CONNECTICUT RIVER FLOOD CONTROL PROJECT

EAST HARTFORD, CONN.

CONNECTICUT RIVER, CONNECTICUT

SPECIFICATIONS

FOR

CHERRY STREET PUMPING STATION

AND

PITKIN STREET PUMPING STATION

ITEM E.H.6a – CONTRACT

AND

ITEM E.H.6b – CONTRACT

WAR DEPARTMENT CORPS OF ENGINEERS, U.S. ARMY

U.S. ENGINEER OFFICE, PROVIDENCE, R.I.

APRIL, 1941

8

407-670A

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR CONSTRUCTION OF

CHERRY STREET AND PITKIN STREET
PUMPING STATIONS

ITEMS EH-6a and 6b

EAST HARTFORD, CONNECTICUT

MARCH 31, 1941

(Issued April 30, 1941)

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE PROVIDENCE, R. I.

No. _____ Bidder _____ Invitation No. 699-41-248
(Do not write above this line)

STANDARD GOVERNMENT FORM OF INVITATION FOR BIDS
(Construction Contract)

War Department
United States Engineer Office
Providence, R. I.
April 30, 1941

SEALED BIDS, in duplicate, subject to the conditions contained herein, will be received until 2:00 p.m., Eastern Daylight Saving Time, May 22, 1941, and then publicly opened, for furnishing all plant, labor and materials except the equipment to be furnished by the Government as provided in the specifications, and performing all work required by the drawings and specifications for the construction of the Cherry Street and Pitkin Street Pumping Stations, located on the east bank of the Connecticut River in East Hartford, Connecticut.

I. THE WORK shall be in strict accordance with the specifications, bidding schedule and drawings, designated as follows:

Specifications for construction of Cherry Street and Pitkin Street Pumping Stations, Connecticut River, East Hartford, Connecticut.

The drawings which will become a part of this contract are designated in Paragraph 1-04 of the specifications. Where copies of drawings are requested, no deposit will be required.

II. GUARANTY will be required with each bid as follows: Bid bond, Standard Form No. 24, will be executed in a penal sum approximately equal to and not less than ten (10) per cent of the total amount of the bid. Individual sureties will justify in sums aggregating not less than double the penalty of the bid bond. (See Paragraphs 8 to 11, inclusive, of Instructions to Bidders.) Certified check may be furnished in lieu of bid bond.

III. PERFORMANCE AND PAYMENT BONDS will be required from the successful bidder as follows:

a. A performance bond with good and sufficient surety or sureties, for the protection of the United States, Standard Form No. 25, will be executed in a penal sum approximately equal to and not less than fifty (50) per cent of the full amount of the consideration of the contract.

b. If the consideration of the contract will exceed $2,000.00 in amount, a payment bond with good and sufficient surety or sureties, for the protection of persons furnishing material and labor for the work, Standard Form No. 25-A, will be executed in a penal sum equal to fifty (50) per cent of the full amount of the consideration of the contract, when the

latter is not more than one million dollars ($1,000,000.00); forty (40) per cent where the contract exceeds one million dollars ($1,000,000.00) but is not more than five million dollars ($5,000,000.00); and two million five hundred thousand dollars ($2,500,000.00) for all contracts above five million dollars ($5,000,000.00).

IV. LIQUIDATED DAMAGES FOR DELAY will be prescribed. (See Paragraph 1-07 of the specifications).

V. TAX ADJUSTMENTS. - Provisions for tax adjustments will be made a part of the contract. (See Paragraph 1-12 of the specifications.)

VI. PARTIAL PAYMENTS will be made. (See Article 16 of the contract and Paragraph 1-10 of the specifications.)

VII. ARTICLES ON PATENTS will be made a part of the contract. (See Paragraph 1-17 of the specifications.)

VIII. BID AND CONTRACT. - a. Bids must be submitted upon the Standard Government Form of Bid and the successful bidder will be required to execute the Standard Government Form of Contract for construction. The bid form has an entry for each item on which estimates will be given or payments made, and no other allowances of any kind will be made unless specifically provided for in the specifications or the contract. Bids shall be for one or more complete schedules and shall have each blank filled in each schedule for which a bid is submitted.

b. The quantities of each item of the bid, as finally ascertained at the close of the contract, in the units given and the unit prices of the several items stated by the bidder in the accepted bid, will determine the total payments to accrue under the contract. The unit price bid for each item must allow for all collateral or indirect cost connected with it.

c. The successful bidder will be required to return the contract duly executed and to furnish the performance and payment bonds herein described, within ten (10) days after the papers are presented to him.

IX. EXPERIENCE. - a. Each bidder shall state in his bid whether he is now or ever has been engaged on any contract or other work similar to that proposed, giving the year in which it was done and the manner of its execution, and shall submit such other information as will tend to show his ability to prosecute vigorously the work required by these specifications.

b. The successful bidder will be required to employ an organization thoroughly experienced and skilled in the manufacture, fabrication, and installation of the crane, lighting system, and other equipment that is to be furnished and installed in the pumping station. After the opening of bids, any bidder may be required to submit satisfactory evidence that the specific organizations which he proposes to employ on this

portion of the contract have successfully executed work of the nature and quality indicated above.

X. COMMENCEMENT AND COMPLETION. - Work shall be commenced within ten (10) calendar days after receipt of notice to proceed and shall be completed within 250 calendar days, in accordance with the provisions of Paragraph 1 -07 of the specifications.

XI. MINIMUM WAGE RATES for the locality of the work have been determined by the U. S. Department of Labor (see Articles 17 and 19 of the contract and Paragraph 1-35 of the specifications).

XII. EIGHT-HOUR LAW. - The requirements of the Eight-Hour Law, Article 11 of the contract as modified by Section 303, Public No. 781, 76th Congress, approved September 9, 1940, will be applicable to the work under the contract.

XIII. ARTICLES ON PREFERENCE for domestic materials will be made a part of the contract. (See Article 18 of the contract and Paragraph 1-31 of the specifications.)

XIV. REPORTS TO THE DEPARTMENT OF LABOR. - In order to assist the Department of Labor in obtaining employment statistics, bidders, unless otherwise indicated in their bids, will be considered as having voluntarily consented, without cost to the Government, to the inclusion of Paragraph 1-36 of the specifications as a part of the contract.

XV. INVESTIGATION OF CONDITIONS. - Samples of borings taken at the site of the work can be seen at the U. S. Engineer Laboratory at Providence, Rhode Island, where they should be inspected by prospective bidders. Bidders are expected to visit the locality of the work and acquaint themselves with all available information concerning the nature of the structure excavations, and the local conditions bearing on transportation, handling and storage of materials. They are also expected to make their own estimates of the facilities need and the difficulties attending the execution of the proposed contract including local conditions, availability of labor, uncertainties of weather, and other contingencies. In no event will the Government assume any responsibility whatever for any interpretation, deduction, or conclusion drawn from the examination of the site. At the bidder's request, a representative of the Government will point out the site of the proposed operations. Failure to acquaint himself with all available information concerning these conditions will not relieve the successful bidder from responsibility for estimating the difficulties and costs of successfully performing the complete work.

XVI. FACILITIES AVAILABLE FOR CONSTRUCTION are described in Paragraph 1-06 of the specifications.

XVII. DATA TO BE SUBMITTED WITH BIDS. - a. Each bidder shall submit with his bid drawings showing proposed plant layout and charts showing the rate of progress the bidder will maintain on the work, carefully

prepared and presented in neat and legible form. These data are considered essential in assisting the contracting officer to determine whether or not the bidder is responsible, experienced in similar types of construction, and that his bid is based on a careful study of construction methods applicable to the work, and with a full realization of the various factors which may affect its progress.

b. The drawings indicating the plant layout shall clearly show the location and manner of employment of the various major items of plant, the method of excavation and disposal of materials, and the manner in which structural features will be erected.

c. The progress charts shall indicate the volume of work to be done and the rate of progress which the bidder agrees to maintain for each of the following major operations required in the performance of the work under these specifications: (1) Excavation, (2) Concreting, (3) Backfill and (4) Pumping Station Superstructure. These charts may be in any convenient form in which the time element shall be plotted to represent definite intervals of time measured from date of notice to proceed with the work, and the volume of work shall be represented by a suitable scale of percentage of completion based on the estimated contract quantities. Careful consideration shall be given to the preparation of the charts as the contractor will be required to maintain the rate of progress indicated thereon.

XVIII. PLANT. - Each bidder shall state in his bid the character and amount of plant that he proposes to employ on the work. After bids are opened any bidder may be required to show that he owns, controls by firm option or can procure the plant necessary for commencing, prosecuting, and completing the work as required by the specifications.

XIX. AWARD OF CONTRACT. - a. Subject to the rights herein reserved, the work will be awarded as a whole to one bidder, or will be awarded by schedules to separate bidders as may be deemed to be to the best interest of the Government. Any bidder bidding on Schedules 1 and 2 separately, and not prepared to undertake the work under both schedules, should state the fact in his proposal. The right is reserved as the interest of the Government may require, to reject any and all bids, to waive any informality in bids received.

b. A bid may be rejected if the bidder cannot show that he has the necessary capital and experience, and owns, controls by firm option, or can procure the necessary plant to commence the work at the time prescribed in the specifications and thereafter to prosecute and complete the work at the rate or time specified; and that he is not already obligated for the performance of other work which would delay the commencement, prosecution or completion of the work contemplated in this advertisement.

c. Any unbalanced bid which, in the opinion of the contracting officer, jeopardizes the interest of the Government will be subject to rejection for that reason.

XX. ADDRESS FOR BIDS. - Bids submitted must be in envelopes with sufficient postage, sealed, marked, and addressed as follows:

(Marked in upper left-hand corner)

Bid for construction of Cherry Street
and Pitkin Street Pumping Stations
on the Connecticut River at East
Hartford, Connecticut.

To be opened May 22, 1941.

(Addressed to)

The District Engineer
United States Engineer Office
819 Industrial Trust Building
Providence, Rhode Island

Note:- See Standard Government Instructions to bidders and copy of the Standard Government Forms of contract, bid bond, payment bond, and performance bond, which may be obtained upon application.

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Invitation No. 6[illegible]-41-248

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
PROVIDENCE, RHODE ISLAND

APPROPRIATION: 21X3113 FLOOD CONTROL, GENERAL.

CHERRY STREET AND PITKIN STREET PUMPING STATIONS
Item EH-6a and EH-6b (Contract)

EAST HARTFORD, CONNECTICUT

SPECIFICATIONS

SECTION I. GENERAL PROVISIONS

1-01. Location. - The site of the work covered by these specifications is located on the east bank of the Connecticut River, in the Town of East Hartford, Connecticut.

1-02. Work to be done. - a. The work provided for herein is authorized by the Flood Control Act of June 28, 1938 (Public No. 761, 75th Congress).

b. The work to be done consists of furnishing all plant, labor, and materials except equipment furnished by the Government (see Paragraphs 1-14, 8-14 b, and Section XIII), and performing all work required for constructing two pumping stations with all appurtenant works, complete in accordance with these specifications and the drawings forming a part hereof, together with such other incidental work at the site as may be required for completion of the work within the intent and scope of the specifications, or as may be ordered in writing by the contracting officer. It will consist of the following major items:

(1) Construction of one pumping station near the intersection of the dike and Cherry Street, and another pumping station near the intersection of the dike and Pitkin Street.

(2) Installing major pumping station equipment, including pumps, piping and valves, gasoline engines, and right-angle gear units, to be furnished by the Government.

(3) Furnishing and installing traveling cranes, electric light and power systems, and other auxiliary pumping station equipment.

1-03. Description of the work. - a. The pumping stations will be located on the landside of the East Hartford dike on the Connecticut River at the existing outfalls near dike Stations 111+00, and 144+85, respectively.

b. Each pumping station will be built on an earth foundation. The pumping station substructure, with the attached intake, and the cast

iron discharge conduit connecting with the existing cast iron cross drain and existing valve chambers, will be of reinforced concrete. Each pumping station superstructure will be constructed with a structural steel frame, brick masonry walls and reinforced concrete roof slab.

c. The contractor shall install in each pumping station two vertical volute pumping units (16-inch at Cherry Street and 20-inch at Pitkin Street) driven by gasoline engines through right-angle gear drive units, and gate valves, check valves and piping, all to be furnished by the Government. In addition to installing the aforesaid main pumping equipment furnished by the Government, the contractor shall furnish and install the following auxiliary equipment, including all accessories:

(1) Electric motor-driven sump pump.

(2) Fuel supply system for gasoline engines.

(3) Electric light and power system.

(4) Traveling crane.

(5) Heating system.

(6) Float gage.

(7) Carbon dioxide fire extinguishing equipment.

1-04. Drawings. - a. The work shall conform to drawings marked, "Connecticut River Flood Control, Cherry Street Pumping Station, East Hartford, Connecticut," and "Connecticut River Flood Control, Pitkin Street Pumping Station, East Hartford, Connecticut," as listed below, which drawings form a part of these specifications and are filed in the United States Engineer Office, Providence, Rhode Island.

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3	Stage Hydrograph No. 1	CT-3-1199
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9	West Elevation and Sections-Architectural	CT-4-2927
10	Entrance Details-Architectural	CT-4-2928

CHERRY STREET DRAWINGS (Cont'd)

Sheet No.	Title	File No.
11	Cast Stone Details-Architectural	CT-4-2929
12	Miscellaneous Details-Architectural	CT-4-2930
13	Structural Steel Framing	CT-4-2931
14	Structural Steel Details	CT-4-2932
15	Roof Slab	CT-4-2933
16	Engine Room Floor Steel-Reinforcement No. 1	CT-4-2934
17	Engine Room Floor Steel-Reinforcement No. 2	CT-4-2935
18	Base Slab	CT-4-2936
19	Horizontal and Vertical Sections	CT-4-2937
20	North and East Walls	CT-4-2938
21	South and West Walls	CT-4-2939
22	Suction Chamber	CT-4-2940
23	Miscellaneous Steel-Details No. 1	CT-4-2941
24	Miscellaneous Steel-Details No. 2	CT-4-2942
25	General Arrangement of Equipment	CT-4-2943
26	Miscellaneous Equipment-Details	CT-4-2944
27	Piping Details	CT-4-2945
28	Electric Light and Power System No. 1	CT-4-2946
29	Electric Light and Power System No. 2	CT-4-2947

LIST OF DRAWINGS FOR PITKIN STREET PUMPING STATION

Sheet No.	Title	File No.
1	Location	CT-4-2853
2	General Plan	CT-4-2854
3	Stage Hydrographs No. 1	CT-3-1190
4	Stage Hydrographs No. 2	CT-3-1191
5	Subsurface Explorations	CT-2-1324
6	Miscellaneous Details	CT-2-2855
7	Plans and Details - Architectural	CT-4-2856
8	Elevations - Architectural	CT-4-2857
9	West Elevation and Sections - Architectural	CT-4-2858
10	Main Entrance Elevation and Details - Architectural	CT-4-2859
11	Details - Architectural	CT-4-2860
12	Structural Steel Framing	CT-4-2861
13	Structural Steel Details	CT-4-2862
14	Roof Slab	CT-4-2863
15	Engine Room Floor Steel - Reinforcement No. 1	CT-4-2864
16	Engine Room Floor Steel - Reinforcement No. 2	CT-4-2865
17	Base Slab	CT-4-2866
18	Vertical Sections	CT-4-2867

Sheet No.	Title	File No.
19	North Wall and Suction Chamber	CT-4-2868
20	South Wall and Horizontal Section	CT-4-2869
21	East and West Walls and Tank Supports	CT-4-2870
22	Miscellaneous Steel Details No. 1	CT-4-2871
23	Miscellaneous Steel Details No. 2	CT-4-2872
24	General Arrangement of Equipment	CT-4-2873
25	Miscellaneous Equipment - Details	CT-4-2874
26	Piping Details	CT-4-2875
27	Electric Light & Power System No. 1	CT-4-2876
28	Electric Light & Power System No. 2	CT-4-2877

Ten sets of prints of all necessary contract drawings will be furnished without charge, upon request by the contractor. Additional prints will be furnished upon request at the cost of printing.

b. The work shall also conform to such other drawings relating thereto as may be exhibited in the office of the contracting officer prior to the opening of proposals, and to such drawings used in explanation of details as may be required from time to time during construction, including such minor modifications as the contracting officer may consider necessary on account of conditions discovered during the prosecution of the work.

c. Prior to performing the work, the contractor shall check all drawings and shall immediately report to the contracting officer any errors or omissions discovered therein. Quantities stated in bills of material on contract drawings are approximate, and the contractor shall furnish the required quantity without change in unit price. All items to be furnished at lump sum prices shall be provided by the contractor, complete and in good working order, regardless of whether or not they are fully shown or listed on the contract drawings. Parts and details not fully indicated on the drawings shall be detailed by the contractor in accordance with standard engineering practice. Detailed drawings conforming to standard practice shall be furnished by the contractor for the following, as specified in the paragraphs referred to:

Designation	Paragraph Reference
Steel reinforcement bending details	6-18 a (2)
Pumping Station Superstructure	
Structural steel	8-02 b
Glass block	8-04 a
Stonework	8-06 b
Doors	8-07 a
Louvers and ventilators	8-12
Downspouts	8-13 b
Electric light and power system	10-01 b
Traveling crane	11-05

1-05. Quantities. - The following estimate of quantities is given to serve as a basis for the comparison of bids and to determine the approximate consideration of the contract. Within the limits of available funds, the contractor will be required to complete the work specified in Paragraph 1-02, whether the required quantities are more or less than the amounts herein estimated, and final payment will not be made until the work is so completed.

CHERRY STREET PUMPING STATION

Item No.	Designation	Unit	Quantity
1	Control of Water and Sewage	job	-
2	Common Excavation - General	cu.yd.	1,800
3	Compacted Backfill	" "	5
4	Semi-Compacted Backfill	" "	1,250
5	4-Inch V.C. Pipe	lin.ft.	64
6	24-Inch Cast Iron Pipe	" "	14
7	Cement	bbl.	290
8	Concrete - Class "A"	cu.yd.	160
9	Concrete - Class "B"	" "	90
10	Steel Reinforcement	lb.	25,000
11	Pumping Station Superstructure	job	-
12	Miscellaneous Iron and Steel	lb.	3,180
13	Miscellaneous Pipe and Fittings	"	330
14	Steel Trash Rack	job	-
15	Electric Light and Power System	job	-
16	Traveling Crane, Complete	job	-
17	Sump Pump	job	-
18	Gasoline Tank and Piping	job	-
19	Float Gage	job	-
20	Heating System	job	-
21	Installing Equipment Furnished by the Government	job	-
22	Topsoil	cu.yd.	90
23	Seeding	sq.yd.	540
24	Gate Valve and Miscellaneous Pipe	job	-
25	Gravel for Roads	cu.yd.	6
26	Carbon Dioxide Fire Extinguishing Equipment	job	-

PITKIN STREET PUMPING STATION

Item No.	Designation	Unit	Quantity
1	Control of Water and Sewage	job	-
2	Common Excavation - General	cu.yd.	900
3	Compacted Backfill	cu.yd.	50
4	Semi-Compacted Backfill	cu.yd.	70
5	4-Inch V.C. Pipe	lin.ft.	40
6	30-Inch Cast Iron Pipe	lin.ft.	14
7	Cement	bbl.	338

PITKIN STREET PUMPING STATION

Item No.	Designation	Unit	Quantity
8	Concrete - Class "A"	cu.yd.	190
9	Concrete - Class "B"	cu.yd.	100
10	Steel Reinforcement	lb.	29,000
11	Pumping Station Superstructure	job	-
12	Miscellaneous Iron and Steel	lb.	3,100
13	Miscellaneous Pipe and Fittings	lbs.	310
14	Steel Trash Rack	job	-
15	Electric Light and Power System	job	-
16	Traveling Crane, Complete	job	-
17	Sump Pump	job	-
18	Gasoline Tank and Piping	job	-
19	Float Gage	job	-
20	Heating System	job	-
21	Installing Equipment Furnished by the Government	job	-
22	Topsoil	cu.yd.	100
23	Seeding	sq.yd.	600
24	Gate Valve and Miscellaneous Pipe	job	-
25	Gravel for Roads	cu.yd.	5
26	Carbon Dioxide Fire Extinguishing Equipment	job	-

1-06. Physical data. - a. General. - Borings have been made in the vicinity of the proposed work with reasonable care and laboratory analyses have been made of the samples from some of these holes. Samples of materials taken from them, and records of laboratory analyses and results of other studies may be seen at the U. S. Engineer Office, Providence, Rhode Island. It is expressly understood that the Government will not be responsible for any deduction, interpretation, or conclusions made by the contractor from his inspection of available samples and records. These samples of materials and contract drawings represent all the pertinent information on subsurface exploration which the Government has made at the site. Concrete aggregates, and gravel or crushed stone shall be obtained from sources approved by the contracting officer.

b. Transportation facilities. - (1) Railroads. - The New York, New Haven and Hartford Railroad serves the Town of East Hartford with main line traffic. The contractor shall investigate the availability of the sidings from the railroad company and make all arrangements with the latter for the use of any sidings for the delivery of any materials and equipment to be used on the work.

(2) Highways. - First-class highways also serve the Town. The contractor shall provide for his own construction or access roads and their maintenance. He shall make his own investigation of available roads for transportation, of load limits for bridges and roads, and other road conditions affecting the transportation of materials and equipment to the site of the work.

c. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 18 degrees to plus 101 degrees Fahrenheit. The mean annual precipitation at East Hartford is 43.38 inches. The mean monthly precipitation varies from a low of 3.32 inches in June to a high of 4.19 inches in August.

1-07. Commencement, prosecution, and completion. - a. The contractor will be required to commence the work under the contract within ten (10) calendar days after date of receipt by him of notice to proceed, to prosecute the said work with faithfulness and energy, and to complete the entire work, including the installation and testing of equipment in each pumping station (see Section XIII), within 250 calendar days after said date of receipt of notice to proceed.

b. The contracting officer may, in his discretion, suspend work for the period during which sub-freezing temperatures are experienced or are reasonably to be expected, ground moisture conditions are unfavorable, or the water surface in the river exceeds elevation of 12.3 feet at the Cherry Street Pumping Station site, or 8.8 feet at the Pitkin Street Pumping Station site. (See Paragraph 2-01 b). The contractor will be required to resume operations on written notice from the contracting officer terminating the suspension, provided that a maximum of 3 days after receipt of notice will be allowed before it becomes effective. The time allowed for completion of the entire work is exclusive of any time that may intervene between the effective date of orders of the contracting officer to suspend operations and the effective date of orders to resume the work.

c. Liquidated damages. - (1) In case of failure on the part of the contractor to complete the work within the time determined and agreed upon for its completion plus any extensions duly granted under the terms of the contract, the contractor shall pay the Government as liquidated damages for delay in completing the entire work under each of Schedules 1 and 2 of the contract, the sum of fifty ($50.00) dollars for each calendar day of delay until all work included in such schedule is completed or accepted, except as otherwise specified in subparagraph (2) below:

(2) Minor deficiencies in the work and operating deficiencies noted in tests on equipment shall be corrected or adjusted within 30 calendar days after date of completion specified in subparagraph (1) above. The provision for liquidated damages shall not apply to the period of time, not exceeding 30 calendar days, allowed by the contracting officer to correct or adjust the aforesaid deficiencies, but final payment will not be made until such deficiencies have been satisfactorily corrected or adjusted.

1-08. Sundays, holidays, and nights. - No work shall be done on Sundays or on days declared by Congress as holidays for per diem employees of the United States except in cases of emergency, and then only with the written consent of the contracting officer. Work may be done at night when authorized in writing by the contracting officer.

1-09. Progress, organization, and plant. - a. The contractor shall employ at all times an ample force of men with proper experience in their respective assignments, and shall provide equipment and a construction plant properly adapted to the work, and of sufficient capacity and efficiency to accomplish the work in a safe and workmanlike manner within the time specified in Paragraph 1-07. All plant and equipment shall be maintained in good working order, and provision shall be made for immediate emergency repairs. The contracting officer may order the removal and require replacement of any unsatisfactory plant or equipment. No reduction in the capacity of the plant employed on the work shall be made, except under written permission of the contracting officer. The measure of "capacity of the plant" shall be its actual performance on the work to which these specifications apply. It is understood that award of this contract shall not be construed as a guarantee by the Government that the plant and equipment listed by the contractor in the bid form is adequate for the performance of the work.

b. Should the contractor fail to maintain a rate of progress which will insure completion of the work within the time specified in Paragraph 1-07, the contracting officer may require that additional men, equipment, or plant be placed on the work, or a reorganization of plant layout be effected in order that the work be brought up to schedule and maintained there. Should the contractor refuse or neglect to comply with these requirements to the satisfaction of the contracting officer, the contracting officer will proceed under the provisions of Article 9 of the contract.

1-10. Payments. - Payments will be made monthly in accordance with Article 16 of the contract.

1-11. Work covered by contract price. - The contractor shall, under his contract prices, furnish and pay for all material, equipment and labor, except the equipment and materials specified in Paragraphs 1-14 and 8-14 b and Section XIII, and all permanent, temporary, and incidental work, furnish all accessories, and do everything that may be necessary to carry out the work specified in good faith, which contemplates everything specified completed, in good working order, of good materials with accurate workmanship, skillfully fitted and properly connected and put together (see Paragraph 1-13).

1-12. Tax adjustments. - The contract price will be considered to include all Federal, State and local taxes imposed prior to the date of opening bids and applicable to the undertaking. If any privilege, sales, gross receipt or other tax (exclusive of taxes on net income or undistributed profits) applicable to the undertaking and payable directly by the contractor, is imposed or changed after the date of opening bids by Federal or State enactment, then the contract price will be increased or decreased accordingly, and any amount due or chargeable against the contractor as a result thereof will be adjusted on payment vouchers as separate items.

