the laws of Congress heretofore passed in relation to government contracts, and more particularly to the joint resolution approved April 14, 1852, in which it is "*Provided*, That nothing herein contained shall be so construed as to authorize any officer of the United States to bind the United States by contract beyond the amount appropriated by Congress, or to sanction any such contract heretofore made."

It is also understood that the government reserves the right to suspend the work embraced in this contract at any time; and that when the work has been faithfully performed by the contractor he will, on such suspension, be paid in full for all work done and materials delivered, and that, unless the work is resumed within one year from the date of said suspension, the contractor will be entitled to payment for the necessary fixtures on hand, and to a cancelment of the contract, and a full release and satisfaction of himself and his bonds and sureties from the further performance thereof.

It is expressly understood and agreed, that the several stipulations of this contract shall be performed in such a manner that the party of the first part will not be relieved from the immediate charge and responsibility of the work; and the same shall not be transferred or assigned, nor any portion of the work embraced therein sub-let to other parties, unless by the written sanction of the chief engineer, and approval thereof by the Secretary of the Interior.

In witness whereof the parties to these presents have hereunto set their hands and seals in triplicate, on the day and year first above written.

RICHARD DUNBAR. [L. S.]
CHAS. H. SHERRILL. [L. S.]
ANSON BANGS. [L. S.]
S. SEYMOUR, [L. S.]
Chief Engineer.

Subject to the approval of the Secretary of the Interior.

Approved:

J. P. USHER, *Secretary.*

Guarantee.

Know all men by these presents, that we, Alexander W. Randall, of the State of Wisconsin, and Robert C. Murphy, of Washington city, D. C., in consideration of the premises, and of one dollar to us in hand paid by the United States, the receipt whereof is hereby acknowledged, do hereby, severally and jointly, covenant and agree with said United States that the above-named Richard Dunbar, Charles H. Sherrill, and Anson Bangs, shall in all things faithfully perform all and singular the covenants and conditions in the foregoing contract set forth to be by them performed and kept.

Witness our hands and seals this thirtieth day of July, 1864.

ALEX. W. RANDALL. [L. S.]
R. C. MURPHY. [L. S.]

In presence of—
JAS. H. MARR, Jr.
J. J. R. CROES.

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Specifications for constructing a dam of solid masonry across the Maryland channel of the Potomac river near the Great Falls.

Clearing and grubbing.—The ground set apart for the work and embraced within the boundary lines as fixed by the engineer will be thoroughly cleared of all trees, stumps, logs, and bushes, and the whole, or such portions thereof as the engineer may direct, will be entirely removed or destroyed.

Preparing foundations.—The foundation of the dam will, whenever practicable, rest upon sound, imperishable, native rock. All earth, boulders, detached rock, and such portions of the present rock surface as are unfit for the foundations, will be removed as directed by the engineer, so as to secure a firm, even, and durable bearing for the foundation masonry.

Whenever required by the engineer, the irregularities and fissures in the native rock will be thoroughly filled with concrete or grout, so as to prevent the passage of water, and afford a proper and uniform bearing for the masonry.

Foundation masonry.—The masonry in the foundation will extend from the rock foundation, as above described and provided for, up to the level of low-water mark in the river, at the point of crossing. It will be built of undressed, heavy, and well-shaped stone, properly bonded, and laid upon their broadest natural beds, in full mortar or grout as the engineer may direct, so as to be perfectly tight and impervious to water, and also to sustain the superincumbent weight of the superstructure. The lower face will have a slope, either in steps or batter, as the engineer may direct, of two feet base to one foot rise, and the upper face will have a slope, in steps, of one to one. The steps must, in all cases, extend well back into the wall. The upper course, upon which the superstructure of the dam is to rest, will be composed of large, flat stones, not less than one foot in thickness, which must extend at least two feet under the superstructure masonry, and project outwardly one foot along each side of the base of the superstructure. The top of the foundation masonry must be brought to a firm, level, and uniform surface before the superstructure masonry is commenced.

Superstructure masonry.—The lower or front face of the superstructure will be vertical; the rear face will batter in the ratio of four inches to the vertical foot, and the top will be seven feet thick, measured horizontally on the line of the upper front angle. The bed for the coping will slope in the ratio of one inch to the foot from front to rear. The work will be of the best quality of rubble cement masonry, up to the bed of the coping. The coping will be of cut stone.