1-13. Material to be furnished by the contractor. - a. The contractor shall furnish all materials and equipment, except as specified in Paragraphs 1-14 and 8-14 b, necessary to complete the work to be done under these specifications. The equipment furnished by the contractor and installed in the work covered by these specifications shall conform to the drawings and specifications, and shall also conform to the drawings and data sheets furnished by the contractor if approved by the contracting officer. The cost of unloading and loading, handling, hauling, storing and caring for materials and equipment furnished by the contractor shall be included in the contract prices for the work to which the materials and equipment pertain. All materials, supplies and articles delivered at the site shall be adequately housed or otherwise protected against deterioration and damage.

b. Each major piece of equipment furnished under the contract shall be provided with a substantial nameplate securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, and the principal rating data.

1-14. Equipment to be furnished by the Government. - The Government will furnish the following materials and equipment for installation by the contractor in each pumping station:

(1) Two pumps including intake and discharge piping and valves (16-inch pumps for Cherry Street and 20-inch pumps for Pitkin Street).

(2) Two gasoline engines with silencers and exhaust piping.

(3) Two right-angle gear units.

b. Delivery. - The contractor shall give the contracting officer 30 days' written notice of the quantities, designation and desired delivery dates of materials and equipment required (see Paragraph 13-02). The equipment and materials to be furnished by the Government will be delivered to the contractor f.o.b. railroad cars at East Hartford, Connecticut, or f.o.b. trucks at the site of the work, at the option of the contracting officer, and shall be received and cared for by the contractor in accordance with the provisions of Paragraph 13-02 b whether or not delivery has been previously requested.

1-15. Order of work. - The work shall be carried on at such places and also in such order of precedence as may be found necessary by the contracting officer. The contractor shall submit, for approval of the contracting officer, his proposed program in writing, giving the sequence of construction operations contemplated. The location and limits of the work to be done will be plainly indicated by stakes, lines, marks or otherwise as established by the contracting officer or his agents.

1-16. Damage. - Damage to Government property due to the failure of the contractor to take reasonable precaution, and all loss or deterioration of, or damage to any of the work by flood, accident or exposure prior to final acceptance of the work, shall be made good by the contractor without expense to the Government, except that the Government will compensate the contractor for repairs to the permanent work, if damaged by flooding or scouring, through no fault of the contractor. (See Paragraph 2-01 b).

1-17. Patents. - The contractor shall hold and save the Government, its officers, agents, and employees harmless from liability of any nature or kind, including costs and expenses for or on account of any patented or unpatented process or invention, article, or appliance manufactured or used in the performance of this contract, including its use by the Government.

1-18. Grounds and rights of way. - a. Grounds and rights of way needed for the work to be done under these specifications will be furnished by the Government. The Government shall not be held liable for any delay in furnishing the grounds or rights of way, but in case such delay retards the operations of the contract, the contracting officer will grant an extension of time for the completion of the work, equal to the length of the delay (see Paragraph 1-07). The contractor will have the privilege of using the Government controlled land at the site, not otherwise reserved by the contracting officer provided that plans for all construction, storage, or other operations proposed thereon by the contractor are submitted for approval of the contracting officer prior to the occupation of such areas.

b. The contractor, without expense to the Government, at any time during the progress of the work and when space is needed for other purposes, shall vacate promptly and clean up any part of the grounds allotted to or in use by him, when directed to do so by the contracting officer.

1-19. Removal of rubbish. - The contractor shall keep the site free from rubbish. Suitable spoil areas for receiving refuse from the grounds shall be provided by the contractor, and the rubbish shall be removed and disposed of as directed by the contracting officer. At the conclusion of the work, the site shall be cleaned up and all rubbish and unused materials shall be removed.

1-20. Obstruction and danger lights. - In the contractor's use of streets and highways, for the work to be done under these specifications, he shall conduct his operations as approved by the contracting officer and in accordance with State and local laws and regulations. The contractor shall provide, erect and maintain effective

barricades, danger signals, and signs on all intercepted roads or highways, and on the site where directed by the contracting officer for the protection of the work and the safety of the public. All barricades, obstructions and plant which encroach on or are adjacent to public rights of way shall be provided with lights at night and all such lights shall be kept burning between sunset and sunrise. Such barricades and lights shall conform to the local and State laws. The contractor shall be responsible for all damages resulting from any neglect or failure of these requirements. The expenses of these and other safety precautions shall be borne by the contractor.

1-21. Inspection and supervision. - a. General. - The work will be conducted under the general direction of the contracting officer, and will be inspected by inspectors appointed by him who will enforce a strict compliance with the terms of the contract. The contracting officer will furnish on request of the contractor, all location and limit marks reasonably necessary as provided in Paragraph 1-23. The inspectors will keep a record of work done, and see that the location and limit marks are kept in proper order. The presence of an inspector shall not relieve the contractor of his responsibility for the superintendence required in the proper execution of the work (see Article 8 of the contract). Tests to determine the quality and fitness of material used and work done under these specifications will be made as indicated under that part of the specifications pertinent to the particular kind of work, and as stated in Paragraph 1-37.

b. Facilities to be furnished. - (1) The contractor shall furnish promptly, in accordance with Article 6 of the contract, all facilities, labor, and materials necessary for the safe and convenient inspection and tests that may be required by the contracting officer.

(2) The contractor shall furnish a room, approximately ten by twelve feet in size, at his concrete mixing plant for a Government laboratory, to be used for making field tests, including the moisture content of aggregates and such other field tests as are prescribed in these specifications under Section VI and for temporary storage of concrete specimens. The room shall be protected from the weather, properly lighted, and heated, all of which together with the location and capacity shall be subject to the approval of the contracting officer. The contractor shall provide electricity in accordance with Paragraph 1-34.

(3) The contractor shall furnish appropriate quarters for a Government field office. Such quarters shall be a room approximately 10 by 12 feet in size, and otherwise shall conform to the provisions of subparagraph (2) above.

(4) No separate payment will be made to the contractor for providing these facilities. Should the contractor refuse, neglect, or delay compliance with the requirements concerning

facilities for inspection and for furnishing the Government field office, the specific facilities may be furnished and maintained by the Government, and the cost therefor will be deducted from any amounts due or to become due the contractor.

c. It is hereby understood and agreed that any instructions or decisions by a superior officer through the contracting officer are to be considered instructions or decisions of the contracting officer in all cases under the terms of the contract where decision rests with the contracting officer.

1-22. Datum and bench marks. - The plane of reference used in these specifications and on the drawings hereof is mean sea level datum. Elevations in feet as specified and as shown on the drawings are to be determined from bench marks located at the site of the work, the locations, descriptions, and elevation of which are as follows:

U.S.G.S. Bench Mark

T-8 at East Hartford, Hartford County, on the N.Y., N.H. and H. R.R., 294 feet east of the station, at the bridge over Main St., in the top of the south end of the west abutment, and 29 feet south of the south rail. A standard disk, stamped "T8 45.33."
(13.769 meters or 45.174 feet)

1-23. Lines and grades. - a. The contractor shall keep the contracting officer informed a reasonable length of time in advance of the time and place at which he intends to do work in order that lines and grades may be given, necessary measurements for record and payment made and progress photographs taken with a minimum of inconvenience to the contracting officer or of delay to the contractor, and the contractor shall have no claim for damages or extension of time on account of delays in the giving of lines and grades or due to destruction of such marks and the consequent necessity for replacement.

b. All lines and grades will be given by the Government inspectors as authorized representatives of the contracting officer, but the contractor shall provide at his own expense such temporary structures and such materials and give such assistance as may be required by the contracting officer and the marks given shall be carefully preserved. After lines, elevations and grades for any part of the work have been given by the contracting officer, the contractor will be held responsible for the proper execution of the work to such lines, elevations, and grades, and all stakes or other marks given shall be preserved by the contractor

until their removal is authorized by the contracting officer. The contracting officer may require the work to be suspended when for any reason such marks cannot be properly followed.

1-24. Interpretation of specifications. - The contracting officer shall decide all questions which may arise as to the performance, quantity, quality, acceptability, fitness, and rate of progress of the several kinds of work to be done or materials to be furnished under this contract. He shall decide all questions which may arise as to the interpretiation of the specifications and of drawings used and as to the fulfillment of this contract on the part of the contractor, and as to defects in the contractor's work. His determination and decision shall be final, subject to appeal as provided for in Article 15 of the contract.

1-25. Water supply. - The contractor shall provide, at convenient points, ample supplies of water of proper quality for all the operations required under this contract.

1-26. Use of explosives. - The contractor shall use the utmost care in the use of explosives necessary for the prosecution of the work, not to endanger life or property. All blasting operations shall be conducted by experienced men only. The handling and use of explosives shall be done strictly in accordance with the latest methods and rulings to insure safety; in accordance with the specifications issued by the U. S. Bureau of Mines; and in compliance with the local and State laws. Failure to observe necessary precautions will be sufficient grounds for temporary suspension of the work. All explosives shall be transported and stored in a secure manner, and in accordance with local and State laws; all vehicles and such storage places shall be marked clearly "DANGER - EXPLOSIVES," and shall be in care of competent watchmen at all times. In no case shall caps or other detonators be stored or transported with dynamite or other explosives. The location of magazines for the storage of explosives and for the separate storage of detonators shall be subject to the approval of the contracting officer.

1-27. Standard stock products. - All material, supplies and articles furnished shall, wherever so specified and otherwise wherever practicable, be the standard stock products of recognized reputable manufacturers. The standard stock products of manufacturers other than those specified will be accepted if, in the opinion of the contracting officer, they are equal in strength, durability, usefulness and convenience for the purpose intended. (See Article 7 of the contract.) Any changes required in the details and dimensions shown on the drawings for the substitution of standard stock products, other than those provided for, shall be properly made as approved by the contracting officer, and at the expense of the contractor.

1-28. Safety requirements. - a. The contractor shall make all necessary provisions to protect the public safety, and to maintain and protect existing structures of whatever kind, and shall repair all damages done to such structures. He shall give ample notification to the proper officials of any city or town and of any public utility or other corporation before entering upon their respective public ways or rights of way to perform the required work of construction. Such construction shall conform to the customary regulations and requirements of said officials or corporations. The contractor shall give all notices, take out all permits, and pay all such charges, fees, water and other rates that may be necessary in the carrying out of the work.

b. The contractor shall be responsible that his employees observe the laws of the United States affecting all operations at the site under the contract. He shall comply with all applicable Federal and State laws under which he is operating, including those concerning the inspection of boilers and other equipment and the licensing of engineers, welders and other employees.

c. The contractor shall conduct the work with due regard to adequate safety and sanitary requirements and shall maintain his plant and equipment in safe condition. He shall conform to current safety engineering practices as set forth in the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America; the publications of the National Safety Council; and with all applicable State or local safety and sanitary laws, regulations and ordinances.

d. The contracting officer will require such safety and sanitary measures to be taken as the nature of the work and the conditions under which it is to be performed, demand. Such measures shall include:

(1) The provision of adequate extinguishers or fire-fighting apparatus in and about all buildings and plant erected or used at the site of the work.

(2) Adequate first aid and life-saving equipment.

(3) Adequate illumination during night operations.

(4) Instruction in accident prevention to reach all employees.

(5) Such machinery guards, safe walkways, scaffolds, ladders, bridges, gang-planks, and other safety devices, equipment, and apparel as are necessary to prevent accidents or injuries.

(6) The provision of watchmen and flagmen at railroad crossings and street intersections where traffic may be affected by the contractor's trucking operations.

e. The contractor shall report promptly to the contracting officer in form prescribed by him all accidents occurring at the site of the work.

f. The contracting officer will notify the contractor in writing of any non-compliance with the foregoing provisions and the corrective action to be taken. If the contractor fails or refuses to comply promptly, the contracting officer may issue a stop order suspending all or any part of the work. Such stop order will be sent by registered mail to the contractor at the site of the work and shall be accepted by him as sufficient notice thereof. Work shall thereupon be suspended as directed. When satisfactory corrective action is taken, a resumption order will be issued. No part of the time lost due to any such stop order shall be made the subject of a claim for extension of time or for excess costs or damages by the contractor.

1-29. Access to work. - The contracting officer, his authorized representative and other duly authorized agents and employees of the Government may at all times enter upon the work and premises used by the contractor, or into his works, or shops. The contractor shall provide safe and proper facilities for such entrance and for the inspection of materials and workmanship.

1-30. Interference with other contractors. - The contractor shall be subject to Article 13 of the contract regarding interference with materials, appliances or employees of the Government or of any other contractor who may have work at the site. As far as practicable, all contractors shall have equal rights to the use of all roads and grounds. In case of disagreement regarding such use, the decision of the contracting officer shall govern, subject to appeal under Article 15 of the contract.

1-31. Purchase of supplies and materials. - a. Preference for domestic articles. - (1) Because the materials listed below or the materials from which they are manufactured are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, their use in the work herein specified (subject to the requirements of the specifications) is authorized without regard to the country of origin.

Platinum	Nickel	Asbestos
Chromium	Rubber	China wood oil (tung oil)
Cork	Teakwood	Balsa wood
Jute	Sisal	English ball clay
Kauri gum	Silk	English china clay
Lac	Tin	Natural copper-nickel alloy

(2) Articles, materials, or supplies, manufactured in the United States and containing mercury, antimony, tungsten, or mica of foreign origin may be used (subject to the requirements of the specifications) in the work herein specified, because such manufactured articles, materials, or supplies have been manufactured in the United States, substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States.

b. Purchasing procedure. - Two copies of all purchase orders showing firm names and addresses, and of all shipping bills or memoranda of shipments received showing car initials and numbers, when shipped by railroad, shall be furnished promptly to the contracting officer. Such orders, shipping bills or memoranda shall clearly indicate weights, and shall be so worded or marked that each item, piece or member can be definitely identified on the drawings.

1-32. Minor modifications. - The right is reserved to make such minor changes in the execution of the work to be done under these specifications as, in the judgment of the contracting officer, may be necessary or expedient to carry out the intent of the contract; provided that the unit cost to the contractor of doing the work shall not be increased thereby, and no increase in unit price over the contract rate will be paid to the contractor on account of such changes.

1-33. Claims, protests, and appeals. - a. If the contractor considers any work demanded of him to be outside the requirements of the contract or if he considers any action or ruling of the contracting officer or of the inspectors to be unfair, the contractor shall, without undue delay, upon such demand, action, or ruling, submit his protest thereto in writing to the contracting officer, stating clearly and in detail the basis of his objections. The contracting officer shall thereupon promptly investigate the complaint and furnish the contractor his decision, in writing, thereon. If the contractor is not satisfied with the decision of the contracting officer, he may, within thirty days, appeal in writing to the Chief of Engineers, whose decision shall be final and binding upon the parties to the contract. Except for such protests or objections as are made of record in the manner herein specified and within the time limit stated, the records, rulings, instructions or decisions of the contracting officer shall be final and conclusive.

b. The Chief of Engineers has been designated by the Secretary of War as his duly authorized representative to make final decision and to take other action where the terms of the contract require that such decision or action shall be "by the head of the department concerned or his duly authorized representative." All appeals from decisions of the contracting officer authorized under the contract shall, therefore, be addressed to the Chief of Engineers, United States Army, Washington, D. C. The appeal shall

contain all the facts or circumstances upon which the contractor bases his claim for relief and should be presented to the contracting officer for transmittal within the time provided therefor in the contract.

1-34. Electric power to be furnished by the contractor. - The contractor shall make arrangements for, shall pay for, and furnish all necessary power to carry on the work, including sufficient power for lighting and other miscellaneous uses in buildings furnished by the contractor for Government use during the life of the contract. No separate payment will be made to the contractor for the power furnished.

1-35. Rate of wages. - a. In accordance with Article 17 of the contract, the minimum wages shown in the following schedule, as approved by the United States Department of Labor, shall be the minimum rates of wages to be paid by the contractor for work under this contract. Corresponding rates for occupations not listed below will be furnished upon application by the contractor.

Designation	Wage Rate - Hourly
Blacksmiths	$1.00
Bricklayers	1.375
Carpenters, journeymen	1.25
Cement finishers	1.375
Electricians	1.25
Electricians' apprentices	.75
Firemen, 15 lbs. or over	.80
Firemen, under 15 lbs.	.65
Jackhammermen	.75
Laborers, unskilled	.50
Laborers, building	.75
Mason tenders	.875
Mechanics, repairmen	1.00
Oilers	.65
Painters	1.125
Painters, structural steel	1.50
Plumbers	1.375
Plumbers' helpers	.65
Reinforcing rod setters	1.65
Riggers (derrick)	1.65
Sheet metal workers	1.25
Steam fitters	1.375
Steam fitters' helpers	.65
Structural iron workers	1.65
Operators of power equipment:	
Air compressors	1.30
Concrete mixers, less than 5 bags	.75
Concrete mixers, 5 bags or over	.85
Cranes, derricks, draglines	1.50
Hoists, 1 drum	1.30
Hoists, 2 or more drums	1.65

Designation	Wage Rate - Hourly
Operators of power equipment (Con't.)	
Piledrivers	1.50
Pumps (mechanical)	.65
Rollers	.90
Shovels, 1/2 yd. or less	1.30
Shovels, over 1/2 yd.	1.50
Tractors, under 50 h.p.	.75
Tractors, 50 h.p. or over, with attachments	1.30
Truck drivers, 2 tons or under	.60
Truck drivers, over 2 tons	.68

b. Any class of laborers and mechanics not listed above, which will be employed on the work, will be classified or reclassified by the contracting officer to conform to the foregoing schedule. In the event of disagreement between the contracting officer and the contractor as to such classification or reclassification, the question accompanied by the recommendation of the contracting officer, will be referred to the United States Department of Labor for final determination.

c. The above list of wages shall be posted by the contractor in a conspicuous place on the work.

1-36. Reports to Department of Labor. - The contractor shall report, and shall cause all subcontractors to report in like manner, within 5 days after the close of each calendar month, on forms to be furnished by the Department of Labor, the number of persons on their respective payrolls, the aggregate amount of such payrolls, the man-hours worked, and the total expenditures for materials. He shall furnish to the Department of Labor the names and addresses of all subcontractors on the work at the earliest date practicable; provided that the foregoing shall be applicable only to work at the site of the construction project.

1-37. Standard tests, qualities and guarantees. - a. All materials, supplies and parts and assemblies thereof, entering into the work to be done under these specifications, shall be tested as specified, or otherwise required, in conformity with the best modern approved methods for the particular type and class of work.

b. Unless waived in writing by the contracting officer, all tests and trials shall be made in the presence of a duly authorized representative of the contracting officer. When the presence of the inspector is so waived, sworn statements, in duplicate, of the tests made and the results thereof, shall be furnished to the contracting officer by the contractor.

c. Costs of all tests and trials, excepting (1) the expense of the Government inspector, (2) cement, concrete aggregate and cylinder tests, and (3) tests on embankment materials, shall be borne by the contractor and shall be included in the contract price. (See Paragraph 6-11).

d. All materials, parts and equipment shall be of the highest grade, free from defects and imperfections, of recent manufacture, new and unused. Workmanship shall be of the highest grade and in accordance with the best modern standard practice.

1-38. Protection of existing structures. - During construction operations, on work covered by these specifications, the contractor shall protect all existing structures and accepted work. Any disturbances or damage to any structures by operations under these specifications shall be repaired promptly by the contractor without cost to the Government.

1-39. Final acceptance and payment. - As soon aspracticable after the completion of the entire work, the contracting officer will make a thorough examination of same and if it is found to comply fully with the requirements of the specifications, it will be accepted, and final payment will be made in accordance with Article 16 of the contract.

PART I

CHERRY STREET PUMPING STATION

DETAILED SPECIFICATIONS

SECTION II. CONTROL OF WATER AND SEWAGE (Item 1)

2-01. Work included. - a. All permanent construction shall be carried on in areas free from water unless otherwise authorized by the contracting officer. Necessary shoring, sheeting and pumping, and clearances for the permanent work shall be provided for (see Paragraphs 3-01 d(4) and 3-03 d).

b. If the water surface rises above Elevation 12.3 at the pumping station site and causes damage to the permanent work, during the period of the contract, such damage shall be repaired by the contractor and will be paid for by the Government at the applicable contract unit prices.

c. The contractor shall maintain existing operating sewers and wasteways during construction so that their discharges are unimpeded, and shall divert the water and sewage away from the permanent construction by flumes or otherwise as directed by the contracting officer.

2-02. Cofferdam protection. - Any suitable type of cofferdam may be used, subject to the approval of the contracting officer. The contractor shall be responsible for the adequacy of the cofferdam protection, and for any damage resulting from failure or washing out of cofferdams. Subject to the approval of the contracting officer, materials excavated from the work shown on the drawings may be used for constructing cofferdams.

2-03. Maintaining existing sewers. - Provisions shall be made to maintain the satisfactory operation of existing sewers throughout the construction period, unless otherwise authorized by the contracting officer. The contractor shall install temporary sewer extensions and connections, including valves and specials, necessary to divert the sewage away from the work. The installation of temporary sewer extensions and connections shall include all shoring, excavation, backfilling, and other incidental work required in connection therewith.

2-04. Pumping and draining. - Before beginning work within the cofferdams, the sewage shall be diverted and the construction areas shall be unwatered and shall be kept free from water and sewage throughout the working period, unless otherwise authorized by the contracting officer.

2-05. Removal of cofferdams and temporary sewer connections. - When the work is finished within the cofferdams or when the need for the cofferdams and temporary sewer connections no longer exists, the temporary protection works and sewer connections shall be removed to spoil areas or otherwise disposed of as approved by the contracting officer.

2-06. Payment. - The contract price for Item 1 shall include payment for control of water and sewage during construction, the construction, maintenance, rebuilding in case of destruction, unwatering and removal of cofferdams, construction and removal of temporary sewer connections, and maintenance of unobstructed flow through the existing sewers encountered in the work. Payment will be made in one sum at the contract price for Item 1, "Control of Water and Sewage", when, in the opinion of the contracting officer, the permanent construction no longer requires the protective measures specified under Item 1, and when such protective measures have been removed to the satisfaction of the contracting officer.

SECTION III. EXCAVATION (Item 2)

3-01. General provisions. - a. Scope of work. - The location and character of the proposed structures and the location and logs of borings are shown on the drawings (see Paragraph 1-04). It is the intent of the Government that excavation be made to the lines and grades given thereon but the right is reserved to modify any part of the work if, in the opinion of the contracting officer, conditions require such modification (see Articles 3 and 4 of the contract).

b. Disposal of material. - Material from the excavations needed for backfill shall be stockpiled and used in the permanent construction as directed by the contracting officer. Materials from the excavation not needed for use in the permanent construction shall be wasted in spoil areas in approved locations as directed by the contracting officer.

c. Measurement. - (1) Excavation will be measured in place and the volume thereof will be computed between the original ground surface as determined by a survey made just prior to the commencement of the work and the pay lines shown on the drawings.

(2) Where pay lines are not shown on the drawings, measurement will be made of the volume between the original surface as determined from the survey made just prior to the commencement of the work and the lines and grades established by the contracting officer.

d. Payment. - (1) Items included. - The contract prices for the various classes of excavation shall include the cost of all labor, plant, and incidental costs for excavating, loading, hauling and disposal of the material in the backfills or spoil areas, including any stockpiling and rehandling, and the grading and dressing of spoil areas.

(2) Construction roads. - The construction and maintenance of roads and bridges for the contractor's use will not be paid for as such but the cost thereof shall be included in the contract prices for the other items of work.

(3) Pay lines. - Payment for all structure excavations will be made to the pay or slope lines shown on the drawings regardless of whether or not it is necessary to remove the material to slopes greater or less than those shown. No payment will be made for excavation outside of the limits described above and the contractor will be required to backfill any such excess excavation with approved material, or with additional concrete where excess excavations are adjacent to concrete structures, at his own expense.

(4) Shoring. - Where approved by the contracting officer, shoring may be used in lieu of excavation to the slope or pay lines shown on the drawings. The contractor shall be responsible for the unfinished work, and that workmen shall be safe from danger of caving or slides while

making structure excavations. Shoring shall be erected in a safe and workmanlike manner, and shall be placed in such a way as to afford ready inspection of and ample clearance for the permanent work. Shoring shall be removed upon completion of the permanent work or as soon as the construction does not require its use. No payment will be made for temporary shoring, but the cost thereof shall be included in the contract price for the excavation. Measurement for payment for excavation will be made to the pay lines specified in Paragraph 3-01 d(3).

(5) Temporary drains. - The contractor shall maintain the site of the work and adjacent grounds in a well drained condition. Temporary drains and ditches required shall be constructed by the contractor at his own expense.

3-02. Classification. - All materials excavated will be classified as follows:

Common excavation - general shall include the removal of all materials to the lines and grades shown on the drawings or established by the contracting officer.

3-03. Common excavation - general (Item 2). - a. Work included. - The contractor shall excavate and dispose of the materials classified as common excavation - general, above and below the mean water level in the river to the lines and grades shown on the drawings for the respective areas, or as otherwise directed by the contracting officer. Excavation shall be performed in accordance with a schedule of operations to be approved by the contracting officer. Common excavation - general includes excavation for the foundation of the pumping station and any other required common excavation for structures, drains and ditches not included in other items of the work.

b. Description. - Excavations shall be made wide enough to permit sheeting, bracing and form work where necessary. Foundations for the concrete structures shall be excavated as directed by the contracting officer to suitable undisturbed foundation material approved by the contracting officer.

c. Shoring. - See Paragraph 3-01 d(4).

d. Sheeting and pumping. - The contractor shall provide all necessary pumps to unwater the site properly and to keep the site free from water during such time as the work is under construction. The contractor shall provide all labor and materials required to keep the site unwatered during the course of construction, and shall provide all necessary sheeting, bulkheads, sumps, drains, etc., to prevent running water from coming in contact with newly placed concrete or concrete being placed. (See Section II.)

e. Disposal of materials. - The provisions of Paragraph 3-01 b shall apply. Excavated materials not used in permanent construction may be used in temporary construction if approved by the contracting officer. Materials for backfill (see Paragraphs 4-02 and 4-03) shall be stockpiled in the vicinity of the work for later use.

f. Measurement and payment. - Measurement for excavation work under Item 2 will be made as specified in Paragraph 3-01 c. Payment for all work in connection with excavation under Item 2, including the loading, hauling and disposal of the materials, will be made at the contract unit price for Item 2, "Common Excavation - general".