Rubble work will be composed of sound, durable, and well-shaped stone, laid alternately, with headers and stretchers, in full mortar or grout, as the engineer may direct, throughout the work. The front faces, beds, and joints to be rough-dressed with the hammer, so that there will be no projections of more than one inch outside of the true face line of the work, and so as not to admit of more than one-half inch thickness of mortar in the beds and joints. No stone less than eight inches thick will be allowed in the front face, and none less than six inches thick in the rear face. The upper course must be not less than sixteen inches thick in front and eight inches in the rear, and must be composed entirely of headers, both in front and rear, interlocking with each other at least two feet in the centre of the wall. The upper surface, or bed for the coping, must be smoothly dressed to an uniform plane, inclining one inch to the foot from front to rear, so as to afford a firm and uniform bearing for the coping; an arris of two inches in width, corresponding with the front line of the work, will be cut with the chisel along the upper front angle of this course.

Coping.—The coping will be of Seneca sandstone, or a stone of equally good quality, and will be cut to the patterns and drawings furnished by the engineer. The front face of the coping will be vertical, and eighteen inches thick, projecting three inches over the front line of the wall. The front and rear upper angles will be either rounded or bevelled off, as the engineer may direct. The lower surface will conform to the slope of the bed prepared upon the underlying masonry. The upper surface will be level for a space extending two feet back from the front face, and will, from that point, be so dressed as to slope to the rear in the ratio of two inches to the foot when laid in place. Each stone must have at least three feet width of bed, and must, when practicable, extend entirely across the wall. When this is not practicable, they will have such length of bed as the engineer may direct. The coping will be laid to one-quarter inch joints, both vertically and horizontally, and each stone will be bolted to the wall below as often as the engineer may direct, with wrought-iron bolts of not less than one and a quarter inch in diameter, and of such length as to extend through the coping and penetrate the wall below at least one foot, and to be secured with a fox-wedge at the bottom and with sulphur and sand cement. The coping stone will be fastened together, as often as the engineer may direct, with wrought-iron clamps, made of one-half by three-quarter inch iron, with prongs extending at least six inches into the stone, and properly secured with lead. The heads will be countersunk into the stone, so as to be flush with the upper surface.

Back filling.—The rear angle formed by the back face of the dam and the bed of the river will be filled with good coarse gravel or broken stone, as the engineer may direct, extending from the top of the dam with a uniform slope not exceeding three feet horizontal to one foot vertical, until it reaches the bed of the river.

The whole to be executed in the most substantial and workmanlike manner, and to the entire satisfaction of the engineer in charge of the work.

The prices named in the contract will include the furnishing of all the materials required for the work as herein specified and provided for, together with the labor necessary for putting the same in place, including all coffer-dams, pumping, bailing, and draining required in preparing the foundations, and all other matters and things necessary to the full and final completion of the work.

Specifications for cement, sand, mortar, grout, and concrete.

Cement.—The cement used in the work must be of the best quality of hydraulic cement, equal in character to the *Rosendale*. It must be fresh, well burned and ground, free from foreign substances, and put up in air-tight casks. It must also be subject to such tests as the engineer may direct, and the contractor must keep it entirely protected from the weather until used in the work.

Sand.—The sand used in the work must be clean and sharp, free from loam, dust, mica, or other impurities which will hinder it from mixing freely with the cement. It must be thoroughly screened and washed when required by the engineer.

Mortar.—All mortar used in the work will be composed of hydraulic cement and sand, mixed with water in such proportions as the engineer may direct, generally one part of cement to two parts of sand. The materials will always be measured under the eye of the inspector, and whilst dry thoroughly mixed on a tight, wooden platform; after which a sufficient quantity of clean water will be applied to bring it to the proper consistency, and then it will be worked with hoes until all the particles have become thoroughly intermixed. The quantity so manufactured must not exceed the amount required for immediate use; and it must be applied to the work within the proper time for rendering the adhesion and solidification most perfect. No mortar will be used in the work which has been once set and worked over the second time.

Grout.—When grout is required in the work it will be composed of the same kind and quality of materials, and mixed in the same proportions, as above specified for mortar, except that it will be manufactured in a tight box, and, by the addition of water, reduced to a proper consistency for running freely through the interstices of the masonry, or other substance to which it may be applied, until, when fully set, the whole mass becomes perfectly solid and impervious to air or water.