SECTION IV. MISCELLANEOUS BACKFILL (Items 3 and 4)

4-01. General. - "Compacted Backfill", Item 3, is structure backfill required as shown on the drawings. "Semi-Compacted Backfill", Item 4, is backfill required around miscellaneous structures as shown on the drawings.

4-02. Compacted backfill (Item 3). - a. Work included. - The contractor shall place, grade, and consolidate materials required as directed.

b. Materials. - Materials shall be obtained from stockpiles of excavated materials (see Paragraph 3-01 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish, or other unsuitable materials.

c. Placing. - The backfills shall consist of materials suitable for the purpose as determined by the contracting officer, and shall be placed in successive layers of not more than 4 inches by tamping with hand or power tampers. The compaction for such portions of the backfill shall be equivalent to that obtained by compacting with tractor equipment. (See Paragraph 4-03 c(2).)

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after compaction. Payment for all work in connection with furnishing and placing compacted backfill will be made at the contract unit price for Item 3, "Compacted Backfill".

4-03. Semi-compacted backfill (Item 4). - a. Work included. - The contractor shall place, grade, and consolidate materials required for backfill at the pumping station, and elsewhere as directed.

b. Materials. - Materials shall be obtained from stockpiles of excavated materials (see Paragraph 3-01 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish, or other unsuitable materials or substances.

c. Placing. - (1) The backfills shall consist of materials suitable for the purpose as determined by the contracting officer, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross section. Each layer shall be consolidated with water or otherwise compacted to the extent directed so that no settlement or voids will later result.

(2) Where backfill is to be placed against only one side of a concrete wall or other structure, no backfill material shall be placed until the concrete has been in place at least 10 days and then only by hand or by trucks or bulldozers operating not closer to the wall than the height of the wall above the foundation. No backfill shall be compacted, nor

placed by dragline, clamshell, or other equipment which drops the material in relatively large quantities, nor spread by equipment operating closer to the wall than the height of the wall, until the concrete has been in place at least 14 days.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of semi-compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after compaction. Payment for all work in connection with furnishing and placing semi-compacted backfill will be made at the contract unit price for Item 4, "Semi-Compacted Backfill".

SECTION V. DRAINS (Items 5 and 6)

5-01. General. - "4-Inch V.C. Pipe", Item 5, will be required for connecting to existing vitrified clay pipe where shown on the drawings or as directed by the contracting officer. "24-Inch Cast Iron Pipe", Item 6, will be required for connecting to existing cast iron pipe where shown on the drawings or as directed by the contracting officer.

5-02. 4-Inch V.C. pipe (Item 5). - a. Work included. - The contractor shall furnish and lay vitrified clay pipe, including specials, of the required diameters for the drainage system as shown on the drawings, or as directed.

b. Materials. - (1) All pipes shall be bell-and-spigot, vitrified clay pipe, conforming to the requirements of Federal Specification SS-P-361, or subsequent amendments or revisions thereof. Each pipe shall be carefully inspected immediately before laying and no cracked, broken or otherwise imperfect pipe shall be used, except for minor defects which, in the opinion of the contracting officer, do not impair the fitness of the pipe for the purpose intended.

(2) Subject to the approval of the contracting officer, non-reinforced concrete pipe conforming to the provisions of the A.S.T.M. C14-35 standard specifications for concrete sewer pipe may be substituted for tile pipe. The provisions of subparagraph (1) above, specifying inspection and selection of pipe, shall apply.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 3-03. Pipe trenches shall have a depth of not less than 2 feet with vertical sides and a minimum width of 2 feet unless otherwise directed. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, except as otherwise shown on the drawings, so that the pipe shall be firmly supported on the bottom and for at least the bottom third of the pipe. Where encountered, rock or boulders shall be removed to a depth sufficient to clear the underside of the pipe and the voids backfilled with well compacted suitable material.

d. Laying pipe. - Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded, and properly connected and jointed. Bell holes shall be excavated to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall meet the requirements of Paragraphs 6-05 and 6-06. The spigots shall be centered in the bells, and there

shall be no shoulders or unevenness ~~of any kind~~ along the invert of the pipes. Special care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement grout to center the pipe. The mortar shall be thoroughly troweled into the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. Mortar joints shall be protected from the sun by a covering of burlap or moist earth over the top third of the pipe. The interior of the pipe shall be carefully cleaned after laying to remove dirt, mortar and other obstructions.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraphs 4-02 and 4-03, as shown on the drawings or directed by the contracting officer.

f. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe installed. Payment for pipe will be made at the contract unit price for Item 5, "4-Inch V.C. Pipe", and shall include all costs of furnishing and installing the pipe including specials, and other required materials, except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 2 (see Paragraph 3-03 f). Payment for earth backfill will be made at the applicable contract unit prices for Items 3 and 4. (See Paragraph 1-05.)

5-03. 24-Inch cast iron pipe (Item 6). - a. Work included. - The contractor shall furnish and place the cast iron pipe, including bends, reducers and other specials required as shown on the drawings.

b. Materials. - All cast iron pipe shall meet the requirements of current American Water Works Association specifications for standard weight pipe, Class A, where applicable, shall be asphalt-coated inside and outside, and shall have bell-and-spigot joints as shown on the drawings or as directed by the contracting officer.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 3-03. Pipe trenches shall have the dimensions shown on the drawings. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least 3 inches up each side. Where encountered, rock or boulders shall be removed to a depth sufficient to clear the under side of the pipe and the voids backfilled with well compacted suitable material.

d. Laying pipe. - (1) All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury. The pipe shall be carefully bedded, and properly connected and jointed. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field.

(2) Bell-and-spigot joints shall be carefully fitted together and shall be made fast by first adjusting the spigot end with wedges to obtain a uniform joint space, and then thoroughly packed with oakum or jute and caulked with lead. Before backfilling, the pipe shall be tested for leakage by a suitable water pressure test as directed by the contracting officer.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe to the limits shown on the drawings or as directed by the contracting officer. Hand tamping shall be done as directed.

f. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe installed. Payment for pipe will be made at the contract unit price for Item 6, "24-Inch Cast Iron Pipe," and shall include all costs of furnishing and installing the pipe complete with bends, reducers and other specials, except the cost of excavation, backfilling, and any concrete required.

(2) Payment for excavation will be made at the contract unit price for Item 2 (see Paragraph 3-03 f). Payment for earth backfill will be made at the applicable contract unit prices for Items 3 and 4 (see Paragraph 1-05).

SECTION VI. CONCRETE (Items 7 to 10, incl.)

COMPOSITION, CLASSIFICATION, AND STRENGTH

6-01. Composition. - Concrete shall be composed of cement, fine aggregate, coarse aggregate, and water, so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements under this section, and suitable to the specific conditions of placement.

6-02. Classification. - Except where required to meet special conditions all concrete shall be either Class "A" or Class "B", as designated in Section VII and on the drawings for the various parts of the work in accordance with the conditions of application and the proportions of materials and strengths required.

6-03. Strength. - The mixes will be designed to secure concrete having at least the following compressive strengths at the age of 28 days, as determined by breaking standard 6-inch diameter by 12-inch height or 8-inch diameter by 16-inch height test specimens:

Class	Average for any 25 consecutive cylinders	Minimum for any one cylinder
A	3400 lbs. per sq. in.	2600 lbs. per sq. in.
B	3000 lbs. per sq. in.	2200 lbs. per sq. in.

6-04. High-early-strength concrete. - High-early-strength concrete made with high-early-strength Portland cement or other special cements shall be used only when specifically authorized by the contracting officer. The 7-day compressive strength of concrete of any class, when made with high-early-strength cement, shall be at least equal to the specified minimum 28-day compressive strength for that class. All provisions of these specifications, except for cement, shall be applicable to such concrete. Any high-early-strength cement used shall be approved by the contracting officer before use.

MATERIALS

6-05. Portland cement (Item 7). - a. The contractor shall furnish Portland cement of the quality herein specified in sufficient quantity for the work required. Cement for all concrete, grout, and mortar, except as specified in subparagraph b, shall conform to Federal Specification SS-C-206, for "Cement, Portland, Moderate-Heat-of-Hardening, September 30, 1936," except that Paragraph E-7, Heat of Hydration, shall be considered inoperative.

b. High-early-strength Portland cement. - Cement for high-early-strength concrete shall be in accordance with Federal Specification SS-C-201 for "Cement, Portland, High-Early-Strength."

c. Special test requirements. - Cement will be tested by the Government at the Central Concrete Laboratory, West Point, New York. No cement shall be used until notice has been given by the contracting officer that the test results are satisfactory. Cement which has been stored, other than in bins at the mills, for more than 4 months after being tested shall be retested before use. Ordinarily, no cement shall be used until after it has satisfactorily passed both the 7 and 28-day tests, but in cases of emergency the contracting officer may waive the 28-day tests and permit the use of cement which has satisfactorily passed the soundness and 7-day tests; provided it is the product of a quarry and mill having established a reputation of not less than 3 years' standing for the production of high-grade cement. If the tests prove any cement unsatisfactory, which has been delivered at the site of the work, such cement shall be removed promptly from the work and its vicinity.

d. Identification. - Cement shipped in bags shall be identified by the manufacturer by marking or tagging the bags with the identifying number or symbol of the Federal Specification under which it was manufactured. Bulk shipments of cement shall be likewise identified by a suitable device affixed to each car or other type of bulk carrier. Marking or tagging shall be done at the mill.

e. Quality and packages. - All cement shall be dry, finely ground and free from lumps or caking. Unless otherwise permitted, the cement shall be delivered in canvas bags or other strong, well-made packages, each plainly marked with the manufacturer's brand. The weights of such bags shall be uniform. Packages received in broken or damaged condition will be rejected or accepted only as fractional packages. Cement shall be stored in a satisfactory manner so as to be unaffected by moisture, keeping each carload separate until the results of the 28-day tests are known. Suitable accurate scales shall be provided by the contractor for weighing bulk cement.

f. Records of cement used. - The contractor shall furnish to the contracting officer, at the end of each day's work, a statement showing in such detail as he may reasonably require, the quantity of cement used during the day at each part of the work.

6-06. Fine aggregate. - a. Composition. - Fine aggregate shall be natural sand.

b. Quality. - Fine aggregate shall consist of hard, strong, durable, and uncoated particles.

c. Grading. - (1) Except as provided in (2) below, fine aggregate shall conform to the following requirements.

Total passing	Percent by weight
No. 4 sieve	95 - 100
No. 16 sieve	45 - 75
No. 50 sieve	10 - 25
No. 100 sieve	1.5 - 7

(2) Deficiencies in the percentage of fine aggregate passing #50 and #100 sieves, as required in the above gradation, may be remedied by the addition of pozzuolanic or cementitious materials, excepting Portland cement; provided, at least 5 percent passes the #50 sieve and the aggregate is of proper consistent gradation within the specified limits. Such added material, which will be considered and included as fine aggregate, shall conform to the requirements in Paragraph 6-08 and shall be in sufficient quantity to meet the minimum requirements above for percentage passing #100 sieve and otherwise to produce the workability required by the contracting officer. The quantity and characteristics of any material used for the purpose of correcting workability shall be such that when the concrete is gaged to the proper consistency, the total water content shall not exceed by more than one gallon per cubic yard the minimum quantity required for proper consistency when not using the admixture. The blending of any material with the original naturally graded sand to remedy deficiency in gradation shall be accomplished in charging the mixer, unless otherwise specifically authorized by the contracting officer.

d. Deleterious substances. - The substances designated shall not be present in excess of the following amounts:

	Percent by weight
Clay lumps	1
Material removed by decantation from aggregates	3
Shale	0.5

e. Mortar strength. - Mortar specimens made with the fine aggregates shall have a compressive strength at 28 days of at least 90 percent of the strength of similar specimens made with Ottawa sand having a fineness modulus of 2.40 ± 0.10.

f. Tests. - Fine aggregate shall be subject to careful, thorough analyses, including magnesium sulphate soundness tests (see Paragraph 6-07 d), to determine conformity with all requirements of these specifications.

6-07. Coarse aggregate. - a. Composition. - Coarse aggregate shall be washed gravel, crushed stone or any approved mixture of washed gravel and crushed stone.

b. Quality. - Coarse aggregate shall consist of hard, tough and durable particles free from adherent coating. It shall contain no vegetable matter, nor soft, friable, thin or elongated particles in quantities considered deleterious by the contracting officer. The substances designated shall not be present in excess of the following amounts (by weight):

Soft fragments	5%
Clay lumps	1/4%
Removed by decantation	1%

When the material removed by decantation consists essentially of crusher dirt, the maximum amount permitted may be raised to 1-1/2 percent. When crushed stone is used, the crusher shall be equipped with a screening system which will entirely separate the dust from the stone and convey it to a separate bin. Aggregate which has disintegrated or weathered badly under exposure conditions, similar to those which will be encountered by the work under consideration, shall not be used.

c. Size. - (1) Coarse aggregate shall be well graded from fine to coarse so that concrete of the required workability, density, and strength can be made without the use of an excess amount of sand, water, or cement.

For Class "A" concrete, required for Item 8, the maximum size mesh screen for the aggregate shall be one inch.

For Class "B" concrete, required for Item 9, the maximum size mesh screen for the aggregate shall be two inches.

(2) When the maximum size mesh screen is greater than one inch, the aggregate shall be separated, and the specified sizes delivered separately to individual proportioning hoppers, in accordance with the following:

For Maximum Size Mesh Screen, 1 in. to 2 in. inclusive:

(1) No. 4 to 1/2 maximum size mesh screen, inclusive
(2) Over 1/2 maximum size to and including full maximum size mesh screen.

Within any of the above-indicated size-limits, not less than 85 percent of the material shall be retained on a standard square mesh screen of the minimum size indicated and not more than 5 percent shall be retained on a standard square mesh screen of the maximum size indicated.

(3) The grading of the coarse aggregate, in the mixed concrete, shall fall within the following limits:

	(Percent by weight) Passing
Maximum size mesh screen (square mesh)	97 - 100
1/2 maximum size mesh screen (square mesh)	40 - 70
No. 4 sieve	0 - 6

d. Tests. - Coarse aggregate will be subjected to freezing and thawing tests and to careful, thorough analyses to determine conformity

with all requirements of these specifications. Coarse aggregate will be subjected to 10 cycles of the magnesium sulphate test for soundness. No aggregate shall be used which develops a loss in excess of 10 percent by weight.

6-08. Material added for workability. - a. The use of any material added to the mix to improve workability (see Paragraph 6-06 c (2)), which, in the opinion of the contracting officer, may have an injurious effect on the strength, density, and durability of the concrete, will not be permitted. Before approval of any material, the contractor will be required to submit the results of complete chemical and sieve analyses made by an acceptable testing laboratory. Subsequent tests will be made of samples taken by the contracting officer from the supply of the material being used on the work to determine whether it is uniform in quality with that approved.

b. The material added shall be pozzuolanic, cementitious or silicious. It shall not contain effective early-heat-producing elements or compounds, such as those contained in Portland cement, nor shall its use result in a material increase in the free-lime content of the concrete. It shall also be in conformity with the following requirements:

Free moisture - a total of not more than 3 percent by weight.
Passing #30 sieve - not less than 100 percent by weight.
Passing #200 sieve - not less than 85 percent by weight.

6-09. Water. - The water used in mixing concrete shall be fresh, clean and free from injurious amounts of oil, acid, alkali, or organic matter.

6-10. Storage. - a. Cement. - Immediately upon receipt, at the site of the work, cement shall be stored in a thoroughly dry, weather-tight, and properly ventilated building with adequate provisions for the prevention of the absorption of moisture. The building shall be of adequate capacity to provide for the requirements of delivery and construction schedules. Storage shall be such as to permit easy access for inspection and definite identification of each shipment.

b. Aggregates. - The fine and coarse aggregates shall be stored separately (see Paragraph 6-07 c (2)) and in such manner as to avoid the inclusion of any foreign material in the concrete. Stockpiles of coarse aggregates shall be built in horizontal layers to avoid segregation.

6-11. Sampling and testing aggregates. - Except where provided otherwise by these specifications, all sampling and testing of aggregates shall be made in accordance with the Federal Specifications. Unless specified otherwise, all test samples shall be taken under the supervision of the contracting officer and supplied to the Central Concrete Laboratory, West Point, New York, by the contractor at his expense. The source from which concrete aggregates are to be obtained shall be

selected by the contractor well in advance of the time when they will be required in the work, and suitable samples as they are to be used in the concrete shall be furnished to the contracting officer at least 40 days in advance of the time when the placing of the concrete is expected to begin. The contractor shall obtain fine and coarse aggregates for concrete from approved sources.

PROPORTIONING, MIXING, AND PLACING

6-12. Proportioning. - a. Basis. - All concrete materials will be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

b. Control. - The exact proportions of all materials entering into the concrete shall be as directed by the contracting officer. The contractor shall provide all equipment necessary to positively determine and control the actual amounts of all materials entering into the concrete. The proportions will be changed whenever in the opinion of the contracting officer, such change becomes necessary to obtain the specified strength and the desired density, uniformity and workability, and the contractor will not be compensated because of such changes.

c. Measurement. - All materials shall be measured by weight except that water may be measured by volume when so authorized by the contracting officer. One bag of cement will be considered as 94 pounds in weight and 1 gallon of water as 8.33 pounds.

d. Cement content. - Each cubic yard of concrete shall contain not less than the quantity of cement stated below:

Class "A" - 5.0 bags or 470 pounds
Class "B" - 4.0 bags or 376 pounds

For concrete deposited in water, the minimum cement content shall be 6.5 bags or 611 pounds to each cubic yard of concrete in place.

e. Water content. - (1) In calculating the total water content in any mix the amount of moisture carried on the surface of the aggregate particles shall be included. The total water content for a bag of cement for each batch of concrete shall not exceed the following:

Class "A" - 5.5 gallons or 45.8 pounds
Class "B" - 6.5 gallons or 54.1 pounds

In all cases, however, the amount of water to be used shall be the minimum amount necessary to produce a plastic mixture of the strength specified and of the desired density, uniformity and workability. In general, the consistency of any mix shall be that required for the specific placing conditions and methods of placement, and ordinarily the slump shall be between 1 inch and 3 inches when tested in accordance with the current specifications for "Method of Test for Consistency of Portland Cement Concrete," of the American Society for Testing Materials.

(2) An increase in the maximum water content, based only on the requirements of materials added in accordance with Paragraph 6-06 c (2) to improve workability will not be permitted unless comparative tests under job conditions show conclusively that such increase in water content will not result in a decrease in concrete strength and provided further that such increase does not exceed 1 gallon per cubic yard.

f. Aggregate content. - The total volume of aggregate to be used in each cubic yard of concrete shall be that necessary to produce a dense mixture of the required workability as determined by the contracting officer.

6-13. Mixing and placing. - a. Equipment. - The contractor shall provide at the site of the work, a modern and dependable batch type mixing plant with a minimum capacity of 100 cubic yards of concrete per 8 hours or, if approved by the contracting officer, the contractor may use ready mixed concrete delivered in standard truck mixing equipment of approved capacity. The equipment shall provide adequate facilities for the accurate measurement and control of all materials and for readily changing the proportion of materials to conform to the varying conditions of the work in order to produce concrete of the required uniform strength and durability.

b. Time. - The minimum time for mixing each batch, after all materials are in the mixer, shall be as follows:

1/2 to 1-1/2 cu. yd. mixer	1-1/2 minutes
Larger than 1-1/2 cu. yd. mixer	2 minutes

The mixer shall revolve a minimum of 12 revolutions after all materials have been placed in it, and at a uniform speed. Neither speed nor volume capacity of the mixer shall exceed those recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted.

c. Conveying. - Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. Conveying of concrete by means of chutes will not be permitted except for short chutes in the forms to distribute the concrete. Chutes used shall be such that the concrete slides in them and does not flow. Chutes with a flatter slope than 1 on 2 will not be permitted. There shall be no free vertical drop greater than 5 feet except where specifically authorized by the contracting officer.

d. Placing. - (1) Concrete shall be placed before initial set has occurred, and in no event after it has contained its water content for more than 45 minutes.

(2) Unless otherwise specified, all concrete shall be placed in the dry upon clean, damp surfaces, free from ice, frost or

running water, and never upon soft mud, dry porous earth, or upon fills that have not been subjected to approved rolling, puddling or tamping so that ultimate settlement has occurred.

(3) All monoliths shall be of the dimensions shown on the drawings.

(4) All concrete shall be deposited in approximately horizontal layers not to exceed 24 inches in thickness, unless otherwise specifically authorized or directed by the contracting officer and the concreting shall be carried on as a continuous operation, as far as practicable, until the placing in the course, section, panel or monolith is completed. Unless otherwise shown on the drawings, courses shall generally have a minimum thickness of 4 feet, and a maximum of 18 feet, except that in hot weather the contracting officer may direct the maximum be reduced to 8 feet. A minimum time interval of 48 hours shall be allowed between successive courses for the dissipation of heat of hydration. In walls of buildings, courses including door or window openings shall terminate at the tops of the openings.

(5) In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On flat surfaces, where the congestion of steel near the forms makes placing difficult, a mortar of the same cement-sand ratio as is used in the concrete shall be first deposited to cover the forms.

(6) All top surfaces not covered by forms and which are not to be covered by additional concrete or backfill shall be carried slightly above grade and struck off by board screed (see Paragraph 6-15), except that top surfaces of walls and piers not covered by forms and which are not to be covered by additional concrete or backfill, when poured in excess of 10 feet in height in one pour, shall be carried not less than 2 inches above the specified finished elevation and struck off by board screed.

e. Vibrating. - Concrete shall be placed with the aid of mechanical vibrating equipment as approved by the contracting officer. Vibration shall be transmitted directly to the concrete unless otherwise directed by the contracting officer. The frequency of vibration shall be not less than 5000 per minute. The intensity of vibration shall be sufficient to cause flow or settlement of the concrete in place. The vibration shall be of sufficient duration to accomplish thorough compaction as approved by the contracting officer. External vibration may be used for thin sections where internal vibration will be impracticable. Vibration shall be supplemented by forking or spading by hand, adjacent to the forms on exposed faces in order to secure smooth, dense, even surfaces. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures.

f. Construction joints. - Vertical joints shall be formed with tongue-and-groove bonds or keys at such locations and of such shapes

and dimensions as approved or directed by the contracting officer. Horizontal joints shall be formed with roughened level joints or with keys, or where horizontal pressure is always in one direction, with steps as approved or directed by the contracting officer. Where required, dowel rods shall be used. All concrete in vertical members shall have been in place not less than 12 hours, and longer if so directed by the contracting officer, before concrete in horizontal members resting thereon is placed. As soon as practicable after placing and immediately before placing the succeeding layers is resumed, all approximately horizontal surfaces shall be washed with a high pressure air-and-water jet, or cleaned as otherwise directed by the contracting officer. Sand shall be added to the air-and-water jet when required, to remove alkali, algae, stains, and other substances injurious to the bond. The time and method of using the jet shall be such that all laitance, scum, etc. will be removed so the partly embedded aggregate is not disturbed and is washed clean. After final cleaning and immediately before placing is resumed, the surfaces shall be wetted and spread with a layer of mortar 1/2 inch thick, thoroughly brushed in. The mortar shall be the same cement-sand ratio as the concrete. Where specified or otherwise required by the contracting officer for watertight construction, copper strips not less than 18 inches in width and weighing not less than 20 ounces per square foot, properly crimped or bent, shall be placed in the concrete to span the joint.

g. Cold weather. - Concrete shall not be placed when the ambient atmospheric temperature is below 35 degrees Fahrenheit, nor when the concrete is likely to be subject to freezing temperatures before final set has occurred, unless specifically authorized in writing by the contracting officer. When so authorized, the materials shall be heated in order that the temperature of the concrete, when deposited, shall be not less than 50 degrees Fahrenheit, nor more than 70 degrees Fahrenheit. All methods and equipment for heating shall be subject to the approval of the contracting officer.

h. Hot weather. - For concrete placed during the extremely warm summer months and otherwise, when directed by the contracting officer, the aggregates shall be cooled by frequent spraying in such manner as to utilize the cooling effect of evaporation. During such periods the placement schedule shall be arranged as approved by the contracting officer in such manner as to provide time for the temperature of the previously placed course to begin to recede. The mixing water shall be the coolest available at the site in so far as is practicable.

6-14. Test specimens. - a. Number. - Test specimens to determine whether the compressive strength of the concrete is in accordance with that specified in Paragraph 6-03 will be taken by the inspector. At least 1 set of 3 specimens will be made for every major pour. A sufficient number of specimens will be taken to give a comprehensive knowledge of the concrete placed during each day in each section of the work.

b. Method. - All specimens will be taken from the concrete at the mixing plant. The specimens will be tested by the Government at the Central Concrete Laboratory, West Point, New York. All costs of transportation and testing of specimens will be borne by the Government.