Concrete.—When concrete is used in the work it will be composed generally of one part of cement, two of sand, and five of hard, durable rock, broken to pass through a two-inch ring. These proportions will be varied at the discretion of the engineer. The cement and sand will be mixed dry, and reduced to the proper consistency with water before the stone are added. The whole mass will then be thoroughly worked with hoes or shovels, and applied to the work immediately in layers not more than eight inches thick—each layer to be properly confined in its place, and rammed until the mortar flushes to the surface—and it must become thoroughly solidified before another layer is added.

CONTRACT FOR CONSTRUCTION OF CONDUIT AROUND THE RECEIVING RESERVOIR.

Articles of agreement, made and concluded this second day of August, in the year one thousand eight hundred and sixty-four, between Richard Dunbar, of Washington city, Charles H. Sherrill, of New York and Anson Bangs, of New York, contractors, of the first part, and Silas Seymour, acting for and in behalf of the United States of America, under the authority and subject to the approval of the Secretary of the Interior, as chief engineer and general superintendent of the Washington aqueduct, of the second part; whereby it is covenanted and agreed as follows, to wit:

The said party of the first part, in consideration of the payments and conditions hereinafter agreed to be made and performed by the party of the second part, hereby covenants and agrees to furnish all the materials and do all the work necessary for the construction of the conduit and tunnel around the receiving reservoir, as the same is described and referred to in the specifications hereunto annexed, and which are to be considered as forming part of this contract; and, also, in accordance with the directions that may from time to time be given by the engineer in charge of the work.

The work shall be commenced as soon as practicable after the execution of these presents; and shall be fully completed, as herein provided, on or before the first day of May, eighteen hundred and sixty-five, with the understanding, however, that if the progress of the work is delayed or suspended by any act, failure, or omission, on the part of the government, or by reason of any direct

interference therewith growing out of wars, insurrections, or civil commotions, no advantage shall be taken of that circumstance by the party of the second part to the injury of the party of the first part, but the time shall be extended to correspond with such delays as may from their nature be beyond the control of the party of the first part.

Whenever the term *engineer*, or *chief engineer*, is used or referred to in this contract, or the annexed specifications, in connexion with the proper execution of the work, it is understood to apply to the chief engineer, for the time being, in charge of the Washington aqueduct; and, also, when said chief engineer is not personally present, to his assistants and inspectors employed upon the work, and acting under his directions.

The work must be commenced at such points, and carried forward at such times and seasons, and in such order and rates of progress, as the chief engineer may direct, and shall, during its progress, be subjected to his constant supervision and direction; and the whole must be executed in the most substantial and workmanlike manner, and to the entire satisfaction of said engineer.

For the purpose of avoiding all cause of difference or dispute between the parties to this agreement relative to its true intent and meaning, and for the purpose of adjusting, in an amicable manner, any difference that may arise relative thereto, it is hereby mutually understood and agreed by and between the parties, that the chief engineer shall determine the amount or quantity of the several kinds of work herein contracted to be done and materials furnished; and shall have full power to reject or condemn all work or materials which, in his opinion, do not fully conform to the spirit of this contract; and shall also decide every question which can or may arise between the parties relative to the execution thereof, and his decision shall be final and conclusive.

Changes in the location of the work, or in the plans and specifications of the same, which do not materially affect its cost, shall not be deemed to constitute any claim for extra compensation. But if any changes be made which, in the opinion of said chief engineer, materially increase or diminish the cost or difficulties of performing the work, it shall be his duty to add to or deduct from the contract prices, in proportion to said increase or diminution; and if any work be done, or materials furnished, which are not now contemplated or provided for in this contract, the said engineer shall allow the contractors such prices for the same as he may consider just and equitable.

If the contractors shall refuse or unreasonably neglect to remedy any imperfection in the materials or workmanship which may be pointed out by the engineer, or shall in any manner violate the conditions of this contract, so that, in the judgment of the engineer, there shall be just grounds of apprehension that the work will not be completed in the manner and in the time specified, (unless such delay shall have occurred by reason of causes hereinbefore referred to,) then said engineer shall have power, and it shall be his duty, to declare this contract forfeited by the contractors; and, in case of such forfeiture, the government may proceed to enter into contract with any other person or persons, or may make any other arrangements to complete the work, in the same manner as if this contract had never existed. And the government may thereupon retain for its own use any reserved percentage or estimates which might, under other circumstances, have been due the contractors, free of any claim thereto by the contractors.