6-15. Finishing. - a. Immediately after placement, the concrete shall be properly forked back along the face of all forms by the use of standard concrete forks or spades unless otherwise specifically authorized or directed by the contracting officer. The finished surfaces shall be free from sand streaks or other voids and the plastering over of such surfaces will not be permitted. Defective concrete shall be repaired by cutting out the unsatisfactory material, and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely to the other work. This concrete shall be drier than the usual mixture and shall be thoroughly tamped into place. All surfaces of concrete not covered by forms, that are not to be covered by additional concrete, or backfill, shall have a wood float finish without addition of mortar, and shall be true to elevations as shown on the drawings. Care shall be taken to see that all excess water is removed before making this finish. Other surfaces shall be brought to the specified finished elevation and left true and regular as approved by the contracting officer. Where considered necessary by the contracting officer, or where indicated on the drawings, joints shall be carefully made with a jointing tool. Every precaution shall be taken by the contractor to protect finished surfaces from stains or abrasions. No fire shall be permitted in direct contact with any concrete at any time. Concrete surfaces or edges likely to be injured during the construction period, shall be properly protected by leaving the forms in place, or by erecting covers satisfactory to the contracting officer.

b. Floor surfaces. - Unless otherwise specified, floors of all buildings, and other surfaces where indicated on the drawings or required by the contracting officer, shall be finished with a one-inch monolithic sand-cement mortar surface. All water, laitance and any foreign matter shall be removed from surfaces. The topping mixture shall be spread evenly over all the base within 45 minutes after the base has been placed. The mortar shall be of 1 part cement and 2 parts approved clean sand. The cement and sand shall be thoroughly mixed dry and then sufficient water shall be added to produce a medium stiff mortar. After placing, the mortar shall be floated to a true, regular surface with a wood float and steel-troweled to a smooth finish. Troweling shall be the minimum amount consistent with obtaining a smooth dense surface and shall not be done until the mortar has hardened sufficiently to prevent excess fine material from being worked to the surface.

6-16. Curing. - a. Warm weather. - All concrete shall be adequately protected from injurious action by the sun. Fresh concrete shall be protected from heavy rains, flowing water, and mechanical injury. All concrete shall be kept wet for a period of not less than 14 days by covering with water, or with an approved wate-saturated covering, or by a system of perforated pipes or mechanical sprinklers, or any other

approved method which will keep all surfaces continuously (not periodically) wet. Where wood forms are left in place for curing, they shall be kept wet at all times to prevent opening at the joints and drying out of the concrete. Water for curing shall be generally clean and entirely free from any elements which in the opinion of the contracting officer might cause staining or discoloration of the concrete.

b. Cold weather. - Concrete when placed during cold weather shall be kept moist and provided with adequate protection for a period of not less than 14 days, subject to the approval of the contracting officer, so that the air in contact with the concrete will be maintained at temperatures between 50 degrees Fahrenheit and 70 degrees Fahrenheit, for at least the first 5 days of the curing period. For massive sections where the atmospheric temperatures are sufficiently low in the opinion of the contracting officer to cause excessively rapid cooling and contraction of the exterior surfaces, this period for maintaining the temperature of the air in contact with the concrete between 50 and 70 degrees Fahrenheit shall extend over the entire curing period. Salt or other chemicals shall not be admitted into the mixture to prevent freezing.

FORMS, REINFORCEMENT, AND PAYMENT

6-17. Forms. - a. Materials. - Forms shall be of wood, steel or other approved material, except that where lining is not specified, the sheeting for all exposed surfaces shall be tongue-and-groove lumber of uniform width unless otherwise specifically authorized. Forms of like character shall be used for similarly exposed surfaces in order to produce a uniform appearance. The type, size, shape, quality and strength of all materials of which the forms are made shall be subject to the approval of the contracting officer.

b. Construction. - Forms shall be built true to line and grade, and shall be mortar-tight and sufficiently rigid to prevent displacement or sagging between supports. Responsibility for their adequacy shall rest with the contractor. Their surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will be not less than 2 inches from any concrete surface. Wire ties will not be permitted where the concrete surface will be exposed to weathering and discoloration will be objectionable. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. Unless otherwise indicated, suitable moldings shall be placed to bevel or round exposed edges, at expansion joints or any other points as may be required by the contracting officer.

c. Coating. - Prior to the placing of steel reinforcement or concrete, forms for exposed surfaces shall be coated with a non-staining mineral oil. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.

d. Removal. - Forms shall not be removed without the approval of the contracting officer, and all removal shall be accomplished in such manner as will prevent injury to the concrete. Forms shall not be removed before the expiration of the minimum number of days indicated below, except when specifically authorized by the contracting officer. When, in the opinion of the contracting officer, conditions on the work are such as to justify it, forms may be required to remain in place for longer periods.

Arches, beams and slabs	7 days
Columns	3 days
Walls and vertical faces	2 days

e. Form lining for buildings. - In addition to the requirements for work specified above, the forms for walls of buildings which will be visible in the finished structures shall be lined with plywood or with pressed wood sheets, "Masonite" or approved equal. Lining shall be applied directly to the sheeting. Forms for windows and door jambs, and their flat or arched soffits, shall be lined also and the corner intersections chamfered. Jointing of the lining shall be neat and close and no patch places, cleats, or blocking will be permitted. Overrun of lining shall be trimmed to secure proper fit to adjoining surfaces. Lining with bruises, imprints or hammer marks shall not be used.

6-18. Furnishing, bending, and placing steel reinforcement (Item 10). - a. Work included. - (1) The contractor shall furnish, cut, bend and build into the concrete, in accordance with the drawings prepared by him and approved by the contracting officer (see subparagraph (2) below), all steel reinforcement of deformed bars, dowels or anchors, or any other plain steel for similar purposes. Materials shall be as specified in Paragraph 9-02 a (1).

(2) Steel reinforcement may be cut and bent at the mill or in the field. All bending shall be in accordance with standard approved practice and by approved machine methods. The contractor shall furnish drawings showing bending details and placing schedules of steel reinforcement for approval, in accordance with the provisions of Paragraph 1-04 c.

b. Placing. - (1) All steel reinforcement shall be placed in the exact positions and with the spacing shown on the drawings or ordered, and it shall be so fastened in position as to prevent its becoming displaced during the placing of the concrete. The clear distance between parallel rods shall be not less than one and one-half times the diameter of round rods, or twice the side dimensions of square rods, and unless specifically authorized, shall in no case be less than 1 inch.

(2) Except where otherwise indicated, steel reinforcement shall be placed as follows:

(a) All main reinforcement shall be placed not less than 3 inches from any surface, except in slabs and in buildings.

(b) All main reinforcement in walls and slabs exposed to the weather and in fire-resistant construction, shall be placed not less than 1-1/2 inches from the surface in walls and slabs, 2 inches in floor beams and 2 inches in girders and columns. The covering of stirrups, spacer rods, and similar secondary reinforcement may be reduced by the diameter of such rods. The above dimensions shall be measured from the face of the reinforcement to the face of the forms.

(c) Where splices in reinforcement, in addition to those indicated, are necessary, there shall be sufficient lap to transfer the stress by bond as may be directed. Rods shall be lapped not less than 40 diameters and splices shall be staggered. The lapped ends of rods shall be separated sufficiently or connected properly to develop the full strength of rod.

c. Protection. - Steel reinforcement shall be new unrusted stock, free from loose scale. It shall be at all times satisfactorily protected from moisture until placed in final position. Ends of rods that are to be left projecting for a considerable time shall be protected from corrosion by heavy wrappings of burlap saturated with bituminous material.

6-19. Embedded items. - In addition to steel reinforcement, there shall be built into, or set, or attached to the concrete, steel beams, pipes, and other metal objects as shown on the drawings or ordered. All necessary precautions shall be taken to prevent these objects from being displaced, broken or deformed. Before placing concrete, care shall be taken to determine that any embedded or wood parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter. The embedding of wood in concrete shall be avoided whenever possible, metal being used instead. The concrete shall be packed tightly around pipes and other metal work so as to prevent leakage and secure perfect adhesion. Drains shall be adequately protected from intrusion of concrete into them. Payment for this work is included in the several items for drains and metal work.

6-20. Expansion and contraction joints. - a. Expansion and contraction joints shall be constructed at such points and of such dimensions as may be indicated or required. The method and materials used shall be subject to the approval of the contracting officer and the materials shall conform to current Federal Specifications wherever applicable. Unless otherwise indicated on the drawings, or required by the contracting officer, expansion joints shall be made by coating concrete surfaces with a coat of bituminous cement as specified in subparagraph b below, and then applying premoulded sponge rubber or compressed cork filler 1/2-inch thick which shall then be similarly coated. The 1/2-inch rubber or cork filler shall be used for the 2 feet adjacent to

top surfaces and one foot adjacent to vertical surfaces. In no case shall corner protection angles or other fixed metal embedded in the surface of the concrete and bonded, be continuous through an expansion joint. Payment for all expansion joint material shall be included in the contract unit price for concrete.

b. Bituminous cement shall be an internal set-up cement of asphaltic base, composed of a liquid asphaltic fluxing agent with an admixture of powdered asphalt, asbestos fiber and other suitable inorganic fillers. When mixed in the proper proportions, the cement shall be suitable for proper trowel application and shall harden to a consistency as specified in subparagraph (3) below:

(1) The material shall be supplied in containers of proper relative size to apportion batches with the desired troweling consistency. The liquid asphaltic fluxing agent shall be a smooth uniform mixture, not thickened or jelled, and showing no separation which cannot be easily overcome by stirring. The powdered cement shall be a uniform mix containing no matted lumps of fiber.

(2) When mixed in the proportions recommended by the manufacturer, the cement shall yield not less than 85 percent of non-volatile matter when 10 grams are heated in an oven at 105 to 110 degrees Centigrade for 24 hours.

(3) When tested in accordance with A.S.T.M. Specification D5-25 for "Penetration of Bituminous Materials" the above mixture shall have the following characteristics: Immediately after mixing, using a 5/8-inch diameter steel ball, 114 grams, 5 seconds, the mixture shall permit a penetration greater than 300. The same specimen, after a lapse of 24 hours at 25 degrees Centigrade under water, shall permit a needle penetration 100 grams, 5 seconds, of not more than 100. The same specimen, after a lapse of 30 days at 25 degrees Centigrade under water, shall permit a needle penetration 100 grams, 5 seconds, of not more than 50.

6-21. Measurement and payment. - a. Portland cement (Item 7). - (1) The quantity to be paid for under Item 7 will be the number of barrels of cement used in all parts of the work unless specifically excepted. For purposes of payment, a barrel of cement shall be considered 376 pounds net of cement. The contract unit price for the cement shall include payment for all expenses incidental to delivering the cement upon the work in which it is to be used.

(2) Only the cement furnished for concrete work to be done under Items 8 and 9 (see Paragraph 1-05) will be paid for at the contract unit price for Item 7, "Cement". Cement used for mortar and grout in pipe joints, brick and stone work and under other items will be included in the payment for those items.

b. Concrete (Items 8 and 9). - See Section VII.

c. Steel reinforcement. - (Item 10). - (1) The quantity to be paid for under Item 10 will be the number of pounds of steel placed in accordance with the drawings or as directed by the contracting officer, measured as specified. It will not include any waste material due to the fact that the lengths supplied are too long for their purpose. The quantity to be paid for will, however, include extra metal in laps, where authorized, due to the fact that single bars would be unreasonably long. In computing the weights, the theoretical weight of plain bars will be used as tabulated in Federal Specification QQ-B-71a for the lengths placed as required. Wire or metal clips, and other supports necessary to hold the steel in place will not be considered as reinforcement but shall be furnished by the contractor without additional compensation. The contract unit price for Item 10, "Steel Reinforcement," shall include furnishing, bending, cutting, placing, fastening in position, coating and protecting the reinforcement, and all other work and materials connected therewith. (See Paragraph 6-18 a).

(2) Partial payments up to 50 percent of the contract price will be made for all steel reinforcement delivered to the site of the work provided the quality of such material is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the material delivered to the site of the work. The material shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any steel reinforcement stored and partly paid for is not kept protected, no further partial payments will be made and the material will be protected by the contracting officer at the expense of the contractor.

6-22. Cinder concrete. - a. Where concrete is indicated as filler in the roof of the pumping station, it shall be mixed in the approximate proportion of 1 bag of cement to 2 cubic feet of sand and 4 cubic feet of cinders, mixed as required by the contracting officer. Test blocks of concrete shall be made by and at the expense of the contractor before the concrete is placed, to determine the correct proportions of the ingredients to obtain a cinder concrete of proper qualities for nailing and permanently supporting the roof surfacing. The cement and sand shall conform to the requirements for regular concrete herein. The cinders shall be coarse, clean and free from dust. The top surface of the concrete shall be given a smooth and even finish, and shall have a uniform slope to the gutters.

b. If so elected by the contractor and approved by the contracting officer, a substitute for cinders may be used. Any such substitute must be a commercial product of proven quality, prepared especially as a roof filler. When mixed and used as recommended by the manufacturer, the resulting product must have strength and nailing properties equivalent to that of cinder concrete and its unit weight shall not be in excess of that of cinder concrete of equivalent quality.

c. Payment for cinder concrete including cement will be included in the payment for Item 11, "Pumping Station Superstructure" (see Paragraph 8-16).

SECTION VII. CONCRETE STRUCTURES (Items 8 and 9)

7-01. General. - a. Description. - Concrete structures shall be constructed as shown on the drawings or in accordance with modifications designated by the contracting officer. Concrete shall conform to all the requirements of Section VI for concrete of the class specified. Surfaces of concrete shall be finished as specified in Paragraph 6-15, except as otherwise specified in this section or indicated on the drawings.

b. Measurement and payment. - The quantity to be paid for under Items 8 and 9, will be the number of cubic yards of concrete satisfactorily placed within the required limits. No deductions shall be made for openings having a cross-sectional area less than that of a 12-inch pipe, nor for the space occupied by reinforcing steel, miscellaneous metal, wood nailing strips, or by other materials required to be built into the concrete. The contract unit prices shall include payment for all costs of furnishing materials, erecting and removing forms, mixing and placing concrete and furnishing and installing expansion joint material, except that cement, reinforcing steel and other metal work are included under other items. (See Paragraph 6-21.)

7-02. Concrete-Class "A" (Item 8). - a. Description. - This classification includes the Class "A" concrete for the pumping station, and miscellaneous structures, placed between the limiting lines and grades as shown on the drawings or directed by the contracting officer. Forms for surfaces exposed to view shall be constructed in accordance with the provisions of Paragraph 6-17. Concrete fins formed on exposed surfaces shall be removed after the forms are stripped. Pipe drains and miscellaneous metal work shall be installed as provided for on the drawings. Any grouting of metal work shall be included as part of the concrete.

b. Measurement and payment. - The volume of concrete to be paid for will be the volume computed between the limiting lines and grades, as shown on the drawings or directed by the contracting officer. Payment will be made at the contract unit price for Item 8, "Concrete - Class 'A'."

7-03. Concrete-Class "B" (Item 9). - a. Description. - This classification includes the Class "B" concrete for the pumping station foundation as shown on the drawings or directed by the contracting officer. Piping and miscellaneous metal work shall be set and concreted in place as provided for on the drawings.

b. Measurement and payment. - The volume of concrete to be paid for will be the volume computed between the limiting lines and grades, as shown on the drawings or directed by the contracting officer. Payment will be made at the contract unit price for Item 9, "Concrete - Class 'B'."

SECTION VIII. PUMPING STATION SUPERSTRUCTURE (Item 11)

8-01. Work included. - The contractor shall furnish all labor, equipment and materials, except the plaque furnished by the Government (see Paragraph 8-14 b), and shall construct and complete, in accordance with the specifications and the drawings, the pumping station superstructure. Item 11 shall include all work incidental to the construction of the pumping station superstructure, and other miscellaneous work in the pumping station as shown on the drawings, except the furnishing and installation of such equipment as is specifically included in other items of the contract and the concrete work and reinforcing steel which will be paid for under Items 8 and 10. The work includes the concrete and reinforcing steel in the roof slab, the structural steel, consisting essentially of columns, roof beams, crane beams and rails, brick, glass-block and cast stone masonry, doors, door frames, louvers, builders' hardware, roofing, cast iron roof insulating sleeves, copper downspouts and cast iron boots, painting and other work included in the construction of the pumping station superstructure.

8-02. Structural steel. - a. All structural steel shapes, plates, bars, and their products shall conform to the requirements of Federal Specification QQ-S-71la for Steel; Structural (for) Bridges. The fabrication and erection of all structural steel shall conform to the requirements of the current American Institute of Steel Construction Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

b. Drawings for approval. - Before commencing fabrication, the contractor shall submit to the contracting officer for approval complete shop details in accordance with Paragraph 1-04 c.

8-03. Brick masonry. - a. Brick. - All brick shall be whole, sound, straight, hard, uniform in structure, with true, even faces and sharp edges; and shall be uniform in size for their respective kinds. The facing of all exterior walls shall be standard size red shale brick in a full range of color to include reds, browns, hearts, bronzes, and blue-blacks. These brick shall be "A" grade, shall have a matt texture, and shall be similar and equal to brick as manufactured by the following companies: Claycraft Company, Columbus, Ohio, Hydraulic Pressed Brick Company, Washington, D. C., or Belden Brick Company, Canton, Ohio. The interior of the building and brick for backing up shall be best quality "Hard" grade sand-lime brick, approximate size 2-1/4 by 3-3/4 by 8 inches, conforming to the requirements of Federal Specification SS-B-681. The contractor shall submit to the contracting officer for approval, samples of all brick he proposes to use.

b. Mortar. - Mortar shall be composed of one part Portland cement, one-half part lime putty, and three parts sand by volume. Mortar shall be thoroughly mixed either by hand or in a mechanical batch mixer, and only in such q uantities that it can be used completely before it has

attained its initial set. The use of a continuous mixer or of retempered mortar will not be permitted. Only enough water shall be used to make a workable mix. All sand shall conform to the requirements of Paragraph 6-06 for fine aggregate and shall pass a No. 8 standard sieve. Sand used for the mortar for face brick shall be a natural, white or clear sand approved by the contracting officer. Lime shall conform to Federal Specifications SS-L-351 for Type "M" Hydrated Lime. Cement shall be Portland cement conforming to the requirements of Paragraph 6-05.

c. Laying brick. - (1) All brick masonry shall be accurately laid in courses as indicated on the drawings. All exposed surfaces shall be laid to lines that are plumb, true, straight, and level. Each brick shall be laid in a full bed of mortar and shall be shoved into place in the mortar, making joints that are full without subsequent slushing or filling. Except where otherwise indicated on the drawings, the brick course including mortar joint shall be 2-5/8 inches high. Vertical and horizontal mortar joints shall have the same thickness. The mortar joints of exposed face and sandlime brickwork shall be neatly underhand struck. Except where otherwise indicated, all exposed faces of brickwork shall be laid in common bond, with stretchers bonded every sixth course by a course of headers staggered for exterior and interior faces. Metal wall ties shall not be used for the bonding of brickwork, except where indicated on the drawings or authorized by the contracting officer. Care shall be taken to insure the weather-tightness of the brick masonry to its concrete foundation. The saturated fabric flashing shown on the drawings at the foundation of the brick walls shall be similar and equal to the through-wall flashings manufactured by Sandell Mfg. Corp., 70 Phillips St., Watertown, Mass., or to the Wasco copperfabric flashing, Type No. 2, manufactured by Wasco Flashing Co., Cambridge, Mass.

(2) The courses shall be laid to correspond exactly in height with the heads of doors and other openings without any cutting or chipping of the brick. Door frames and all other fixtures shall be built into the brickwork as it is laid. Brick masonry around glass block panels and door openings shall have jambs built true and plumb with the reveals at right angles and of the depth shown on the drawings; and the brickwork shall either be kept back a sufficient distance or raked out to permit a caulked joint as indicated on the drawings. The filling in or backing brickwork shall be kept level with the facing and each piece of facing material shall be backed up solid with brick and mortar so as to make a perfectly bonded homogeneous mass between wall lines. All walls shall be carried up together as nearly as possible on the same level. If during construction, the walls become displaced, damaged, or marred, by the contractor or his workmen, the contractor shall without additional compensation, execute all patching and repairing necessary to leave the entire work in perfect condition. The placing of putlogs in masonry walls is prohibited. The contractor shall place boards over all sills and projecting stone or water tables during construction.

(3) Care must be taken that the tops of all unfinished work are thoroughly covered or protected against inclement weather, by means of waterproof canvas and boards. Brick laid in warm weather shall be kept wet before laying and shall be wet when laid. Bricks laid in cold

weather shall be laid dry and warm. In winter the brick, sand, water, and other material shall be kept warm and if required by the contracting officer, shall be heated by steam pipes or other approved methods in order that the work shall proceed properly. The brickwork shall be carefully covered and protected to prevent freezing.

(4) The contractor shall carefully set or build in all door frames, wall plates, anchors, beams, bolts, or other iron work; bronze, or other incidental materials; and shall build all recesses and pipe chases, as indicated on the drawings, or directed by the contracting officer.

(5) After completion, all brickwork shall be cleaned and pointed where necessary. Before pointing, the joints shall be raked out, cleaned and well moistened. The caulking around all doors, louvers and ventilators shall be carefully checked, and the joints recaulked where necessary.

(6) The dimensions of the brickwork shown on the drawings may be varied slightly depending on the size of the brick used.

8-04. Glass block. - a. Glass block panels shall be installed as shown on the drawings. The blocks shall have a light transmission of not less than 70 percent of the incident light. The glass block shall be hollow, partially evacuated, water-clear units of pressed glass construction of the best quality, similar and equal to the units manufactured by the Owens-Illinois Glass Company, Toledo, Ohio, or the Pittsburgh Plate Glass Company, Pittsburgh, Pa. Unless otherwise shown on the drawings, all glass block shall have a standard size of 7-3/4 by 7-3/4 by 3-7/8 inches. A sample of the type of glass block the contractor proposes to furnish shall be submitted for the approval of the contracting officer, with drawings showing the details of installation, in accordance with the standard practice of the manufacturer of the glass block (see Paragraph 1-04c).

b. Laying of block. - (1) Each block shall be set in a 1/4-inch layer of mortar composed of one part Portland cement, one part lime, and four parts sand by dry volume. The sand used in the mortar shall conform in quality to that specified in Paragraph 8-03 b for sand used for mortar for face brick. Glass blocks shall be laid true to line and grade. Both head and bed joints shall be filled completely with mortar; after the mortar has reached its initial set, the joints on both surfaces shall be compressed and pointed with a metal pointing tool, leaving the finished surface of the joint smooth and non-porous. Blocks shall not be cleaned until after mortar has reached its final set.

(2) Horizontal mortar joints shall be reinforced with continuous 20-gauge expanded metal wall ties 2-3/8 inches wide or with wire wall ties of approved type and of a length suitable for the glass block panel, galvanized after forming. Ties shall run continuously by lapping 6 inches at ends; they shall be placed every course and shall not extend into brick masonry or pierce expansion joints.

(3) Expansion joints shall be provided at the head and jambs of all glass block panels, and all joints at head and jamb of panels shall be kept free from mortar and free from transmission of structural loads carried by adjacent masonry. Expansion joints shall consist of a pre-moulded waterproof expansion joint filler furnished and installed in accordance with the detailed drawings furnished by the contractor and approved by the contracting officer. After the glass block panels have been laid and the mortar has set, non-staining oakum shall be caulked between the sides of the block and the sides of the "chase" to within 1/2-inch from the finished surface. The 1/2-inch recess shall be filled flush with the finished surface with non-hardening waterproof caulking material similar and equal to "Vulcatex" manufactured by A. C. Horn Co., Long Island City, N. Y., "Kaukit" manufactured by L. Sonneborn Sons, Inc., New York, N. Y., or other approved elastic (or mastic) compound as shown on the drawings.

8-05. Chimney. - The chimney shall be constructed as shown on the drawings, and shall be lined with size 8-1/2 by 8-1/2 inch fire clay flue lining. The joints shall be well cemented and struck smooth inside. A suitable cast iron thimble shall be installed in the base of the chimney.

8-06. Stonework. - a. All stone work shall be of cast stone, light-gray, and shall be placed as indicated on the drawings. The stone shall be uniform in color, sound, and perfect throughout; and subject to inspection before being placed in the work. All exposed surfaces shall have a rubbed finish. The cast stone shall be similar and equal to that made by the Emerson and Norris Company, Boston, Mass. and conform in all respects to Federal Specification SS-S-721, for architectural cast stone, Type 1. The contractor shall submit samples of the precast stone proposed to be used, for the approval of the contracting officer. Samples shall be not less than 8 by 12 inches. The contractor shall also submit evidence satisfactory to the contracting officer that the manufacturer who will furnish the cast stone has had at least 10 years' experience in designing and manufacturing cast stone of satisfactory appearance and durability.

b. Before purchasing the stone, the contractor shall submit, for approval of the contracting officer, prints (in quadruplicate) of drawings showing in detail the sizes, coursing, and full details of trim. (see Paragraph 1-04c).

c. The casting, sizing, and coursing of all cast stone shall be done in accordance with the approved detail drawings. The stone shall be dressed and finished to a clean, smooth, uniform surface. Washes shall be cast or cut on the tops of copings, and drips on the undersides of projections where indicated on the drawings. All arrises shall be sharp and true. Anchors, cuts for accommodating steel work, and other incidental details shall be provided as required. Holes and sinkages shall be cast or cut in stones for all anchors, clamps, dowels, etc. Lewis holes shall be cut or cast in stones weighing more than 100 pounds. Lewis holes or other holes shall be not closer than two inches to exposed faces of stone, and holes on exposed faces of stone are prohibited. The cast stone shall be made to check in dimensions with all adjoining brickwork.

d. Mortar for setting the cast stone shall consist of one part Portland cement, three parts fine white sand, and 10 percent by volume of hydrated lime.

e. Setting stone. - (1) Just before setting, each stone shall be brushed clean and thoroughly drenched with clean water. The stone shall then be accurately set, by competent stone setters, true to line and level, with full flushed joints. Each stone shall rest on a full bed of mortar placed under the center of the stone; the amount of mortar being sufficient to fill all anchor holes and to fill out to the edges of the stone on all sides. All stone shall be set with 1/4-inch joints raked out at the face to a depth of one inch and left for future pointing. The backs of stone facings shall be pargeted with neat cement where shown on the drawings. Where required in connection with the setting of heavy stones and projecting courses, in order to arrest the squeezing out of mortar beds, tipping or uneven setting of the stone; and wherever required in connection with stone bedded on structural members, to prevent cracking or spalling from unequal pressure, the contractor shall provide and install lead pads or buttons. These pads or buttons shall be made of soft, sheet lead, either round or octagonal in shape, and of the same thickness as mortar joints. They shall be set not less than one inch back from the face of the stone, and have the mortar bed spread around them. Wherever practicable, heavy stones shall be set with derricks and lifted with lewis plugs or hoisting loops. Where lewis plugs or hoisting ropes cannot be used, the stone shall be set with clamps. The use of pinch bars, except on the embedded parts of the stones, is prohibited. No defective stones, and no broken, spalled, patched, or otherwise damaged stone shall be set in place. Rejected material shall be removed promptly from the work area.