The aforesaid chief engineer shall also have the power, at his option, to employ laborers and furnish materials for the said work, whenever, in his opinion, the more speedy prosecution thereof will be better attained by such means, or the interests of the government better promoted thereby, and to charge the expenses of the same to the contractor in the monthly or final estimates for said work; and the said engineer is further authorized and empowered to require the party of the first part to pay all just demands for labor and materials that may

be incurred by him or his agents in connexion with the prosecution of said work and properly chargeable thereto; and for that purpose the said chief engineer may retain from the estimates a sufficient amount to cover said demands, and apply the same to the payment thereof, in case the contractor refuses to liquidate said demands within thirty days after receiving notice from the chief engineer that the same have been satisfactorily verified and left with him for collection. But all such claims must be placed in the hands of the chief engineer, together with proper evidences of their correctness, within thirty days after the date when due.

The contractors shall immediately dismiss from their service any foreman, laborer, or other persons, who are insolent, riotous, or disorderly in their conduct, or disobedient to the directions of the engineer, or who, in the opinion of the engineer, are unskilful or remiss in the performance of their duty; and no person shall be employed upon the work who is not a citizen of the United States, and known to be loyal to the government.

The aforesaid party of the second part, in consideration of the full and faithful performance, by the parties of the first part, of all the conditions and covenants hereinbefore set forth to be by them performed and kept, hereby covenants and agrees to pay to the said parties of the first part, upon the certificate of the chief engineer, as soon after the first day of each month, during the progress of the work, as the estimates can be conveniently prepared, for materials delivered and labor performed under this contract, at the rates and prices named in the following schedule, viz:

Schedule of prices for work and materials required for the construction of the conduit around the receiving reservoir.

Clearing and grubbing required for the entire work, five hundred (500) dollars.
Earth excavation, thirty-five (35) cents per cubic yard.
Rock excavation, three (3) dollars and fifty (50) cents per cubic yard.
Tunnel excavation ten (10) dollars per cubic yard.
Embankment, forty-two (42) cents per cubic yard.
Retaining wall, six (6) dollars per cubic yard.
Brick masonry in conduit, sixteen (16) dollars per cubic yard.
Stone masonry in conduit, ten (10) dollars per cubic yard.
Concrete and rubble cement masonry in foundations, nine (9) dollars and fifty (50) cents per cubic yard.

For materials, either delivered, manufactured, or ready for delivery and use in the work, the engineer will make such an allowance in his monthly estimates as, in his opinion, may be fairly proportionate to the value of such materials when placed in the work; and when such allowances are made, and the estimates paid, such materials shall become the property of the government, but the contractors shall be held responsible for their safe-keeping and final use in the work.

The engineer will deduct ten per cent. from all monthly estimates, which amount shall be retained by the government as part security for the full and faithful performance of this contract on the part of the contractors. The percentage thus retained, together with the final estimate of the chief engineer, covering all the work done and materials delivered on the final completion of the work, in accordance with the conditions of this contract, shall bec me due and be paid to the said party of the first part, their successors or assigns, by the party of the second part, within thirty days after the completion of said work.

It is further understood and agreed by the parties hereto, that this contract, and all the provisions thereof, are subject to the laws of Congress heretofore passed in relation to government contracts, and more particularly to the joint resolution approved April 14, 1852, in which it is "*Provided*, That nothing herein

contained shall be so construed as to authorize any officer of the United States to bind the United States by contract beyond the amount appropriated by Congress, or to sanction any such contract heretofore made."

It is also understood that the government reserves the right to suspend the work embraced in this contract at any time; and that when the work has been faithfully performed by the contractor, he will, on such suspension, be paid in full for all work done and materials delivered, and that, unless the work is resumed within one year from the date of said suspension, the contractor will be entitled to payment for the necessary fixtures on hand, and to a cancelment of the contract, and a full release and satisfaction of himself and his bonds and sureties from the further performance thereof.

It is expressly understood and agreed that the several stipulations of this contract shall be performed in such a manner that the party of the first part will not be relieved from the immediate charge and responsibility of the work; and the same shall not be transferred or assigned, nor any portion of the work embraced therein sub-let to other parties, unless by the written sanction of the chief engineer, and approval thereof by the Secretary of the Interior.

In witness whereof, the parties to these presents have hereunto set their hands and seals, in triplicate, on the day and year first above written.

RICHARD DUNBAR. [L. S.]
CHARLES H. SHERRILL. [L. S.]
ANSON BANGS. [L. S.]
S. SEYMOUR, [L. S.]
Chief Engineer.