(2) The contractor shall furnish and install all necessary anchors and dowels, as indicated on the drawings or as required by the contracting officer. Dowels other than bronze shall be coated with an approved dampproofing paint before being used.

(3) The contractor shall protect all cast stone work from damage of every description until all construction work is completed. Any damaged work shall be replaced at the contractor's expense.

(4) After the stone has been set, all work shall be gone over by a competent stone mason, thoroughly cleaned, and all joints brushed clean, soaked with clean water, filled solid with pointing mortar, and dressed. The use of wire brushes, or acids and solutions which might cause discoloration will not be permitted in cleaning stone.

(5) The mortar for pointing stone work shall consist of one part white "Medusa" cement or equal, two parts white sand, and 10 percent by volume of hydrated lime. The mortar shall be colored as directed by the contracting officer.

8-07. Doors. - a. Doors shall be of the type and design shown on the drawings. The contractor shall submit to the contracting officer, in accordance with the provisions of Paragraph 1-04 c, shop drawings showing the details of all doors.

b. The entrance door shall be of the vertical, double-leaf, ornamental type, supported at the jambs with butts as shown on the drawings. The quality of the material and workmanship shall in all respects be equal to the flush hollow metal door, Type F, manufactured by the Richmond Fireproof Door Co., Richmond, Ind. Bronze weather-stripping as indicated on the drawings shall be equal to the product of the Chamberlin Metal Weatherstrip Company.

c. The service door shall be of the vertical swinging, steel industrial type, supported at the jambs with 3 butts. The quality of the material and workmanship shall in all respects be equal to the hollow metal door, Type 2M, manufactured by the Richmond Fireproof Door Co., Richmond, Ind.

d. The doors shall be painted and finished at the shop in the color to be selected by the contracting officer in accordance with the standard practice of the manufacturer of the doors. The doors shall be cleaned and primed with one coat of approved rust-resistant paint baked on, and one coat of mineral filler shall be baked on and rubbed before assembling. The doors shall be finished with two additional coats, baked on, the last coat being of the color selected. If the paint on the doors is marred in transit or during installation, the finish shall be replaced at the contractor's expense to the satisfaction of the contracting officer.

8-08. Door frames. - As shown on the drawings, the entrance door shall be provided with a suitable cast bronze saddle, properly fitted and secured in place with expansion bolts. All door frames shall be made of steel, accurately fitted, welded, and anchored in place as shown on the drawings. The door frames shall be similar and equal to products of the Richmond Fireproof Door Co., Richmond, Ind. Loose lintels, as indicated on the drawings, shall have not less than 6 inches of bearing at each end.

8-09. Builders' hardware. - a. The contractor shall furnish and install heavy bronze hardware for the entrance door, including locksets, butts, chain bolts, floor and wall bumpers, clamps, stops or checks, and all other details of a complete installation.

b. The hardware shall be secured in place with machine screws and reinforcing plates shall be provided where necessary. Grouting around the foot bolt keepers in the floor shall be brought flush with the top. The hardware shall be subject to approval of the contracting officer, shall be of the heavy solid bronze type, and of sufficient strength and size for the use intended. It shall conform to Federal Specifications FF-H series, where applicable, and shall be similar and equal to products of the P. & F. Corbin Hardware Co., New Britain, Conn., as shown on the drawings.

8-10. Roofing. - a. Deck. - The roof slab and beam covering shall be of concrete as indicated on the drawings and shall conform to the requirements for Class "A" concrete as specified in Section VI. Before taking its initial set the concrete shall be struck off approximately to grade and then

roughened with a broom. When directed by the contracting officer or in any event not less than 48 hours after the slab has been poured, the contractor shall thoroughly clean the slab, dampen it and place a filler slab of cinder concrete to the lines and grades indicated on the drawings (see Paragraph 6-22). The cinder concrete slab shall be provided with an expansion joint adjacent to the parapet at the location shown on the drawings, which shall conform to the applicable provisions of Paragraph 6-20. This slab of concrete shall be struck off and wood float finished to a surface with a reasonably smooth finish. Forms and shores under the roof slab shall not be removed or disturbed in less than 14 days after placing of the cinder concrete and then only upon specific authorization of the contracting officer.

b. The cinder concrete filler slab shall be covered with a built-up gravel roof as follows: Before the application of any roofing materials, the concrete slab shall be smooth, clean, firm, and dry. The entire surface of the slab shall then be coated uniformly with an approved asphalt primer, using not less than one gallon of primer for each 100 square feet of roof surface. Not less than 24 hours after the application of the priming coat the entire surface shall be coated uniformly with hot asphalt conforming to the Tentative Specifications for Asphalt for Use in Constructing Built-Up Roof Coverings (A.S.T.M. Designation: D 312-39T) of the American Society for Testing Materials. Into this coating, while hot, there shall be laid four layers of 15-pound, 36-inch asphalt-saturated felt over the entire surface of the roof, lapping each sheet 27-1/2 inches over the preceding one, lapping the ends of the sheets not less than 6 inches, and mopping with asphalt the full 27-1/2 inches so that in no place shall felt touch felt. The felt shall conform to Federal Specification HH-F-191 for Asphalt-Saturated Felt. At all vertical surfaces the roofing shall be carried up at least 6 inches and thoroughly mopped to the wall so that contact is obtained throughout. The layers of felt shall be laid so as to be free from wrinkles and buckles. Over the entire surface there shall be poured from a dipper a uniform coating of asphalt, into which, while hot, there shall be embedded not less than 400 pounds of gravel per 100 square feet. Not less than 160 pounds of asphalt shall be used for constructing each 100 square feet of the completed roof and the asphalt shall be applied at a temperature of approximately 350 degrees Fahrenheit. The roofing gravel shall be hard, durable, water worn, dry, and free from clay, loam, sand, or other foreign substances. All gravel shall pass a 1/2-inch square mesh sieve, not less than 80 percent shall pass a 3/8-inch square mesh sieve and shall be retained on a 1/4-inch square mesh sieve, and 100 percent shall be retained on a 1/8-inch square mesh sieve.

8-11. Flashings. - All copper flashings indicated on the drawings or otherwise required shall be 16-ounce copper conforming to Federal Specifications QQ-C-501, Type V. The chimney shall be flashed and counterflashed.

8-12. Louvers and ventilators. - a. Where shown on the drawings, louvers of the size indicated, shall be placed.

(1) The louver frames for the west elevation shall be constructed in such a manner that will assure a watertight connection between the frame and the wall. They shall be equipped on the exterior with copper mesh screens of the size and type made by the same manufacturer who furnishes the louvers. The louvers shall be similar and equal to the Beco adjustable louver manufactured by the H.H.W. Bergmann & Co., New York, N. Y.

(2) The louver frames for the east elevation shall be of 16-gauge galvanized iron and shall be constructed in such a manner that will assure a watertight connection between the frame and the wall. They shall be equipped on the exterior with galvanized iron screens of the size shown on the drawings. The louvers shall be similar and equal to Type F12, as manufactured by the American Foundry and Furnace Co., Bloomington, Illinois. A 16-gauge metal duct with door shall be installed from the louver frame to the engine radiator. The contractor shall submit for approval detail drawings for the louvers, louver frames and hot air ducts he proposes to install in sufficient detail to check the design (see Paragraph 1-04 c).

b. The ventilator shall be of the Uno braced turbine, wind-driven type, of standard galvanized iron construction as manufactured by the Uno Ventilator Company, Cliftondale Station, Saugus, Mass. or equal. The metal base supporting the ventilator shall incorporate drip gutters to carry off condensation. The contractor shall furnish detailed drawings for approval, showing method of anchoring the ventilator in place. (See Paragraph 1-04 c.)

8-13. Downspout. - a. The contractor shall furnish and install, under Item 11, the copper downspout with scupper box head, bronze beehive strainer and cast iron boot, as located and shown on the drawings.

b. The contractor shall submit for approval detail drawing for the scupper box head he proposes to install in sufficient detail to check the design (see Paragraph 1-04 c).

8-14. Miscellaneous details. - a. The contractor shall furnish and install, under Item 11, the bronze letters over the entrance door as shown on the drawings and shall submit, for approval, template for setting the letters.

b. The contractor shall install under Item 11, at the location shown on the drawings, the plaque which will be furnished by the Government.

8-15. Painting. - The concrete floor of the pumping station, the concrete machinery bases, and the side walls below the brick masonry shall be painted as specified in Paragraph 14-07. The cost of all painting shall be included in the contract price for Item 11 (see Paragraph 8-16).

8-16. Payment. - Payment for constructing and completing the pumping station superstructure in accordance with the specifications and the drawings will be made at the contract price for Item 11, "Pumping Station Superstructure".

SECTION IX. METALS AND EMBEDDED ITEMS (Items 12 to 14 incl.)

9-01. General. - All metals, unless otherwise specified, shall conform to applicable Federal Specifications, and, when not covered thereby, to applicable A.S.T.M. specifications. All castings shall have the pattern or mark number cast on them. Unless otherwise authorized by the contracting officer, the scale weights of each casting or forging after machining shall be within 5 percent of the weights as calculated from the dimensions specified or shown on the drawings. Castings shall conform, at the minimum section thereof, to the following dimensional tolerances: where embedded in concrete, to within 1/8 inch; where not embedded in concrete, to within 1/16 inch of the dimensions shown on the drawings.

9-02. Materials and workmanship. - a. The articles included in Items 12 to 14 inclusive, other miscellaneous materials, and all metal required in the work except as otherwise specified, shall meet the requirements of the following specifications where applicable to the use intended:

(1) Steel reinforcement shall be of new billet intermediate grade, open-hearth steel, deformed, and shall conform to the Federal Specification QQ-B-71a for "Bars, reinforcement, concrete, Type "B", Grade 2 (dated January 12, 1938)." Certified copies of any mill test required shall be furnished by the contractor and the steel shall be subjected to such tests as the contracting officer may consider necessary to establish its quality, including particularly the requirements of bending and elongation. The steel shall be free from oil, paint, dirt or excessive rust. Expanded metal reinforcement shall be used as shown on the drawings in the fire-proofing of steel beams. This reinforcement shall consist of a diamond-shaped steel mesh manufactured from open-hearth steel, by a cold drawn process which will cut and draw the material so that uniform strands are formed at regular intervals along the length of the sheet with the plate intact between successive strands. It shall possess ductile properties which will permit any strands to be bent through an angle of 180 degrees over one diameter, without fracture, and to have a yield point of not less than 55,000 pounds per square inch. The size of the diamond shall be approximately 1-1/2 inches, and the weight per square yard shall be not less than 1.8 pounds.

(2) Structural steel; - Federal Specification QQ-S-71la; shapes, plates, bars, pins and bolts shall be Class "A" and rivets shall be Class "C", unless otherwise required. Welding will be accepted only where specified or authorized, and approved only when done in accordance with the current requirements of the American Welding Society.

(3) Cold-rolled steel; - A.S.T.M. Specifications A-108-36 for "Commercial Cold-Finished Bar Steels and Cold-Finished Shafting". Unless otherwise specified this material shall be used for rods, pins, keys, and similar parts.

(4) Hot-rolled steel, for shafting, sleeves and rollers; - A.S.T.M. Specifications A-107-36 for "Commercial Quality Hot-Rolled Bar Steels."

(5) Machine steel; - same as for Hot-rolled steel.

(6) Steel, corrosion resisting; - Federal Specification QQ-S-763 or QQ-S-766.

(7) Steel forgings, shall be of hot-rolled open-hearth steel forging bars conforming to A.S.T.M. Specifications A-18-30 for carbon steel and alloy steel forgings, Class "C", except that shafts of this material not otherwise specified shall be S.A.E. No. 1045 hot-rolled, open-hearth steel forging bars.

(8) Steel castings; - Federal Specification QQ-S-681a.

(9) Iron castings, gray; - Federal Specification QQ-I-652, class as indicated. Tensile tests and chemical analysis will not be required.

(10) Malleable iron castings; - Federal Specification QQ-I-666, Type "A".

(11) Steel rail track and fittings, shall be standard A.S.C.E. sections and shall conform to the A.R.E.A. standard specification for carbon steel rails.

(12) Chains and attachments; - Federal Specification RR-C-271 of Type "A" and Grade "2" unless otherwise specified.

(13) Bolts, screws, and washers; - Appropriate Federal Specification and current standard practice, unless otherwise specified.

(14) Wrought iron bars and shapes; - Federal Specification QQ-I-686, Grade "B".

(15) Wrought iron pipe; - Federal Specification WW-P-441a.

(16) Cast iron pipe; - A.S.T.M. Specifications A-44-04, Class "A"; for soil pipe refer to Federal Specification WW-P-401.

(17) Black steel pipe and fittings; Federal Specification WW-P-403a, Type "A", and WW-P-521.

(18) Sheet copper; - Federal Specification QQ-C-501, Type "V", Class "A".

(19) Zinc coatings (hot galvanized); - Federal Specification QQ-I-696.

(20) Babbitt metal; - Federal Specification QQ-M-161.

(21) Lead: - Federal Specification QQ-L-171, Grade A.

(22) Solder: - Federal Specification QQ-S-551.

(23) Valves: - Federal Specification WW-V-76a.

b. Other items, unless otherwise specified, shall conform to current standard practice for the material required and use intended.

9-03. Galvanizing and painting. - a. Galvanized iron or steel articles shall be galvanized by the hot-dip process unless otherwise permitted. Injuries to the galvanizing shall be satisfactorily repaired. Provision shall be made for protecting threads either by counter-boring fittings, so as to cover threads or by cutting threads so as to make a very loose fit before galvanizing and carefully rerunning threads after galvanizing so as to leave a good coating all over threads. Hot galvanizing shall be of such quality as to endure at least 4 one-minute imersions in copper sulphate solution, in accordance with the requirements of the Preece test.

b. Except as otherwise specified all ungalvanized iron and steel to be exposed in the finished work shall be thoroughly cleaned and then thoroughly and evenly painted, in accordance with the provisions of Section XIV.

9-04. Miscellaneous iron and steel (Item 12). - a. Ladder rungs, anchors, and malleable iron pipe fittings and connections and other miscellaneous iron and steel items as shown on the drawings shall be furnished and installed. In accordance with the provisions of Paragraph 1-04c, the contractor shall submit for approval detailed drawings and data descriptive of the miscellaneous iron and steel work which he proposes to install. General requirements are as follows:

(1) Ladder rungs and hand grabs shall be of wrought iron shop bent or manufactured.

(2) All miscellaneous anchors shall be hot-dip galvanized after bending and welding.

b. Payment will be made as specified in Paragraph 9-07.

9-05. Miscellaneous pipe and fittings (Item 13). - a. Black steel or standard wrought iron pipe complete with malleable iron fittings and connections shall be furnished and installed on the structures where shown on the drawings. Pipe shall be of the size as shown on the drawings and shall conform to Federal Specifications WW-P-403a and WW-P-521. Pipe fittings and connections shall be malleable iron castings (see Paragraph 9-02a (10)), of ball pattern and pin-connected where required, post connections at the floor, and caps used on the bottoms of sleeves embedded in the concrete shall be standard screw type. All fittings shall be of Crane Company type or equal. Floor or wall flanges of screw type shall be anchored into the concrete with stud type expansion bolts consisting

of one primary and one secondary expansive unit similar and equal to that manufactured by Akerman Johnson Company. In accordance with the provision of Paragraph 1-04c, the contractor shall submit for approval detailed drawings and data descriptive of the miscellaneous pipe and fittings which he proposes to install.

b. Payment will be made as specified in Paragraph 9-07.

9-06. Steel trash rack (Item 14). - a. A steel trash rack, complete, including frames, angle iron guards and accessories shall be furnished and installed as shown on the drawings. The steel trash rack, nuts, bolts, rivets, and pipe spacers shall conform to the requirements of Federal Specification QQ-S-711a; shapes, plates, bars, and bolts shall be Class "A" and rivets shall be Class "C", unless otherwise shown. All frames and guards to be attached to the concrete shall have anchors as shown on the drawings or as directed. The steel shall be painted as provided in Paragraphs 14-03 and 14-06. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the steel trash rack and accessories which he proposes to install.

b. Payment will be made at the contract price for Item 14, "Steel Trash Rack," and shall include all costs of furnishing and installing the trash rack complete with frames, guards and accessories as specified.

9-07. Measurement and payment. - a. The quantities to be paid for under Items 12 and 13, will be the number of pounds respectively furnished and installed in accordance with the drawings and specifications. Wherever practicable, the quantities shall be determined by weighing the articles and materials. When weighing is not practicable, the actual weight of each part or item involved will be determined by the contracting officer, who will use for that purpose manufacturer's weights, catalog weights, and computed weights. The weight of all tare, packing, and blocking will be deducted, using only net weights for payment quantities; provided, that no payment will be made for any weight in excess of 5 percent more than the computed weight as determined from the drawings.

b. In calculating computed weights the following unit weights of the several materials will be used unless otherwise specified:

Structural Steel	-	0.2833 pounds per cubic inch.
Cast Iron	-	0.2604 pounds per cubic inch.
Wrought Iron Pipe	-	The weight per linear foot shown in Table I of Federal Specification WW-P-441a.
Black Steel Pipe	-	The weight per linear foot shown in Table I of Federal Specification WW-P-403a.

c. Payment will be made at the applicable contract unit prices for Items 12 and 13, (see Paragraph 1-05).

SECTION X. ELECTRIC LIGHT AND POWER SYSTEM (Item 15)

10-01. Work included. - a. The contractor shall furnish and install complete and ready for operation all equipment, conduits, and wiring for the electric light and power system of the pumping station as indicated on the drawings and as required by these specifications, including outlets, pull boxes, incoming service feeder, interior lighting fixtures, lamps, exterior ornamental lights, portable floodlight, meterboard, lighting and power distribution panelboard, service switch and battery charging system. The contractor shall make all necessary connections to sump pump motor, motors for heating equipment, and other electrical equipment.

b. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings, dimensioned when necessary, and data descriptive of the lighting distribution panelboard, switches, battery charger, portable floodlight, lighting fixtures, conduits and conduit layouts, wiring and accessories which he proposes to install.

10-02. General description. - a. The lighting and power system includes interior lighting fixtures, lighting and power distribution panelboard, control equipment, convenience outlets, exterior ornamental lights, conduits, wires, portable floodlight, service entrance switch, pull box, incoming underground feeder, and all wire connections of circuits to the several parts of the operating equipment.

b. The emergency lighting system includes fixtures, conduits, wires, lamps, fuse box and switches for 12-volt lighting supplied from the engine batteries as indicated on the drawings.

c. The battery-charging system includes conduit, wire, and battery charger with controls and ammeter for charging the battery on each gasoline engine through the wire and onduit brought up to each engine panel and properly connected.

d. The pumping station will be supplied with electrical energy at 115 and 230 volts, single-phase, 3-wire, 60-cycle AC from an outside source. The contractor shall furnish and install the incoming service feeder, as covered by Paragraph 10-05 b, from the service entrance box in the pumping station to and up the Power Company's pole from which power will be supplied to the pumping station. The cable up the pole shall be installed in conduit in accordance with The Hartford Electric Light Company's standard.

e. The electrical equipment in the pumping station will be subject to extreme conditions of fog, moisture, and changes of temperature, and shall be suitable for such service conditions.

10-03. Standard rules and specifications. - a. Unless otherwise specified, all electrical materials, workmanship, and tests shall conform to the current standard rules, regulations and specifications of the following authorities.

(1) American Institute of Electrical Engineers, 33 West 39th Street, New York, N. Y.

(2) National Board of Fire Underwriters, National Electrical Code, 85 John Street, New York, N. Y.

(3) National Electrical Manufacturers Association, 155 East 44th Street, New York, N. Y.

(4) Bureau of Standards, National Electrical Safety Code, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

(5) Insulated Power Cable Engineers Association, 420 Lexington Avenue, New York, N. Y.

(6) Federal specifications cited herein (Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.).

(7) The Hartford Electric Light Company, Hartford, Conn.

b. Copies of these rules, regulations, and specifications may be procured at the addresses given, or may be seen at the U. S. Engineer Office, Providence, R. I.

10-04. Conduits. - a. Conduits shall be located as indicated on the drawings or as directed by the contracting officer.

b. The conduits shall be hot-dip galvanized or sherardized on both inside and outside, and shall meet the requirements of Federal Specification WW-C-581a for "Conduit, Steel, Rigid, Zinc Coated". Conduit fittings or bodies shall be galvanized, sherardized, or cadmium plated high-test alloy castings of the types and sizes specified or shown on the drawings, or required for the work to be done. They shall be approved by the National Board of Fire Underwriters, and be similar and equal to those manufactured by the Crouse-Hinds Company. Conduit sizes shall meet the requirements of Article 346 of the 1940 edition of the National Electrical Code with the exception that no conduits smaller than 3/4-inch shall be used.

c. The installation of conduits shall comply with Article 346 of the 1940 edition of the National Electrical Code. All wires and cables shall be run in rigid conduits forming a complete raceway from the cabinet or panel to the last outlet in the system. Conduits shall be run concealed in the floors, ceilings and walls except as indicated on the drawings. Conduits in masonry walls and floors shall be built-in complete with all necessary fittings at the time the masonry is being placed. Any exposed conduits shall be securely fastened and anchored to the structural portions of the building and shall be run parallel with or at right angles to the walls. All conduits shall be run with long-radius bends where possible, and not more than three quarter bends shall be used on any run. All bends shall have a minimum radius of six diameters. If more than

three bends are required, pull boxes shall be installed at points approved by the contracting officer. All conduit ends shall be reamed to remove burrs and obstructions after the threads have been cut. All conduit joints shall be made watertight with an approved sealing compound. At all conduit terminals there shall be provided approved bushings or conduit fittings. All metal conduit runs shall have electrical continuity. Open conduit ends shall be capped in approved manner to exclude dirt and moisture. No threadless fittings or running-thread couplings shall be used on runs of conduit. As soon as possible after the concrete has set, each conduit shall be cleaned, inspected, and tested by the contractor to ascertain its mechanical and electrical continuity and freedom from obstructions. Any defects in material or workmanship shall be remedied immediately as directed by the contracting officer. After each duct line is completed, the contractor shall inspect and test the conduit in an approved manner and the conduit ends shall be capped.

10-05. Wiring. - a. The contractor shall furnish and install all wire and cable, terminals, junction boxes, supports, hangers, make all connections, grounds, and properly place, arrange, and identify all material as specified or directed by the contracting officer. All wiring shall be in rigid conduit unless otherwise specified, shown on the drawings, or directed by the contracting officer.

b. The service feeder from the utility company's pole to the service entrance shall be a metallic Parkway-Type cable, rubber insulated, with a protective covering made up of a lead sheath, layers of asphalted jute and asphalt compound and a double flat-band-steel armor, in accordance with standard practice. The cable will be #6 A.W.G. 3-conductor designed for 600 volts, 60 cycles, A. C. service. Where applicable, Federal Specifications JC-71 will govern the quality of materials and the methods of sampling, inspection and tests. The service feeder shall be buried in earth 2-1/2 feet deep, and covered with a 2" x 10" creosoted wood plank. A conduit with weatherproof entrance cap, suitable to the utility regulations, shall be provided on the pole to protect the cable.

c. All wire used shall be copper, soft drawn and annealed, and having not less than 95 percent conductivity. Wire sizes shall comply with Article 300 of the National Electrical Code. No wire shall be used that is smaller than No. 12 A.W.G. Insulation for all wires and cables shall be flame-retarding and moisture proof and shall conform to Federal Specifications J-C-106a for "Cable and Wire: Rubber Insulated Building Type, Heat Resistant Grade (0 to 5,000-Volt Service)".

d. All wire and cable shall be shipped on reels or in coils, plainly marked for complete identification, including the wire or cable size, number of conductors, length, weight, thickness, and character of the insulation and the name of the manufacturer.

e. Materials used in the wiring shall conform to the following requirements:

(1) Solder for splicing or wiping shall conform to Federal Specification QQ-S-571, for "Solder Tin Lead", Grade A , for sweat conductor joints.

(2) Solder for brazing shall conform to Federal Specifications QQ-S-551, for "Solder, Brazing", Composition B.

(3) Silver solder shall conform to Federal Specifications QQ-S-561b for "Solder, Silver", Grade O.

(4) Rubber tape shall conform to Federal Specifications HH-T-111 for "Tape, Rubber Insulating".

(5) Friction tape shall conform to Federal Specifications HH-T-101 for "Tape, Friction", Grade A.

(6) Cotton tape shall conform to United States Navy Department Specifications 17-T-15 for "Tape, Insulating, Linen, Finish, Plain", thickness .007 inch.

10-06. Grounding. - Permanent and effective ground connections shall be provided for all enclosures of electrical equipment, for equipment frames and housings, continuous runs of metal conduit, for the neutral conductor of the service entrance, and elsewhere to comply with Article 250 of the National Electrical Code, and as specified or directed by the contracting officer. The contact area of all joints in grounding circuits shall provide a current-carrying capacity not less than that of the connecting wire or cable, and the joints shall be bolted or brazed, as specified or directed. All ground connections to equipment that may require removal for maintenance or repair shall be bolted to the equipment.