Subject to the approval of the Secretary of the Interior.

Approved: J. P. USHER, *Secretary.*

Guarantee.

Know all men by these presents, that we, Alexander W. Randall, of the State of Wisconsin, and Robert C. Murphy, of Washington, D. C., in consideration of the premises, and of one dollar to us in hand paid by the United States, the receipt whereof is hereby acknowledged, do hereby, severally and jointly, covenant and agree with said United States that the above-named Richard Dunbar, Charles H. Sherrill, and Anson Bangs, shall in all things faithfully perform all and singular the covenants and conditions in the foregoing contract set forth to be by them performed and kept.

Witness our hands and seals this second day of August, 1864.

ALEXANDER W. RANDALL.
R. C. MURPHY.

In presence of—
JAMES H. MARR, Jr.
J. J. R. CROES.

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Specifications for graduation.

Clearing and grubbing.—The ground set apart for the work will be thoroughly cleared of all timber, stumps, roots, and brushwood, and the same will be either destroyed or removed outside the boundary lines as fixed by the engineer. The surface of ground forming excavations, and also the ground upon which embankments are to rest, will be thoroughly stripped of all muck or vegetable matter, and the same will be disposed of as directed by the engineer. The price named in the contract for this item will include all work of the above character.

Excavation.—The open excavation for the conduit will generally be fourteen feet wide at the centre of the conduit, which is the grade line of the aqueduct.

The slopes will vary from one foot base to from one to four feet rise, at the discretion of the engineer, according to the nature of the material. Excavation will be divided into three classes, to wit: earth excavation, rock excavation, and tunnel excavation.

Earth excavation will include all material softer than rock, and also all detached masses of rock or boulders measuring less than one-half a cubic yard in size, whether found in open cuts, the bed of the conduit, benches, foundations, borrowing pits, side drains, or in any other manner connected with the work.

Rock excavation will include all material harder than earth, except detached masses and boulders as above described, whether found in open cuts, the bed of the conduit, benches, foundations, side drains, approaches to tunnels, or in any other manner connected with the work.

Tunnel excavation will be circular in form, and of eleven feet clear diameter, and will include all material of whatsoever nature found between the extremities of the tunnel.

The quantity of material in tunnels will be computed by multiplying the net area of eleven feet diameter into the length of tunnel. Any material excavated outside of these dimensions will be at the expense of the contractor, unless the same be directed as a measure of safety or necessity by the engineer.

The prices named in the contract for the above three classes of excavation will include the cost of all pumping, bailing, and draining that may be necessary, and the removal of all material to the place designated by the engineer, unless the haul should exceed a distance of five hundred feet, in which case an additional price of one cent per cubic yard will be allowed for each one hundred feet so hauled in excess of five hundred. The prices will also include the depositing of any portion of said materials in spoil banks, as the same may be directed by the engineer.

Embankment.—This item will include all labor and expense necessary in the proper arrangement and manipulation of such material as may be selected by the engineer and deposited from excavations, when used either in the foundations, the banks upon which the conduit is to rest, the formation of side slopes, the trimming for the bed of the conduit, the covering of the conduit, top and slope dressings, ramming, puddling, together with any and all other labor and expenses connected with the final disposition of the material and completion of the work, as the same may be measured in embankment, which is not properly chargeable to the excavation and removal of said material as provided for under the head of *excavation*.

The banks and side slopes designed for the support of the conduit must be composed of material selected by the engineer, and entirely free from perishable matter, and must be formed by placing the material in horizontal layers of not less than three nor more than six inches in thickness, as the engineer may direct; after which it must be rammed with heavy hand-mauls until it has become perfectly solid and incompressible.

The material upon the top of the conduit, whether in excavations or upon embankments, must also be approved by the engineer, and carried up in horizontal layers not exceeding six inches thick, and properly solidified by carting thereon, or the use of rammers, as the engineer may direct. Whenever, in the opinion of the engineer, the safety or durability of the work requires that any portion of the banks should be puddled instead of rammed, as above described, the same shall be done in such manner as the engineer may direct.

Retaining wall.—Whenever required by the engineer, retaining walls will be constructed to support the outer slope of the embankments. These will be built of dry rubble masonry, composed of durable, well-shaped stones, laid with alternate headers and stretchers in a workmanlike manner, as directed by the engineer. The face of the wall will generally batter one foot in four, and the thickness of

the base will generally be equal to one-third the height; but it may vary from these particulars in form and dimensions at the discretion of the engineer.

These walls, when required by the engineer, will extend underneath the conduit.

Specifications for conduit.

The centre of the conduit is, in all cases, the grade line of the aqueduct.

The foundation or bed of the conduit in earth-work must be carefully trimmed below grade, so as to conform to the outer circumference of the conduit; and in rock-work it will be levelled or surfaced up to the same line with concrete or rubble masonry, as the engineer may direct.

The conduit will be circular in form, and nine feet interior diameter. It will be constructed of brick or stone, or in parts and sections of each, at the discretion of the engineer.

When brick are used they must be of the best quality, full and uniform in size, and hard-burned throughout, and entirely free from lime or other impurities. They must be laid true to the centres or lines given, and in full beds of mortar, with not exceeding one-fourth inch joints at the centre of the brick. The bed of the bricks will be on a line with the radius of the circle, and, when required by the engineer, a bond will be made at regular intervals connecting laterally the different courses or rings composing the conduit. The ordinary thickness of the conduit masonry will be about thirteen inches, or three breadths of brick, but this will be varied at the discretion of the engineer. The bricks must be thoroughly saturated in water just before laying, and must be pressed into the mortar so as to completely fill the joints.

When stone are used they must be sound, durable, and well shaped, so that their beds will conform to the radius of the circle. The stone conduit will generally be eighteen inches in thickness, but will vary from this at the discretion of the engineer. At least one-half of the stones as laid must extend through the wall; and they must be well cleaned and saturated in water just before laying, and laid in a full bed of mortar with not exceeding one-half inch joints. The outer and inner surfaces of the wall must be thoroughly pointed or covered with a full coat of mortar, as the engineer may direct, in order to make it impervious to water.

The conduit through tunnel excavations will, when required by the engineer, be formed by filling up the irregularities of the lower section with a bed of concrete or rubble masonry, as the engineer may direct; and when any portion of the tunnel passes through material that is not self-sustaining, and is liable to fall in and obstruct the passage of the water, the same will be lined throughout, either with a sheeting of brick or stone, as the engineer may direct, laid similar to the other portions of the conduit, and backed up solid against the sides and top of the tunnel.

The centring for the conduit will be furnished by the contractor without extra charge, and will be constructed and placed as directed by the engineer.

Specifications for cement, sand, mortar, grout, and concrete.

Cement.—The cement used in the work must be of the best quality of hydraulic cement, equal in character to the *Rosendale*. It must be fresh, well burned and ground, free from foreign substances, and put up in air-tight casks. It must also be subject to such tests as the engineer may direct; and the contractor must keep it entirely protected from the weather until used in the work.

Sand.—The sand used in the work must be clean and sharp, free from loam, dust, mica, or other impurities, which will hinder it from mixing freely with the cement. It must be thoroughly screened and washed when required by the engineer.

Mortar.—All mortar used in the work will be composed of hydraulic cement and sand, mixed with water in such proportions as the engineer may direct, generally one part of cement to two parts of sand. The materials will always be measured under the eye of the inspector, and whilst dry thoroughly mixed on a tight, wooden platform; after which a sufficient quantity of clean water will be applied to bring it to the proper consistency, and then it will be worked with hoes until all the particles have become thoroughly intermixed. The quantity so manufactured must not exceed the amount required for immediate use; and it must be applied to the work within the proper time for rendering the adhesion and solidification most perfect. No mortar will be used in the work which has been once set and worked over the second time.

Grout.—When grout is required in the work it will be composed of the same kind and quality of materials, and mixed in the same proportions, as above specified for mortar, except that it will be manufactured in a tight box, and, by the addition of water, reduced to a proper consistency for running freely through the interstices of the masonry, or other substance to which it may be applied, until, when fully set, the whole mass becomes perfectly solid and impervious to air or water.

Concrete.—When concrete is used in the work it will be composed generally of one part of cement, two of sand, and five of hard, durable rock, broken to pass through a two-inch ring. These proportions will be varied at the discretion of the engineer. The cement and sand will be mixed dry, and reduced to the proper consistency with water before the stone are added. The whole mass will then be thoroughly worked with hoes or shovels, and applied to the work immediately in layers not more than eight inches thick, each layer to be properly confined in its place, and rammed until the mortar flushes to the surface, and it must become thoroughly solidified before another layer is added.