10-07. Lighting and outlets. - a. The lighting panelboard, lighting fixtures, plug receptacles, switches, lamps and outlet boxes shall be installed as specified and at locations indicated on the drawings and shall be in accord with the description as shown on the Bill of Material.

b. The ornamental fixtures on the front of the pumping station shall be moisture-proof octagonal lanterns attached to the pumping station by the brackets furnished with the fixtures. The fixtures shall be the lantern and bracket type, complete with glass, lamp, and wiring devices, catalog No. 1796, Murlin Manufacturing Company, Philadelphia, Pa., or equal, solid bronze, dark oxidized finish. The fixture for the rear of the pumping station shall be furnished complete with globe, lamp and wiring devices, and shall be catalog #1463, Murlin Manufacturing Company, Philadelphia, Pa., or equal, cast iron with bronze finish.

c. Lamps, except for emergency lights, shall be rated at 115 volts and of the watt rating shown or specified, and shall conform to Federal Specification W-L-101c for "Lamps, Electric, Incandescent, Large, Tungsten-Filament".

d. Lamps for emergency lighting shall be rated at 100 watts, 12 volts, D. C., and shall be similar or equal to Maxda A-19 for aviation service. Where applicable, Federal Specification W-L-101c shall govern the quality of material and general construction of these lamps. Each lamp shall be furnished with a lamp socket extension to bring the lamp filament to the focal point of the fixture for the emergency lighting outlet.

e. All lighting fixtures shall be installed as specified and at locations indicated on the drawings and shall be similar or equal to that specified in the Bill of Material.

f. Portable floodlight. - The contractor shall furnish, complete with bulb, a portable 150-watt floodlight on a rust-proofed telescoping stand with at least an 18" diameter base. The light shall be easily adjustable through a wide angle and to any desired height from 1'0" to 6'0" above the floor. The light shall have an aluminum reflector with adjustable beam spread, moisture-proof gaskets, heat-resisting glass cover, rust-proof wire guard and heavy duty rubber covered two conductor service cord with a weather-proof plug for a threaded receptacle. The weatherproof plug shall be Crouse-Hinds #WP 722 or equal. The portable floodlight shall be similar and equal to Benjamin catalog #5787.

g. All sockets, switches, and receptacles shall be National Electric Code Standard and shall be in accord with the Bill of Material.

10-08. Miscellaneous electrical equipment. - a. A battery charger of approved make, similar and equal to the product of the General Electric Company, shall be installed as shown on the drawings. The charger shall be designed to operate at 230 volts, single phase, 60 cycles, A. C., and shall be fed from the lighting panelboard. The charger shall have sufficient capacity to charge two 12-volt batteries in parallel with positive terminals grounded at a charging rate of 12 amperes each. It shall be provided with a control device for varying the charging rate from zero to maximum in at least 20 steps and shall be equipped with an ammeter to indicate the direct current output. Both shall be mounted on the front panel of the charger. The output side shall be provided with a suitable switch and fuse or circuit breaker.

b. The lighting distribution panelboard shall have 125/250 volt, 60 cycle, single phase, 3 wire, solid neutral mains, with a two pole, 50 ampere, 600 volt A. C. automatic air circuit breaker in the main leads. It shall have four 115 volt, 2 wire branch lighting circuits, with single pole, 15 ampere, 250 volt, A. C. automatic air circuit breakers in the live side, and two 230 volt, 2 wire branch power circuits, with 2 pole, 15 ampere, 250 volt, A. C. automatic air circuit breakers. The panelboard cabinet front, trim and door shall be of Code grade galvanized sheet steel, finished a dull black over a priming coat or binder. The panelboard shall be for flush mounting with proper width trim and shall be in accordance with Federal Specifications W-P-131. It shall be similar and equal to Catalog #NA1B06-3AB050, of the Westinghouse Electric and Manufacturing Company. Branch circuit breakers shall be of the air break type rated at

250 volts, 60 cycles A. C. manually operated, trip free, with thermal overload trip. The main breaker shall be of the air break type, rated at 600 volts, 60 cycles A. C. manually operated, trip free, with thermal overload and instantaneous overload trips. The circuit breakers shall be similar and equal to type AB of the Westinghouse Electric and Manufacturing Company or type AF1 of the General Electric Company.

c. The service entrance metering switch shall be of the steel, safety-enclosed, "dead accessible fuse" type mounted in a dust-resisting enclosure designed for mounting on an ebony asbestos panel and provided with an e xternal operating handle interlocked with the cover. The switch shall be single-throw, fusible type, rated to carry 60 amperes continuously at 230 volts, 60 cycles, A. C. The case shall be of welded steel construction, cadmium-plated and painted black, and shall be provided in accordance with The Hartford Electric Light Company's standard switch for this type of service.

d. The connections of the battery-charging system and the emergency lighting system to the engine batteries shall be made in a workmanlike manner using conduit fittings, and two-conductor flexible BXL armored conductors shall be installed from the batteries to the conduit boxes on the engine base and to the engine panel switch box.

e. All fuses shall comply with Federal Specification W-F-791 for "Fuses, Cartridge, Inclosed, Non-Renewable".

f. The pull box for the incoming underground service feeder shall be similar and equal to the standard product of the Thomas & Betts Company, Inc., Elizabeth, N. J., and shall be in accord with the Bill of Material.

10-09. Motor control. - The control for the sump-pump motor shall consist of an enclosed magnetic across-the-line starter similar and equal to the Westinghouse Electric and Manufacturing Company's Class 11-200, push-button operated, and arranged to provide thermal overload and under-voltage protection to the motor.

10-10. Payment. - Payment will be made at the contract price for Item 15, "Electric Light and Power System", for furnishing, installing, testing, and placing in operation the lighting and power system as required by the specifications and shown on the drawings.

SECTION XI. TRAVELING CRANE, COMPLETE (Item 16).

11-01. Work included. - The contractor shall design, furnish and install one traveling crane, complete. The crane shall be mounted on the track in the pumping station ready for operation, in accordance with the drawings and the specifications.

11-02. General description. - The crane shall be hand operated, and shall have a working capacity of not less than 4 tons carried on one trolley. The distance from center line to center line of crane rails shall be 16 feet 6 inches. The distance from operating floor to top of crane shall be 13 feet 0 inches.

11-03. Detailed description. - a. The hoist and trolley shall be similar or equal to the combined geared "Army" type as manufactured by the Yale and Towne Manufacturing Company, Philadelphia, Pa., or David Round and Son, Cleveland, Ohio. The hoist shall be equipped with hoisting chain and shall provide for a vertical lift of 27 feet. The gearing for the hoist shall be accurately machine cut and shall be of ample strength and fully enclosed with safety guards. The hoist shall be self-locking, and integral with the trolley. The hoist and trolley traverse shall be operated by chains from the operating floor. Trolley wheel bearings shall be antifriction bearings of ample capacity. Provision shall be made to support the hoist lifting chain clear of the floor when the crane hook is in the raised position.

b. The bridge shall consist of one I-beam girder of ample section to provide rigidity against excessive vertical deflection and side sway. The girder shall be securely attached and braced to the end trucks. The end trucks shall be of rigid construction and shall be provided with double-flanged wheels. One wheel of each end truck shall be geared to a cross shaft operated by a pendant hand chain and suitable gearing. The hand chain shall provide for one-man operation of the bridge traverse from the operating floor, and shall be located near the end of the main girder adjacent to the rear wall of the pumping station. The end truck wheels shall be equipped with roller bearings. The cross shaft bearings shall be either smoothly finished gray iron or bronze bushings. Four crane stops shall be provided for attachment to the crane rails.

11-04. Design. - a. The detailed design of traveling crane shall be in accordance with the clearances indicated on the drawings and with these specifications. All working parts shall be readily accessible for inspection and repair, properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall not be greater than one-fifth of the ultimate strength of the material used.

11-05. Drawings. - In accordance with Paragraph 1-04 c, the contractor shall submit for approval detail drawings for the traveling crane he pro-

poses to install, in sufficient detail to enable a check on the design. These drawings shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article, the contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Thickness of plates and sizes of structural shapes must be shown either on the part or in the itemized list of parts. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details and by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications, shall be supplied by the contractor, whether or not it is included on the drawings, the list of parts, or in the requirements of these specifications. Approved drawings submitted by the contractor shall become a part of these specifications.

11-06. Materials and workmanship. - The traveling crane shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished by the contractor and approved by the contracting officer and shall conform to the provisions of Section IX, where applicable. All metal workmanship shall be of approved standard quality.

11-07. Installation. - The traveling crane shall be assembled and installed in the pumping station, as shown on the drawings.

11-08. Inspection and tests. - The traveling crane will be tested by the Government as soon as practicable after installation. The field tests will include complete operation of the crane throughout all its functions. Acceptance and final payment will not be made until such tests are completed to the satisfaction of the contracting officer.

11-09. Painting. - Shop painting shall be in accordance with the provisions in Paragraph 14-04. Such retouching as may appear necessary in the opinion of the contracting officer, shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust preventative compound. Field painting of all exterior parts, except brass, bronze or finished surfaces shall include one coat of metal filler, one shop coat of red lead, one field touch-up coat of red lead if found necessary by the contracting officer, and two coats of selected engine enamel.

11-10. Payment. - a. Payment for designing, furnishing, installing and painting the traveling crane will be made at the contract price for Item 16, "Traveling Crane, Complete," and includes all necessary accessories not included in any other item.

b. Partial payment up to 50 percent of the contract price will be made when the traveling crane is delivered to the site of the work provided the quality of the equipment is satisfactory to the con-

tracting officer, but in no case will the payment to the contractor exceed the cost of the equipment delivered to the site of the work. The traveling crane shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

SECTION XII. MISCELLANEOUS EQUIPMENT (Items 17 to 20, incl.)

12-01. Sump pump (Item 17). - a. Description. - The contractor shall furnish and install one vertical centrifugal sump pump of the submerged type with discharge piping, as indicated on the drawings. The pump shall have a capacity of 50 gallons per minute against a total head of 32 feet. The pump shall have a cast iron casing and a bronze impeller of either the closed or open type capable of passing coarse or fibrous material. The shaft shall be of stainless steel enclosed in a wrought iron support pipe. The upper bearing shall be of the combined radial and thrust type, grease lubricated anti-friction bearing. The lower and intermediate bearing shall be made up of a non-seizing, non-scoring high lead bronze bearing bushing with a grease reservoir. The reservoir shall be connected through suitable piping to an Alemite or Zerk fitting above the pit cover. The pump shall be bolted or welded to a small cover plate which in turn shall be bolted to the pit cover. The pump shall be driven by a 230-volt, 1-phase, 60-cycle, 1750 r.p.m., vertical, drip-proof capacitor motor with normal starting torque characteristics. The motor shall be rated not less than one horsepower with a limiting temperature rise of 40 degrees Centigrade, and shall have a special moisture resisting treatment for all insulation in accordance with the N.E.M.A. standards. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the sump pump, complete with motor, controller and piping, which he proposes to install.

b. Payment. - The contractor will be paid the contract price for Item 17, "Sump Pump", for furnishing and installing the sump pump.

12-02. Gasoline tank and piping. - (Item 18). - a. The contractor shall furnish and install one gasoline storage tank together with fill and vent pipes, fill box, gasoline gage, and supply and drain piping to the gasoline engines as shown on the drawings. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the gasoline tank, piping and gage which he proposes to install.

b. The gasoline tank shall be of welded steel construction, and shall comply with the legal requirements of the Town of East Hartford, Connecticut.

c. All piping outside the pumping station shall be wrought iron pipe conforming to Federal Specification WW-P-441a. Fittings shall be malleable iron screwed fittings conforming to Federal Specification WW-P-521. All piping inside the pumping station shall be copper tubing conforming to Federal Specification WW-T-799, installed with flared fittings. The foot valves on the suction lines inside the gasoline tank shall be of the Single Poppet type similar and equal to Amco Figure 438. The vent pipes shall be securely clamped to the concrete wall.

d. The gasoline gage shall be installed on the wall of the engine room as shown on the drawings. It shall be capable of indicating the amount of gasoline in the storage tanks and shall be of the automatic remote reading type similar and equal to that manufactured by the Liquidometer Corporation of Long Island City, New York. It shall be float operated, the motion of the float operating against sylphons of a closed hydraulic system, and the system shall be filled with a liquid for the purpose of transmitting the motion of the float to the indicator sylphons. The indicator shall be installed in a protecting case not less than 12 inches by 12 inches and provided with a scale graduated to 500 gallons. The flexible tubing for connecting the indicator with the float mechanism shall be protected by a metallic armor. The connection between the gasoline tank and the gage line shall be protected by a structural steel box of suitable size.

e. Payment. - The contractor will be paid the contract price for Item 18, "Gasoline Tank and Piping", for furnishing and installing the gasoline tank, gage and piping in accordance with the drawings and specifications.

12-03. Float gage. (Item 19). - a. Description. - The contractor shall furnish and install an indicating dial type float gage. The float gage well shall be of 6-inch, standard weight, genuine wrought iron pipe installed at the location and in the manner shown on the drawings. The float, tape, and counterweight shall be made of corrosion-resisting metal. The dial shall be 12 inches in diameter and graduated from 0 to 10 feet in tenths of a foot. The equipment shall be similar and equal to the No. 639 Dial Indicator manufactured by the W. and L. E. Gurley Company of Troy, New York. The protection grille for the tape shall be baked enamel wire-mesh of 1/8-inch wire, with 1-1/2-inch diamond shaped mesh complete with ferrule for attaching the grille to the pumping station wall. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the float gage and accessories which he proposes to install.

b. Payment. - The contractor shall be paid the contract price for Item 19, "Float Gage", for furnishing and installing the float gage and well in accordance with the specifications and drawings.

12-04. Heating system (Item 20). - a. Work included. - The contractor shall furnish and install the heating system which shall consist essentially of an oil burning heating furnace of the warm air type, with built-in electrically-driven blower, fuel pump, and a 180-gallon fuel oil storage tank as shown on the drawings or as directed by the contracting officer. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the heating furnace, fuel pump, fuel tank and piping which he proposes to install.

b. Heating furnace. - The heating furnace shall be a Duo-Therm oil burning furnace, Model No. 807-O, as manufactured by the Duo-Therm Division, Motor Wheel Corporation, Lansing, Michigan, or its equal. It shall have a heating capacity of not less than 70,000 B.t.u. per hour at the bonnet. It shall be furnished complete with enameled metal jacket of a color to be determined by the contracting officer, automatic draft regulator, smoke pipe, constant level oil valve, electrically-driven blower and an outlet cowl with directional louvers. Provision shall be made for manual control of the burner and blower. The blower motor shall be suitable for operation on 115-volt, 60-cycle current, single-phase and the blower shall have a capacity of 1000 C.F.M. of warmed air. Directing louvers shall be attached to the furnace, properly designed to distribute warmed air to all parts of the engine room.

c. Fuel tank and piping. - The fuel oil tank shall be a 180-gallon, 1/4-inch welded steel tank, 30 inches in diameter and 60 inches long set on concrete supports underground and suitably anchored as indicated on the drawings. The fill line and vent line shall be of standard weight galvanized wrought iron pipe with galvanized malleable iron fittings. A vent cap shall be provided on the vent line and the fill pipe shall have a lock type fill connection. The oil lines from the tank to the fuel pump shall be 1/2-inch (5/8-inch O.D.) type K soft copper tubing conforming to Federal Specification WW-T-799 and installed with flared fittings. The feed line from pump to burner shall be 3/8-inch (1/2-inch O.D.), Type K, soft copper tubing, fitted with a shut-off valve at the pump, and a Ryan fusible valve, or equal, at the burner. Unless otherwise specified, all fuel oil piping materials, workmanship and tests shall be in conformity with the current standard rules, regulations and specifications of the National Board of Fire Underwriters, Chicago, Illinois.

d. Fuel oil pump. - The fuel oil pump shall be similar and equal to the Trumbull oil pump No. 522, manufactured by the Trumbull Electric Manufacturing Company, Plainville, Connecticut, and shall be suitably mounted on the engine-room wall as shown on the drawings.

e. Payment. - The contractor will be paid the contract price for Item 20, "Heating System", for furnishing and installing the heating system in accordance with the specifications and drawings.

SECTION XIII. INSTALLATION AND TESTING OF EQUIPMENT

13-01. Work included. - a. The contractor shall install all of the equipment furnished by him under the contract, and shall also install under Item 21 the following equipment to be furnished by the Government:

(1) Two 16-inch pumps, including intake and discharge piping and valves.

(2) Two gasoline engines with silencers and exhaust piping.

(3) Two right angle gear units.

b. The equipment to be furnished by the Government shall be installed under the supervision of a representative of the manufacturer. This supervision will be paid for by the Government.

13-02. Delivery. - a. The embedded items and anchor bolts for all equipment to be furnished by the Government will be available as follows: Anchor bolts approximately 30 days after notice to proceed, and other embedded items approximately 100 days after notice to proceed; and the remainder of the equipment 150 days after notice to proceed. The contractor shall notify the contracting officer of the desired date of delivery (see Paragraph 1-14).

b. The contractor shall promptly unload the materials and equipment from railroad cars and trucks, and will be held responsible for any demurrage charges incurred due to failure to unload promptly the cars or trucks. The contractor shall transport the materials and equipment from the point of delivery to the site of the work and shall store them in a suitable warehouse until they are incorporated in the work. The cost of unloading, handling, hauling, storage, and caring for materials and equipment furnished by the Government shall be included in the contract price for Item 21.

c. The contractor shall check the quantity and condition of all materials and equipment when delivered to him and in case there is any damage to, or shortage of, material or equipment, he shall so report to the contracting officer, in writing, within 24 hours.

13-03. Packing and shipping. - All of the equipment that is to be furnished by the contractor and installed under the contract shall be adequately protected during shipment and shall be brought to the site of the work in good condition, free from damage, corrosion, or other defects. The apparatus shall be boxed, crated, or otherwise protected so as to prevent damage during shipment. Before shipment, all the apparatus shall be thoroughly cleaned, unfinished iron and steel surfaces shall be painted as required in Section XIV, and all finished surfaces that might be subject to rust or corrosion prior to assembly shall be coated with a suitable, easily removable, rust-preventing compound (see Paragraph 1-13).

13-04. Installation. - The contractor shall install, erect, attach or build into the structures all the machinery, piping, and other metal work in a workmanlike manner as shown on the drawings or directed by the contracting officer. Wherever possible, all parts shall be made accurately to standard gauge to facilitate replacement and repair. All work of the installation of the equipment shall follow the best modern practice in the installation of machinery of this type, notwithstanding any omission from these specifications. All work of installation shall be done by mechanics skilled in their various trades. The equipment shall be anchored to concrete foundations by means of steel anchor bolts. The anchor bolts shall be set at the time of placing the concrete foundations, as shown on the drawings. The concrete foundations for the equipment shall be constructed to the dimensions shown on the drawings or as recommended by the equipment manufacturer and shall be securely attached to the structural concrete floor slab by means of steel dowels. The equipment shall be given a touch-up coat of paint as required before the finish painting is done. (See Section XIV.)

13-05. Pumps, gear units, discharge piping, valves and accessories. - Two 16-inch volute type pumps complete with intake and discharge piping, gate valves, check valves, gear units, anchor bolts and accessories shall be installed in the pumping station at the locations as shown on the drawings. The complete pumping units shall be set accurately plumb and anchored to the concrete floor slab by means of anchor bolts. The contractor will be permitted to grout in the wall section of each pump after the pump is assembled. The anchor bolts shall be set at the time the concrete is placed. The gate valves and horizontal discharge piping will be supported by concrete bases as shown on the drawings. All discharge piping shall be securely anchored, as shown on the drawings, at the section extending through the pumping station wall.

13-06. Gasoline engines. - Two gasoline engines with silencers and exhaust piping, anchor bolts and accessories shall be installed in the pumping station at the locations shown on the drawings. The contractor shall furnish and install a 2-inch insulation similar and equal to Keasbey and Mattison "Hy-Temp", Johns Manville "Superex", or Carey "Hi-Temp", with an 8-ounce canvas jacket for exhaust pipe assembly insulation as shown on the drawings. The gasoline engines shall be set accurately and anchored to the floor slab by means of anchor bolts. The anchor bolts shall be set at the time the concrete is placed.

13-07. Pipe fitting. - All pipe connections and joints shall be made tight and shall conform to local laws and regulations. Pipe threads shall be coated with Crane thread lubricant or equal so as to insure a tight joint. Sleeves for all pipes through floors and walls shall be extra strong, black wrought iron pipe conforming to Federal Specification WW-P-441a for Wrought Iron Pipe. A lead joint shall be caulked between the pipe and the sleeve to form a watertight joint. Before any piping is covered up, it shall be tested for leaks and made tight. All piping tests shall be conducted as directed by the contracting officer and in the presence of his authorized representative.

13-08. Operation of equipment. - a. Equipment furnished by the contractor. - (1) After installation, all of the equipment and apparatus furnished and installed under the contract shall be placed in operation by the contractor and operated for a sufficient length of time and in such a manner as to satisfy the contracting officer that the equipment has been properly installed and that it meets all of the other requirements of the specifications. The contractor shall also perform such field tests as are required by the specifications and as may be directed by the contracting officer, relating to the following equipment:

Electric lightand power system (see Section X).
Traveling crane (see Paragraph 11-08).
Miscellaneous equipment (see Section XII).

(2) In the event the operation or testing of the equipment by the contractor discloses any defects or failure to comply with the specifications, the equipment shall be immediately shut down and said defect or failure shall be corrected by the contractor to the satisfaction of the contracting officer, and the equipment shall again be placed in operation (see Paragraphs 1-37, 13-10 b and 13-11 a).

b. Equipment furnished by the Government. - After installation, all of the equipment furnished by the Government (see Paragraph 13-01 a), and installed under the contract shall be placed in operation by the contractor and operated for a sufficient length of time and in such a manner as to satisfy the contracting officer that the equipment has been properly installed. In the event the operation of the equipment by the contractor discloses any defect due to faulty or improper installation, the equipment shall be immediately shut down and said defect shall be corrected by the contractor to the satisfaction of the contracting officer. All field tests of this equipment will be conducted by the Government (see Paragraphs 1-37, 13-10 and 13-11 b).

13-09. Fuel and lubricants. - All fuel, electric energy, and lubricants necessary to place the equipment furnished under these specifications in operation and to perform the required field tests shall be furnished by the contractor. All oil reservoirs and grease containers shall be filled to their proper operating level. All fuel, lubricants, and other materials furnished by the contractor shall be those recommended by the manufacturer of the equipment in which it is to be used and shall meet the a pproval of the contracting officer. The Government will furnish all fuels and lubricants necessary to place in operation the equipment furnished by the Government.

13-10. Tests. - a. Installation. - Special care shall be exercised when aligning gear unit and pump shafts to insure free running in the bearings without binding. The shafts shall be turned by hand for at least 50 complete revolutions of the pump impeller. After the pump unit is completely installed it shall be given a thorough check for alignment and anchorage. The gate valves shall be opened and closed to insure free travel from the fully closed to the fully open positions. The check valve shall be swung open and shut without causing any undue binding.

b. Final operations. - After complete installation of pumping station equipment the contractor shall operate the equipment for sufficient duration to ascertain that all equipment is in good running condition. Any changes or adjustments necessary to secure satisfactory operation shall be made by and at the expense of the contractor. Provided that if any part of the equipment is found to be defective due to no fault of the contractor as determined by the contracting officer, the contracting officer may order the contractor to correct such defects and payments therefor will be made to the contractor under the provisions of Article 3 of the contract.

13-11. Payment. - a. Equipment furnished by the contractor. - Payment for installing and testing the equipment and apparatus furnished by the contractor shall be included in the applicable contract prices. (See Sections X to XII, incl.)

b. Equipment furnished by the Government. - Payment for installing the equipment furnished by the Government (see Paragraphs 1-14 and 13-01 a) will be made at the contract price for Item 21, "Installing Equipment Furnished by the Government," and shall include the cost of unloading and hauling from the point of delivery, storing, handling, erecting, cleaning, placing, painting, testing and maintaining said equipment until final acceptance of the work by the contracting officer, and for furnishing and installing gasoline engine exhaust pipe insulations, as specified.

c. Coordination of the work. - It is the intention of these specifications to provide for the construction of a complete and finished pumping station, ready for operation, and the prices named in the contract shall include all labor, equipment, material, expenses, and costs which are not properly to be classified under any other item or items, and which may be necessary completely to perform the work to be done under said item in the manner herein set forth and specified. The contractor shall, without additional compensation therefor, coordinate and join together all of the various subdivisions of the work and complete the pumping station in accordance with the drawings and specifications.

SECTION XIV. PAINTING

14-01. Work included. - The contractor shall do all shop and field painting of equipment, and all other painting required at the pumping station, except that shop painting of equipment furnished by the Government as provided in Paragraph 1-14 will be done by others. All exposed iron and steel work not galvanized, all unfinished iron or steel parts of the equipment, all doors, door frames, and louvers, and the finished concrete surfaces of the engine-roof floor and side walls shall be painted.

14-02. Paint materials. - a. All paint and paint materials shall conform, where applicable, to Federal Specifications of Group TT.

b. Priming coats for metal work shall be pure red lead paint, except that priming coats for standard manufactured articles and equipment may conform to the manufacturer's standard practice when approved by the contracting officer. Red lead paint shall be mixed in approximately the following proportions:

Paste red lead.....	100 lbs.
Raw linseed oil.....	1-7/8 gals.
Turpentine.....	2-1/2 pints (max.)
Drier.....	2-1/2 pints (max.)

c. Except as otherwise provided, finish painting above the engine-room floor shall be done with pure lead and oil paint of a composition and color as specified herein or approved by the contracting officer. With the exception of color pigments, the only pigments used in the paint shall be lead carbonate, zinc oxide, and titanium dioxide. No lithopone or fillers shall be used in the paint. Samples of all paint shall be submitted to the contracting officer for approval and selection.

14-03. Painting steel. - a. All ungalvanized structural and miscellaneous steel work not to be encased in concrete shall be given one shop coat and one field coat of red lead paint. After the shop fabrication has been completed and accepted, all material shall be cleaned of rust, loose scale, dirt, oil, grease, and other foreign substances, by wiping with gasoline or benzene, or by other approved means. After cleaning, the steel shall be given one shop coat of red lead paint. Surfaces which will not be accessible after assembly, but not in contact in riveted connections, shall be given a second shop coat.

b. After erection, the steel shall be touched up by painting over all spots where the shop coat has been scratched, knocked off, or otherwise damaged. After touching up, the steel shall then be given a field coat of red lead paint. Either the shop coat or field coat shall contain a small amount of lamp black so that the field coat may be readily differentiated from the shop coat.

c. Steel above the engine-room floor shall be given one finishe coat of approved paint (see Paragraph 14-02 c). Finish painting of steel below the engine-room floor shall be one coat of an asphalt paint similar and equal to "Anchor" asphalt paint manufactured by the Barrett Company of New York, and shall meet the requirements of Federal Specification TT-V-51, Type B, for Asphalt Varnish.

14-04. Painting equipment. - a. The equipment furnished by the Government will be painted by the equipment manufacturer. After installation, the contractor shall touch up all painted surfaces of equipment below the engine-room floor as found necessary by the contracting officer with the same type and color of paint as originally used by the manufacturer. Equipment above the engine-room floor shall be given one coat of approved paint (see Paragraph 14-02 c).

b. All unfinished iron and steel parts of the equipment furnished by the contractor shall be given one shop priming coat, one field touch-up priming coat, and two finish coats of approved paint (see Paragraph 14-02 c).

14-05. Painting pipe. - All exposed, ungalvanized iron and steel pipe, valves, and fittings shall be given one shop priming coat, one field priming coat, and two finish coats of approved paint. Cast iron pipe and other pipe below the engine-room floor shall be finished with black asphalt paint as specified in Paragraph 14-03 c. Unless otherwise directed by the contracting officer, pipe insulation shall be sized and painted with two coats of an approved lead and oil paint.

14-06. Painting tanks and trash rack. - a. That portion of the trash rack that is not encased in concrete shall be thoroughly cleaned and given one coat of red lead paint after installation. The finish painting shall consist of two coats of black graphite paint. Painting shall be similar and equal to Detroit Graphite Company's Iron-Gard System for underwater steel structures.

b. The gasoline and oil tanks shall be painted in the shop with one coat of red lead paint and two coats of black graphite paint as specified in subparagraph a above. After installation any spots on the tanks where the paint has been damaged shall be touched up with graphite paint.

14-07. Painting concrete. - The concrete floor and equipment foundations of the engine-room and the walls below the brick masonry shall be painted with two coats of an approved lead and oil paint. Before painting, the concrete shall be thoroughly cleaned of all dirt, oil, grease, and other foreign material by scrubbing with soap-suds and flushing with clean, warm water. After washing, the concrete shall be treated with a weak solution of muriatic acid and again flushed with clean water. The concrete shall then be allowed to become thoroughly dry before painting. No painting shall be applied to concrete for at least 30 days after the concrete is placed.

14-08. Application of paint. - Paint may be applied by either brushing or spraying, provided satisfactory results are obtained. No paint shall be applied on damp or frosted surfaces and material painted under cover in damp or cold weather shall remain under cover until dry. Painting shall be done in a neat and workmanlike manner and all joints and crevices shall be thoroughly coated.

14-09. Payment. - No direct payment will be made to the contractor for painting, but all compensation desired therefor shall be included in the contract prices for the several contract items involved.

SECTION XV. MISCELLANEOUS (Items 22 to 26, incl.)

15-01. Placing topsoil and seeding (Items 22 and 23). - a. Work included. - The contractor shall furnish and place topsoil in the earth fills as shown on the drawings, and on other areas as required by the contracting officer. Under Item 22, acceptable topsoil shall be placed to the required depth over the required areas. Under Item 23, the prepared topsoil surface shall be seeded when and as directed by the contracting officer.

b. Placing topsoil. - After the backfill has been completed to the required dimensions, the contractor shall apply the stored topsoil (see Paragraph 3-01 b) or additional acceptable topsoil if necessary, to the specified depth when compacted, over the backfill to the limits shown on the drawings. The topsoil shall be lightly rolled or tamped and any unevenness of surface shall be corrected to conform to finished grades.

c. Seeding. - (1) Preparation. - All grass or cover crop seed shall be sown, when directed by the contracting officer, so as to secure the greatest possible protection against erosion. The finished surface grade shall be maintained in a true and even condition during the seed-sowing operation, and the contractor shall rake the soil to a depth of three-quarters of an inch (3/4") by using iron rakes immediately previous to sowing seed. All raking shall be done in a direction parallel to the contour lines on the slope and not uphill or downhill. All sticks, stones, weeks or trash appearing on the surface shall be removed.

(2) Seed mixture. - The following mixture will be approved for each acre of seeding:

Perennial Rye Grass	7 lbs.
Orchard Grass	15 lbs.
Hard Fescue	4 lbs.
Kentucky Blue	6 lbs.
Sheep Fescue	6 lbs.
Timothy	7 lbs.
Perennial Red Clover	4 lbs.
White Clover	4 lbs.
Red Top	7 lbs.
Total per acre	60 lbs.

For all seeded areas, about 15 pounds of oats per acre shall be added if the planting is done between the middle of June and the middle of September, and about 15 pounds of winter rye per acre shall be added if the planting is permitted and done in the late season after the middle of September.

(3) Method of seeding. - The contractor shall take advantage of favorable weather and shall employ a method of sowing

satisfactory to the contracting officer. The seed shall be raked in and the whole surface then lightly rolled. Seeding shall be done immediately after the preparation of the earth surface and completion of sodding operations unless otherwise directed. If there by any any delay, and if weeds grow in and with the grass, such weeds shall be cut before they go to seed or at such time as directed by the contracting officer. If any loam is washed away or any portions of the seeded areas are not covered by grass, the contractor shall replace the topsoil, fertilize, and re-seed.

(4) Maintenance. - The contractor shall maintain the areas sown to grass seed on each section of the project, until all work on the entire contract has been completed and accepted by the contracting officer. This maintenance shall consist of occasional mowing with a scythe or mechanical mower, watering during periods of drought, and removal of conspicuous weeds, or any other similar operations whenever required by the contracting officer. The turf areas shall be fertilized with an acceptable commercial lawn fertilizer of a quality equal to Vigoro or Scott's lawn fertilizer at the customary quantity per acre recommended by the manufacturer.

d. Measurement and payment. - (1) The quantity of topsoil to be paid for under Item 22 will be the number of cubic yards actually placed in accordance with directions, measured after compacting whether obtained from stockpiles or from other sources at the expense of the contractor. Payment shall include the costs of all labor, materials and expenses incidental to furnishing and placing the topsoil. Payment will be made at the contract unit price for Item 22, "Topsoil".

(2) The quantity to be paid for under Item 23 will be the number of square yards seeded as directed. The measurement will be the actual superficial areas seeded. Payment shall include all costs for seeding as specified in subparagraph c above, and for all materials and expenses incidental thereto. Payment will be made at the contract unit price for Item 23, "Seeding".

15-02. Gate valve and miscellaneous pipe (Item 24). - a. Work included. - The contractor shall furnish and place a gate valve and miscellaneous cast iron and wrought iron pipe of various sizes, including specials, as shown on the drawings or required by the contracting officer.

b. Materials. - (1) The gate valve shall be a Crane Co. No. 490-1/2 or equal and shall conform to the requirements of current American Water Works Association specifications applicable to the size and use intended.

(2) The 4-inch cast iron pipe shall have a bell end where connecting to the 4-inch V.C. pipe and a flange end where connecting to the 4-inch gate valve inside the pumping station.

(3) The 6-inch extra heavy wrought iron pipe extends through the pumping station wall as a sleeve through which the 4-inch cast iron pipe extends.

(4) The 2-1/2-inch wrought iron pipe extends through the pumping station wall as a sleeve for a future water connection and shall be capped on the outside end.

(5) All cast iron pipe shall meet the requirements of current American Water Works Association specifications for standard weight pipe, Class A, where applicable, shall be asphalt-coated inside and outside, and shall have bell-and-spigot or flanged joints as shown on the drawings or as directed by the contracting officer. Flanged cast iron pipe shall have flanges faced and drilled to the 125-pound American Standard and the bolts used in the installation of the pipe shall conform to appropriate Federal Specifications.

(6) All wrought iron pipe shall conform to Federal Specification WW-P-441a where applicable.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 3-04. Pipe trenches shall have the dimensions shown on the drawings. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least 2 inches up each side. Where encountered, rock or boulders shall be removed to a depth sufficient to clear the underside of the pipe and the voids backfilled with well compacted suitable material.

d. Laying pipe. - (1) All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury. The pipe shall be carefully bedded, and properly connected and jointed. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field. The interior of the pipe shall be carefully cleaned after laying to remove dirt and other obstructions.

(2) Bell-and-spigot joints shall be fully fitted together and shall be made fast by first adjusting the spigot end with wedges to obtain a uniform joint space, and then thoroughly packed with oakum or jute and caulked with lead. Flanged joints shall be carefully jointed and connected, and suitable lead or other gaskets shall be used as directed by the contracting officer, to prevent rupture in tightening bolts. Before backfilling, the pipe shall be tested for leakage by a suitable water pressure test where required and as directed by the contracting officer.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe to the limits shown on the drawings or as directed by the contracting officer. Hand tamping shall be done as directed.

f. Payment. - (1) Payment will be made at the contract price for Item 24, "Gate Valve and Miscellaneous Pipe", and shall include all costs of furnishing and installing the gate valve and miscellaneous cast iron and wrought iron pipe, including specials and any concrete required, except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 2 (see Paragraph 3-03 f). Payment for earth backfill will be made at the applicable contract unit prices for Items 3 and 4 (see Paragraph 1-05).

15-03. Gravel for roads (Item 25). - a. Work included. - The contractor shall furnish and place gravel, or crushed stone if approved by the contracting officer, of the sizes and quality specified or directed for surfacing of roads, to the lines and grades shown on the drawings.

b. Material. - The gravel or crushed stone shall be composed of hard, durable stones, free from thin or elongated pieces. The gravel or crushed stone shall be of such sizes for the bottom layer that all will pass a 3-inch screen with square openings and not less than 50 percent will be retained on a 1-1/4-inch screen with square openings; and for the top layer, all will pass through a 1-inch screen with square openings, and not less than 50 percent will be retained on a 1/4-inch screen with square openings; and for either layer it shall be uniformly graded. The finer material shall consist of sand or other suitable binding material encountered in bank-run gravel and approved by the contracting officer. Should the material as received for the work fail to maintain suitable proportions of coarse and fine particles, or should the coarse particles not be uniformly graded between the maximum and minimum sizes as specified, it shall be screened or mixed in such a manner as to furnish a material to meet the above requirements.

c. Placing. - The 8-inch gravel base shall be placed in two layers, a bottom layer and a top layer each 4 inches thick after compaction. After the subgrade or foundation shall have been properly prepared and compacted and proper drainage provided, the bottom layer of material shall be spread evenly by means of approved spreader vehicles or trucks. The material as spread shall be well-graded with no pockets of fine material or segregation of large and fine particles. After being spread evenly, the material shall be thoroughly compacted, by rolling with a self-propelled three-wheel roller weighing not less than ten tons, until a firm even surface is obtained. After the bottom layer has been properly and satisfactorily compacted, the top layer shall be spread and compacted to the required thickness. If at any time the material does not contain a sufficient amount of moisture to insure binding of the material, water shall be added by any approved method in a sufficient amount to obtain the desired results.

d. Measurement and payment. - The quantity to be paid for under Item 25 will be the number of cubic yards furnished and placed

in accordance with the drawings or as directed by the contracting officer. The material will be measured in place after compacting. Payment will be made at the contract unit price for Item 25, "Gravel for Roads", and shall include payment for all expenses incidental forfurnishing, placing, rolling or otherwise compacting the gravel or crushed stone.

15-04. Carbon dioxide fire extinguishing equipment (Item 26). - a. - Description. - The contractor shall furnish and install two portable, 15-pound, carbon dioxide fire extinguishers, each with three feet of hose, a nozzle, and a permanent shut-off of the seat type. Each portable extinguisher shall be mounted on a wall bracket and located as directed by the contracting officer. The equipment shall be similar and equal to that manufactured by Walter Kidde and Company or the C-O-Two Equipment Company. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the carbon dioxide fire extinguishing equipment which he proposes to install.

b. Payment. - The contractor will be paid the contract price for Item 26, "Carbon Dioxide Fire Extinguishing Equipment" for furnishing and installing the carbon dioxide fire extinguishing equipment as required by the specifications.

15-05. Cleaning up. - a. Work included. - The contractor shall remove all construction equipment and all temporary structures built or used by him, shall remove rubbish of all kinds from the site of the work, and from any grounds which he shall have occupied within the limits of the work, and shall leave the site of the work in a clean condition satisfactory to the contracting officer. All materials salvaged shall be the property of the contractor.

b. Payment. - For all work, materials, and incidentals required to clean up as set forth in a above, the contractor will receive no direct payment, but payment shall be considered as having been included in the contract prices for Items 1 to 26, inclusive.

United States Engineer Office
Providence, Rhode Island
April 30, 1941

PART II

PITKIN STREET PUMPING STATION

DETAILED SPECIFICATIONS

SECTION II. CONTROL OF WATER AND SEWAGE (Item 1)

2-01. Work included. - a. All permanent construction shall be carried on in areas free from water unless otherwise authorized by the contracting officer. Necessary shoring, sheeting and pumping and clearances for the permanent work shall be provided (see Paragraphs 3-01 d(4) and 3-03 d).

b. If the water surface rises above Elevation 8.8 at the pumping station site, and causes damage to the permanent work, during the period of the contract, such damage shall be repaired by the contractor and will be paid for by the Government at the applicable contract unit prices.

c. The contractor shall maintain existing operating sewers during construction so that their discharges are unimpeded, and shall divert the water and sewage away from the permanent construction by flumes or otherwise as directed by the contracting officer.

2-02. Cofferdam protection. - Any suitable type of cofferdam may be used, subject to the approval of the contracting officer. The contractor shall be responsible for the adequacy of the cofferdam protection, and for any damage resulting from failure or washing out of cofferdams. Subject to the approval of the contracting officer, materials excavated from the work shown on the drawings may be used for constructing cofferdams.

2-03. Maintaining existing sewers. - Provisions shall be made to maintain the satisfactory operation of existing sewers throughout the construction period, unless otherwise authorized by the contracting officer. The contractor shall install temporary sewer extensions and connections, including valves and specials, necessary to divert the sewage away from the work. The installation of temporary sewer extensions and connections shall include all shoring, excavation, backfilling, and other incidental work required in connection therewith.

2-04. Pumping and draining. - Before beginning work within the cofferdams, the sewage shall be diverted and the construction areas shall be unwatered and shall be kept free from water and sewage throughout the working period, unless otherwise authorized by the contracting officer.

2-05. Removal of cofferdams and temporary sewer connections. - When the work is finished within the cofferdams or when the need for the cofferdams and temporary sewer connections no longer exists, the temporary protection works and sewer connections shall be removed to spoil areas or otherwise disposed of as approved by the contracting officer.

2-06. Payment. - The contract price for Item 1 shall include payment for control of water and sewage during construction, the construction, maintenance, rebuilding in case of destruction, unwatering and removal of cofferdams, construction and removal of temporary sewer connections, and maintenance of unobstructed flow through the existing sewers encountered in the work. Payment will be made in one sum at the contract price for Item 1, "Control of Water and Sewage", when, in the opinion of the contracting officer, the permanent construction no longer requires the protective measures specified under Item 1, and when such protective measures have been removed to the satisfaction of the contracting officer.

SECTION III. EXCAVATION (Item 2)

3-01. General provisions. - a. Scope of work. - The location and character of the proposed structures and the location and logs of borings are shown on the drawings (see Paragraph 1-04). It is the intent of the Government that excavation be made to the lines and grades given thereon but the right is reserved to modify any part of the work if, in the opinion of the contracting officer, conditions require such modification (see Articles 3 and 4 of the contract).

b. Disposal of material. - Material from the excavations needed for backfill shall be stockpiled and used in the permanent construction as directed by the contracting officer. Materials from the excavation not needed for use in the permanent construction shall be wasted in spoil areas in approved locations as directed by the contracting officer.

c. Measurement. - (1) Excavation will be measured in place and the volume thereof will be computed between the original ground surface as determined by a survey made just prior to the commencement of the work and the pay lines shown on the drawings.

(2) Where pay lines are not shown on the drawings, measurement will be made of the volume between the original surface as determined from the survey made just prior to the commencement of the work and the lines and grades established by the contracting officer.

d. Payment. - (1) Items included. - The contract prices for the various classes of excavation shall include the cost of all labor, plant, and incidental costs for excavating, loading, hauling and disposal of the material in the backfills or spoil areas, including any stockpiling and rehandling, and the grading and dressing of spoil areas.

(2) Construction roads. - The construction and maintenance of roads and bridges for the contractor's use will not be paid for as such but the cost thereof shall be included in the contract prices for the other items of work.

(3) Pay lines. - Payment for all structure excavations will be made to the pay or slope lines shown on the drawings regardless of whether or not it is necessary to remove the material to slopes greater or less than those shown. No payment will be made for excavation outside of the limits described above and the contractor will be required to backfill any such excess excavation with approved material, or with additional concrete where excess excavations are adjacent to concrete structures, at his own expense.

(4) Shoring. - Where approved by the contracting officer, shoring may be used in lieu of excavation to the slope or pay lines shown on the drawings. The contractor shall be responsible for the unfinished work, and that workmen shall be safe from danger of caving or slides while

making structure excavations. Shoring shall be erected in a safe and workmanlike manner, and shall be placed in such a way as to afford ready inspection of and ample clearance for the permanent work. Shoring shall be removed upon completion of the permanent work or as soon as the construction does not require its use. No payment will be made for temporary shoring, but the cost thereof shall be included in the contract price for the excavation. Measurement for payment for excavation will be made to the pay lines specified in Paragraph 3-01 d(3).

(5) Temporary drains. - The contractor shall maintain the site of the work and adjacent grounds in a well drained condition. Temporary drains and ditches required shall be constructed by the contractor at his own expense.

3-02. Classification. - All materials excavated will be classified as follows:

Common excavation - general shall include the removal of all materials to the lines and grades shown on the drawings or established by the contracting officer.

3-03. Common excavation - general (Item 2). - a. Work included. - The contractor shall excavate and dispose of the materials classified as common excavation - general, above and below the mean water level in the river to the lines and grades shown on the drawings for the respective areas, or as otherwise directed by the contracting officer. Excavation shall be performed in accordance with a schedule of operations to be approved by the contracting officer. Common excavation - general includes excavation for the foundation of the pumping station and any other required common excavation for structures, drains and ditches not included in other items of the work.

b. Description. - Excavations shall be made wide enough to permit sheeting, bracing and form work where necessary. Foundations for the concrete structures shall be excavated as directed by the contracting officer to suitable undisturbed foundation material approved by the contracting officer.

c. Shoring. - See Paragraph 3-01 d(4).

d. Sheeting and pumping. - The contractor shall provide all necessary pumps to unwater the site properly and to keep the site free from water during such time as the work is under construction. The contractor shall provide all labor and materials required to keep the site unwatered during the course of construction, and shall provide all necessary sheeting, bulkheads, sumps, drains, etc., to prevent running water from coming in contact with newly placed concrete or concrete being placed. (See Section II.)

e. Disposal of materials. - The provisions of Paragraph 3-01 b shall apply. Excavated materials not used in permanent construction may be used in temporary construction if approved by the contracting officer. Materials for backfill (see Paragraphs 4-02 and 4-03) shall be stockpiled in the vicinity of the work for later use.

f. Measurement and payment. - Measurement for excavation work under Item 2 will be made as specified in Paragraph 3-01 c. Payment for all work in connection with excavation under Item 2, including the loading, hauling and disposal of the materials, will be made at the contract unit price for Item 2, "Common Excavation - general".

SECTION IV. MISCELLANEOUS BACKFILL (Items 3 and 4)

4-01. General. - "Compacted Backfill", Item 3, is structure backfill required around concrete structures and elsewhere as shown on the drawings. "Semi-Compacted Backfill", Item 4, is backfill required around miscellaneous pipes as shown on the drawings.

4-02. Compacted backfill (Item 3). - a. Work included. - The contractor shall place, grade, and consolidate materials required for backfill of concrete structures, and elsewhere as directed.

b. Materials. - Materials shall be obtained from stockpiles of excavated materials (see Paragraph 3-01 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish, or other unsuitable materials.

c. Placing. - The backfills shall consist of materials suitable for the purpose as determined by the contracting officer. The backfill shall be thoroughly compacted in 4-inch layers by tamping with hand or power tampers.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after compaction. Payment for all work in connection with furnishing and placing compacted backfill will be made at the contract unit price for Item 3, "Compacted Backfill".

4-03. Semi-compacted backfill (Item 4). - a. Work included. - The contractor shall place, grade, and consolidate materials required for backfill of miscellaneous pipes and elsewhere as directed.

b. Materials. - Materials shall be obtained from stockpiles of excavated materials (see Paragraph 3-01 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish, or other unsuitable materials or substances.

c. Placing. - (1) The backfills shall consist of materials suitable for the purpose as determined by the contracting officer, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross section. Each layer shall be consolidated with water or otherwise compacted to the extent directed so that no settlement or voids will later result.

(2) Where backfill is to be placed against only one side of a concrete wall or other structure, no backfill material shall be placed until the concrete has been in place at least 10 days and then only by hand or by trucks or bulldozers operating not closer to the wall than the height of the wall above the foundation. No backfill shall be compacted, nor

placed by dragline, clamshell, or other equipment which drops the material in relatively large quantities, nor spread by equipment operating closer to the wall than the height of the wall, until the concrete has been in place 14 days.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of semi-compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after compaction. Payment for all work in connection with furnishing and placing semi-compacted backfill will be made at the contract unit price for Item 4, "Semi-Compacted Backfill".

SECTION V. DRAINS (Items 5 and 6)

5-01. General. - "4-Inch V.C. Pipe", Item 5, will be required for connecting to existing vitrified clay pipe where shown on the drawings or as directed by the contracting officer. "30-Inch Cast Iron Pipe", Item 6, will be required for connecting to existing cast iron pipe where shown on the drawings or as directed by the contracting officer.

5-02. 4-Inch V.C. Pipe (Item 5). - a. Work included. - The contractor shall furnish and lay vitrified clay pipe, including specials, of the required diameters for the drainage system as shown on the drawings, or as directed.

b. Materials. - (1) All pipe shall be bell-and-spigot, vitrified clay pipe, conforming to the requirements of Federal Specification SS-P-361, or subsequent amendments or revisions thereof. Each pipe shall be carefully inspected immediately before laying and no cracked, broken, or otherwise imperfect pipe shall be used, except for minor defects which, in the opinion of the contracting officer, do not impair the fitness of the pipe for the purpose intended.

(2) Subject to the approval of the contracting officer, non-reinforced concrete pipe conforming to the provisions of the A.S.T.M. C14-35 standard specifications for concrete sewer pipe may be substituted for tile pipe. The provisions of subparagraph (1) above, specifying inspection and selection of pipe, shall apply.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 3-03. Pipe trenches shall have a depth of not less than 2 feet with vertical sides and a minimum width of 2 feet unless otherwise directed. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, except as otherwise shown on the drawings, so that the pipe shall be firmly supported on the bottom third of the pipe. Where encountered, rock or boulders shall be removed to a depth sufficient to clear the underside of the pipe and the voids backfilled with well compacted suitable material.

d. Laying pipe. - Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded, and properly connected and jointed. Bell holes shall be excavated to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall meet the requirements of Paragraphs 6-05 and 6-06. The spigots shall be centered in the bells, and there shall be no shoulders or unevenness of any kind along the invert of the pipes. Special

care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement grout to center the pipe. The mortar shall be thoroughly troweled into the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. Mortar joints shall be protected from the sun by a covering of burlap or moist earth over the top third of the pipe. The interior of the pipe shall be carefully cleaned after laying to remove dirt, mortar, and other obstructions.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraphs 4-02 and 4-03, as shown on the drawings or directed by the contracting officer.

f. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe installed. Payment for pipe will be made at the contract unit price for Item 5, "4-Inch V.C. Pipe", and shall include all costs of furnishing and installing the pipe including specials, and other required materials, except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 2 (see Paragraph 3-03 f). Payment for earth backfill will be made at the applicable contract unit prices for Items 3 and 4. (See Paragraph 1-05.)

5-03. 30-Inch cast iron pipe (Item 6). - a. Work included. - The contractor shall furnish and place the cast iron pipe, including bends, reducers and other specials required as shown on the drawings.

b. Materials. - All cast iron pipe shall meet the requirements of current American Water Works Association specifications for standard weight pipe, Class A, where applicable, shall be asphalt-coated inside and outside and shall have bell-and-spigot joints as shown on the drawings or as directed by the contracting officer.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 3-03. Pipe trenches shall have the dimensions shown on the drawings. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least 3 inches up each side. Where encountered, rock or boulders shall be removed to a depth sufficient to clear the underside of the pipe and the voids backfilled with well compacted suitable material.

d. Laying pipe. - (1) All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury. The pipe shall be carefully bedded, and properly connected and jointed. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field.

(2) Bell-and-spigot joints shall be fully fitted together and shall be made fast by first adjusting the spigot end with wedges to obtain a uniform joint space, and then thoroughly packed with oakum or jute and caulked with lead. Before backfilling, the pipe shall be tested for leakage by a suitable water pressure test as directed by the contracting officer.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe to the limits shown on the drawings or as directed by the contracting officer. Hand tamping shall be done as directed.

f. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe installed. Payment for pipe will be made at the contract unit price for Item 6, "30-Inch Cast Iron Pipe", and shall include all costs of furnishing and installing the pipe complete with bends, reducers and other specials, except the cost of excavation, backfilling, and any concrete required.

(2) Payment for excavation will be made at the contract unit price for Item 2 (see Paragraph 3-03 f). Payment for earth backfill will be made at the applicable contract unit prices for Items 3 and 4 (see Paragraph 1-05).

SECTION VI. CONCRETE (Items 7 to 10, incl.)

COMPOSITION, CLASSIFICATION, AND STRENGTH

6-01. Composition. - Concrete shall be composed of cement, fine aggregate, coarse aggregate, and water, so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements under this section, and suitable to the specific conditions of placement.

6-02. Classification. - Except where required to meet special conditions all concrete shall be either Class "A" or Class "B", as designated in Section VII and on the drawings for the various parts of the work in accordance with the conditions of application and the proportions of materials and strengths required.

6-03. Strength. - The mixes will be designed to secure concrete having at least the following compressive strengths at the age of 28 days, as determined by breaking standard 6-inch diameter by 12-inch height or 8-inch diameter by 16-inch height test specimens:

Class	Average for any 25 consecutive cylinders	Minimum for any one cylinder
A	3400 lbs. per sq. in.	2600 lbs. per sq. in.
B	3000 lbs. per sq. in.	2200 lbs. per sq. in.

6-04. High-early-strength concrete. - High-early-strength concrete made with high-early-strength Portland cement or other special cements shall be used only when specifically authorized by the contracting officer. The 7-day compressive strength of concrete of any class, when made with high-early-strength cement, shall be at least equal to the specified minimum 28-day compressive strength for that class. All provisions of these specifications, except for cement, shall be applicable to such concrete. Any high-early-strength cement used shall be approved by the contracting officer before use.

MATERIALS

6-05. Portland cement (Item 7). - a. The contractor shall furnish Portland cement of the quality herein specified in sufficient quantity for the work required. Cement for all concrete, grout, and mortar, except as specified in subparagraph b, shall conform to Federal Specification SS-C-206, for "Cement, Portland, Moderate-Heat-of-Hardening, September 30, 1936," except that Paragraph E-7, Heat of Hydration, shall be considered inoperative.

b. High-early-strength Portland cement. - Cement for high-early-strength concrete shall be in accordance with Federal Specification SS-C-201 for "Cement, Portland, High-Early-Strength."

c. Special test requirements. - Cement will be tested by the Government at the Central Concrete Laboratory, West Point, New York. No cement shall be used until notice has been given by the contracting officer that the test results are satisfactory. Cement which has been stored, other than in bins at the mills, for more than 4 months after being tested shall be retested before use. Ordinarily, no cement shall be used until after it has satisfactorily passed both the 7 and 28-day tests, but in cases of emergency the contracting officer may waive the 28-day tests and permit the use of cement which has satisfactorily passed the soundness and 7-day tests; provided it is the product of a quarry and mill having established a reputation of not less than 3 years' standing for the production of high-grade cement. If the tests prove any cement unsatisfactory, which has been delivered at the site of the work, such cement shall be removed promptly from the work and its vicinity.

d. Identification. - Cement shipped in bags shall be identified by the manufacturer by marking or tagging the bags with the identifying number or symbol of the Federal Specification under which it was manufactured. Bulk shipments of cement shall be likewise identified by a suitable device affixed to each car or other type of bulk carrier. Marking or tagging shall be done at the mill.

e. Quality and packages. - All cement shall be dry, finely ground and free from lumps or caking. Unless otherwise permitted, the cement shall be delivered in canvas bags or other strong, well-made packages, each plainly marked with the manufacturer's brand. The weights of such bags shall be uniform. Packages received in broken or damaged condition will be rejected or accepted only as fractional packages. Cement shall be stored in a satisfactory manner so as to be unaffected by moisture, keeping each carload separate until the results of the 28-day tests are known. Suitable accurate scales shall be provided by the contractor for weighing bulk cement.

f. Records of cement used. - The contractor shall furnish to the contracting officer, at the end of each day's work, a statement showing in such detail as he may reasonably require, the quantity of cement used during the day at each part of the work.

6-06. Fine aggregate. - a. Composition. - Fine aggregate shall be natural sand.

b. Quality. - Fine aggregate shall consist of hard, strong, durable, and uncoated particles.

c. Grading. - (1) Except as provided in (2) below, fine aggregate shall conform to the following requirements.

Total passing	Percent by weight
No. 4 sieve	95 - 100
No. 16 sieve	45 - 75
No. 50 sieve	10 - 25
No. 100 sieve	1.5 - 7

(2) Deficiencies in the percentage of fine aggregate passing #50 and #100 sieves, as required in the above gradation, may be remedied by the addition of pozzuolanic or cementitious materials, excepting Portland cement; provided, at least 5 percent passes the #50 sieve and the aggregate is of proper consistent gradation within the specified limits. Such added material, which will be considered and included as fine aggregate, shall conform to the requirements in Paragraph 6-08 and shall be in sufficient quantity to meet the minimum requirements above for percentage passing #100 sieve and otherwise to produce the workability required by the contracting officer. The quantity and characteristics of any material used for the purpose of correcting workability shall be such that when the concrete is gaged to the proper consistency, the total water content shall not exceed by more than one gallon per cubic yard the minimum quantity required for proper consistency when not using the admixture. The blending of any material with the original naturally graded sand to remedy deficiency in gradation shall be accomplished in charging the mixer, unless otherwise specifically authorized by the contracting officer.

d. Deleterious substances. - The substances designated shall not be present in excess of the following amounts:

	Percent by weight
Clay lumps	1
Material removed by decantation from aggregates	3
Shale	0.5

e. Mortar strength. - Mortar specimens made with the fine aggregates shall have a compressive strength at 28 days of at least 90 percent of the strength of similar specimens made with Ottawa sand having a fineness modulus of 2.40 ± 0.10.

f. Tests. - Fine aggregate shall be subject to careful, thorough analyses, including magnesium sulphate soundness tests (see Paragraph 6-07 d), to determine conformity with all requirements of these specifications.

6-07. Coarse aggregate. - a. Composition. - Coarse aggregate shall be washed gravel, crushed stone or any approved mixture of washed gravel and crushed stone.

b. Quality. - Coarse aggregate shall consist of hard, tough and durable particles free from adherent coating. It shall contain no vegetable matter, nor soft, friable, thin or elongated particles in quantities considered deleterious by the contracting officer. The substances designated shall not be present in excess of the following amounts (by weight):

Soft fragments	5%
Clay lumps	1/4%
Removed by decantation	1%

When the material removed by decantation consists essentially of crusher dirt, the maximum amount permitted may be raised to 1-1/2 percent. When crushed stone is used, the crusher shall be equipped with a screening system which will entirely separate the dust from the stone and convey it to a separate bin. Aggregate which has disintegrated or weathered badly under exposure conditions, similar to those which will be encountered by the work under consideration, shall not be used.

c. Size. - (1) Coarse aggregate shall be well graded from fine to coarse so that concrete of the required workability, density, and strength can be made without the use of an excess amount of sand, water, or cement.

For Class "A" concrete, required for Item 8, the maximum size mesh screen for the aggregate shall be one inch.

For Class "B" concrete, required for Item 9, the maximum size mesh screen for the aggregate shall be two inches.

(2) When the maximum size mesh screen is greater than one inch, the aggregate shall be separated, and the specified sizes delivered separately to individual proportioning hoppers, in accordance with the following:

For Maximum Size Mesh Screen, 1 in. to 2 in. inclusive:

(1) No. 4 to 1/2 maximum size mesh screen, inclusive
(2) Over 1/2 maximum size to and including full maximum size mesh screen.

Within any of the above-indicated size-limits, not less than 85 percent of the material shall be retained on a standard square mesh screen of the minimum size indicated and not more than 5 percent shall be retained on a standard square mesh screen of the maximum size indicated.

(3) The grading of the coarse aggregate, in the mixed concrete, shall fall within the following limits:

	(Percent by weight) Passing
Maximum size mesh screen (square mesh)	97 - 100
1/2 maximum size mesh screen (square mesh)	40 - 70
No. 4 sieve	0 - 6

d. Tests. - Coarse aggregate will be subjected to freezing and thawing tests and to careful, thorough analyses to determine conformity

with all requirements of these specifications. Coarse aggregate will be subjected to 10 cycles of the magnesium sulphate test for soundness. No aggregate shall be used which develops a loss in excess of 10 percent by weight.

6-08. Material added for workability. - a. The use of any material added to the mix to improve workability (see Paragraph 6-06 c (2)), which, in the opinion of the contracting officer, may have an injurious effect on the strength, density, and durability of the concrete, will not be permitted. Before approval of any material, the contractor will be required to submit the results of complete chemical and sieve analyses made by an acceptable testing laboratory. Subsequent tests will be made of samples taken by the contracting officer from the supply of the material being used on the work to determine whether it is uniform in quality with that approved.

b. The material added shall be pozzuolanic, cementitious or silicious. It shall not contain effective early-heat-producing elements or compounds, such as those contained in Portland cement, nor shall its use result in a material increase in the free-lime content of the concrete. It shall also be in conformity with the following requirements:

Free moisture - a total of not more than 3 percent by weight.
Passing #30 sieve - not less than 100 percent by weight.
Passing #200 sieve - not less than 85 percent by weight.

6-09. Water. - The water used in mixing concrete shall be fresh, clean and free from injurious amounts of oil, acid, alkali, or organic matter.

6-10. Storage. - a. Cement. - Immediately upon receipt, at the site of the work, cement shall be stored in a thoroughly dry, weather-tight, and properly ventilated building with adequate provisions for the prevention of the absorption of moisture. The building shall be of adequate capacity to provide for the requirements of delivery and construction schedules. Storage shall be such as to permit easy access for inspection and definite identification of each shipment.

b. Aggregates. - The fine and coarse aggregates shall be stored separately (see Paragraph 6-07 c (2)) and in such manner as to avoid the inclusion of any foreign material in the concrete. Stockpiles of coarse aggregates shall be built in horizontal layers to avoid segregation.

6-11. Sampling and testing aggregates. - Except where provided otherwise by these specifications, all sampling and testing of aggregates shall be made in accordance with the Federal Specifications. Unless specified otherwise, all test samples shall be taken under the supervision of the contracting officer and supplied to the Central Concrete Laboratory, West Point, New York, by the contractor at his expense. The source from which concrete aggregates are to be obtained shall be

selected by the contractor well in advance of the time when they will be required in the work, and suitable samples as they are to be used in the concrete shall be furnished to the contracting officer at least 40 days in advance of the time when the placing of the concrete is expected to begin. The contractor shall obtain fine and coarse aggregates for concrete from approved sources.

PROPORTIONING, MIXING, AND PLACING

6-12. Proportioning. - a. Basis. - All concrete materials will be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

b. Control. - The exact proportions of all materials entering into the concrete shall be as directed by the contracting officer. The contractor shall provide all equipment necessary to positively determine and control the actual amounts of all materials entering into the concrete. The proportions will be changed whenever in the opinion of the contracting officer, such change becomes necessary to obtain the specified strength and the desired density, uniformity and workability, and the contractor will not be compensated because of such changes.

c. Measurement. - All materials shall be measured by weight except that water may be measured by volume when so authorized by the contracting officer. One bag of cement will be considered as 94 pounds in weight and 1 gallon of water as 8.33 pounds.

d. Cement content. - Each cubic yard of concrete shall contain not less than the quantity of cement stated below:

Class "A" - 5.0 bags or 470 pounds
Class "B" - 4.0 bags or 376 pounds

For concrete deposited in water, the minimum cement content shall be 6.5 bags or 611 pounds to each cubic yard of concrete in place.

e. Water content. - (1) In calculating the total water content in any mix the amount of moisture carried on the surface of the aggregate particles shall be included. The total water content for a bag of cement for each batch of concrete shall not exceed the following:

Class "A" - 5.5 gallons or 45.8 pounds
Class "B" - 6.5 gallons or 54.1 pounds

In all cases, however, the amount of water to be used shall be the minimum amount necessary to produce a plastic mixture of the strength specified and of the desired density, uniformity and workability. In general, the consistency of any mix shall be that required for the specific placing conditions and methods of placement, and ordinarily the slump shall be between 1 inch and 3 inches when tested in accordance with the current specifications for "Method of Test for Consistency of Portland Cement Concrete," of the American Society for Testing Materials.

(2) An increase in the maximum water content, based only on the requirements of materials added in accordance with Paragraph 6-06 c (2) to improve workability will not be permitted unless comparative tests under job conditions show conclusively that such increase in water content will not result in a decrease in concrete strength and provided further that such increase does not exceed 1 gallon per cubic yard.

f. Aggregate content. - The total volume of aggregate to be used in each cubic yard of concrete shall be that necessary to produce a dense mixture of the required workability as determined by the contracting officer.

6-13. Mixing and placing. - a. Equipment. - The contractor shall provide at the site of the work, a modern and dependable batch type mixing plant with a minimum capacity of 100 cubic yards of concrete per 8 hours or, if approved by the contracting officer, the contractor may use ready mixed concrete delivered in standard truck mixing equipment of approved capacity. The equipment shall provide adequate facilities for the accurate measurement and control of all materials and for readily changing the proportion of materials to conform to the varying conditions of the work in order to produce concrete of the required uniform strength and durability.

b. Time. - The minimum time for mixing each batch, after all materials are in the mixer, shall be as follows:

1/2 to 1-1/2 cu. yd. mixer	1-1/2 minutes
Larger than 1-1/2 cu. yd. mixer	2 minutes

The mixer shall revolve a minimum of 12 revolutions after all materials have been placed in it, and at a uniform speed. Neither speed nor volume capacity of the mixer shall exceed those recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted.

c. Conveying. - Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. Conveying of concrete by means of chutes will not be permitted except for short chutes in the forms to distribute the concrete. Chutes used shall be such that the concrete slides in them and does not flow. Chutes with a flatter slope than 1 on 2 will not be permitted. There shall be no free vertical drop greater than 5 feet except where specifically authorized by the contracting officer.

d. Placing. - (1) Concrete shall be placed before initial set has occurred, and in no event after it has contained its water content for more than 45 minutes.

(2) Unless otherwise specified, all concrete shall be placed in the dry upon clean, damp surfaces, free from ice, frost or

running water, and never upon soft mud, dry porous earth, or upon fills that have not been subjected to approved rolling, puddling or tamping so that ultimate settlement has occurred.

(3) All monoliths shall be of the dimensions shown on the drawings.

(4) All concrete shall be deposited in approximately horizontal layers not to exceed 24 inches in thickness, unless otherwise specifically authorized or directed by the contracting officer and the concreting shall be carried on as a continuous operation, as far as practicable, until the placing in the course, section, panel or monolith is completed. Unless otherwise shown on the drawings, courses shall generally have a minimum thickness of 4 feet, and a maximum of 18 feet, except that in hot weather the contracting officer may direct the maximum be reduced to 8 feet. A minimum time interval of 48 hours shall be allowed between successive courses for the dissipation of heat of hydration. In walls of buildings, courses including door or window openings shall terminate at the tops of the openings.

(5) In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On flat surfaces, where the congestion of steel near the forms makes placing difficult, a mortar of the same cement-sand ratio as is used in the concrete shall be first deposited to cover the forms.

(6) All top surfaces not covered by forms and which are not to be covered by additional concrete or backfill shall be carried slightly above grade and struck off by board screed (see Paragraph 6-15), except that top surfaces of walls and piers not covered by forms and which are not to be covered by additional concrete or backfill, when poured in excess of 10 feet in height in one pour, shall be carried not less than 2 inches above the specified finished elevation and struck off by board screed.

e. Vibrating. - Concrete shall be placed with the aid of mechanical vibrating equipment as approved by the contracting officer. Vibration shall be transmitted directly to the concrete unless otherwise directed by the contracting officer. The frequency of vibration shall be not less than 5000 per minute. The intensity of vibration shall be sufficient to cause flow or settlement of the concrete in place. The vibration shall be of sufficient duration to accomplish thorough compaction as approved by the contracting officer. External vibration may be used for thin sections where internal vibration will be impracticable. Vibration shall be supplemented by forking or spading by hand, adjacent to the forms on exposed faces in order to secure smooth, dense, even surfaces. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures.

f. Construction joints. - Vertical joints shall be formed with tongue-and-groove bonds or keys at such locations and of such shapes

and dimensions as approved or directed by the contracting officer. Horizontal joints shall be formed with roughened level joints or with keys, or where horizontal pressure is always in one direction, with steps as approved or directed by the contracting officer. Where required, dowel rods shall be used. All concrete in vertical members shall have been in place not less than 12 hours, and longer if so directed by the contracting officer, before concrete in horizontal members resting thereon is placed. As soon as practicable after placing and immediately before placing the succeeding layers is resumed, all approximately horizontal surfaces shall be washed with a high pressure air-and-water jet, or cleaned as otherwise directed by the contracting officer. Sand shall be added to the air-and-water jet when required, to remove alkali, algae, stains, and other substances injurious to the bond. The time and method of using the jet shall be such that all laitance, scum, etc. will be removed so the partly embedded aggregate is not disturbed and is washed clean. After final cleaning and immediately before placing is resumed, the surfaces shall be wetted and spread with a layer of mortar 1/2 inch thick, thoroughly brushed in. The mortar shall be the same cement-sand ratio as the concrete. Where specified or otherwise required by the contracting officer for watertight construction, copper strips not less than 18 inches in width and weighing not less than 20 ounces per square foot, properly crimped or bent, shall be placed in the concrete to span the joint.

g. Cold weather. - Concrete shall not be placed when the ambient atmospheric temperature is below 35 degrees Fahrenheit, nor when the concrete is likely to be subject to freezing temperatures before final set has occurred, unless specifically authorized in writing by the contracting officer. When so authorized, the materials shall be heated in order that the temperature of the concrete, when deposited, shall be not less than 50 degrees Fahrenheit, nor more than 70 degrees Fahrenheit. All methods and equipment for heating shall be subject to the approval of the contracting officer.

h. Hot weather. - For concrete placed during the extremely warm summer months and otherwise, when directed by the contracting officer, the aggregates shall be cooled by frequent spraying in such manner as to utilize the cooling effect of evaporation. During such periods the placement schedule shall be arranged as approved by the contracting officer in such manner as to provide time for the temperature of the previously placed course to begin to recede. The mixing water shall be the coolest available at the site in so far as is practicable.

6-14. Test specimens. - a. Number. - Test specimens to determine whether the compressive strength of the concrete is in accordance with that specified in Paragraph 6-03 will be taken by the inspector. At least 1 set of 3 specimens will be made for every major pour. A sufficient number of specimens will be taken to give a comprehensive knowledge of the concrete placed during each day in each section of the work.

b. Method. - All specimens will be taken from the concrete at the mixing plant. The specimens will be tested by the Government at the Central Concrete Laboratory, West Point, New York. All costs of transportation and testing of specimens will be borne by the Government.

6-15. Finishing. - a. Immediately after placement, the concrete shall be properly forked back along the face of all forms by the use of standard concrete forks or spades unless otherwise specifically authorized or directed by the contracting officer. The finished surfaces shall be free from sand streaks or other voids and the plastering over of such surfaces will not be permitted. Defective concrete shall be repaired by cutting out the unsatisfactory material, and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely to the other work. This concrete shall be drier than the usual mixture and shall be thoroughly tamped into place. All surfaces of concrete not covered by forms, that are not to be covered by additional concrete, or backfill, shall have a wood float finish without addition of mortar, and shall be true to elevations as shown on the drawings. Care shall be taken to see that all excess water is removed before making this finish. Other surfaces shall be brought to the specified finished elevation and left true and regular as approved by the contracting officer. Where considered necessary by the contracting officer, or where indicated on the drawings, joints shall be carefully made with a jointing tool. Every precaution shall be taken by the contractor to protect finished surfaces from stains or abrasions. No fire shall be permitted in direct contact with any concrete at any time. Concrete surfaces or edges likely to be injured during the construction period, shall be properly protected by leaving the forms in place, or by erecting covers satisfactory to the contracting officer.

b. Floor surfaces. - Unless otherwise specified, floors of all buildings, and other surfaces where indicated on the drawings or required by the contracting officer, shall be finished with a one-inch monolithic sand-cement mortar surface. All water, laitance and any foreign matter shall be removed from surfaces. The topping mixture shall be spread evenly over all the base within 45 minutes after the base has been placed. The mortar shall be of 1 part cement and 2 parts approved clean sand. The cement and sand shall be thoroughly mixed dry and then sufficient water shall be added to produce a medium stiff mortar. After placing, the mortar shall be floated to a true, regular surface with a wood float and steel-troweled to a smooth finish. Troweling shall be the minimum amount consistent with obtaining a smooth dense surface and shall not be done until the mortar has hardened sufficiently to prevent excess fine material from being worked to the surface.

6-16. Curing. - a. Warm weather. - All concrete shall be adequately protected from injurious action by the sun. Fresh concrete shall be protected from heavy rains, flowing water, and mechanical injury. All concrete shall be kept wet for a period of not less than 14 days by covering with water, or with an approved wate-saturated covering, or by a system of perforated pipes or mechanical sprinklers, or any other

approved method which will keep all surfaces continuously (not periodically) wet. Where wood forms are left in place for curing, they shall be kept wet at all times to prevent opening at the joints and drying out of the concrete. Water for curing shall be generally clean and entirely free from any elements which in the opinion of the contracting officer might cause staining or discoloration of the concrete.

b. Cold weather. - Concrete when placed during cold weather shall be kept moist and provided with adequate protection for a period of not less than 14 days, subject to the approval of the contracting officer, so that the air in contact with the concrete will be maintained at temperatures between 50 degrees Fahrenheit and 70 degrees Fahrenheit, for at least the first 5 days of the curing period. For massive sections where the atmospheric temperatures are sufficiently low in the opinion of the contracting officer to cause excessively rapid cooling and contraction of the exterior surfaces, this period for maintaining the temperature of the air in contact with the concrete between 50 and 70 degrees Fahrenheit shall extend over the entire curing period. Salt or other chemicals shall not be admitted into the mixture to prevent freezing.

FORMS, REINFORCEMENT, AND PAYMENT

6-17. Forms. - a. Materials. - Forms shall be of wood, steel or other approved material, except that where lining is not specified; the sheeting for all exposed surfaces shall be tongue-and-groove lumber of uniform width unless otherwise specifically authorized. Forms of like character shall be used for similarly exposed surfaces in order to produce a uniform appearance. The type, size, shape, quality and strength of all materials of which the forms are made shall be subject to the approval of the contracting officer.

b. Construction. - Forms shall be built true to line and grade, and shall be mortar-tight and sufficiently rigid to prevent displacement or sagging between supports. Responsibility for their adequacy shall rest with the contractor. Their surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will be not less than 2 inches from any concrete surface. Wire ties will not be permitted where the concrete surface will be exposed to weathering and discoloration will be objectionable. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. Unless otherwise indicated, suitable moldings shall be placed to bevel or round exposed edges, at expansion joints or any other points as may be required by the contracting officer.

c. Coating. - Prior to the placing of steel reinforcement or concrete, forms for exposed surfaces shall be coated with a non-staining mineral oil. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.

d. Removal. - Forms shall not be removed without the approval of the contracting officer, and all removal shall be accomplished in such manner as will prevent injury to the concrete. Forms shall not be removed before the expiration of the minimum number of days indicated below, except when specifically authorized by the contracting officer. When, in the opinion of the contracting officer, conditions on the work are such as to justify it, forms may be required to remain in place for longer periods.

Arches, beams and slabs	7 days
Columns	3 days
Walls and vertical faces	2 days

e. Form lining for buildings. - In addition to the requirements for work specified above, the forms for walls of buildings which will be visible in the finished structures shall be lined with plywood or with pressed wood sheets, "Masonite" or approved equal. Lining shall be applied directly to the sheeting. Forms for windows and door jambs, and their flat or arched soffits, shall be lined also and the corner intersections chamfered. Jointing of the lining shall be neat and close and no patch places, cleats, or blocking will be permitted. Overrun of lining shall be trimmed to secure proper fit to adjoining surfaces. Lining with bruises, imprints or hammer marks shall not be used.

6-18. Furnishing, bending, and placing steel reinforcement (Item 10). - a. Work included. - (1) The contractor shall furnish, cut, bend and build into the concrete, in accordance with the drawings prepared by him and approved by the contracting officer (see subparagraph (2) below), all steel reinforcement of deformed bars, dowels or anchors, or any other plain steel for similar purposes. Materials shall be as specified in Paragraph 9-02 a (1).

(2) Steel reinforcement may be cut and bent at the mill or in the field. All bending shall be in accordance with standard approved practice and by approved machine methods. The contractor shall furnish drawings showing bending details and placing schedules of steel reinforcement for approval, in accordance with the provisions of Paragraph 1-04 c.

b. Placing. - (1) All steel reinforcement shall be placed in the exact positions and with the spacing shown on the drawings or ordered, and it shall be so fastened in position as to prevent its becoming displaced during the placing of the concrete. The clear distance between parallel rods shall be not less than one and one-half times the diameter of round rods, or twice the side dimensions of square rods, and unless specifically authorized, shall in no case be less than 1 inch.

(2) Except where otherwise indicated, steel reinforcement shall be placed as follows:

(a) All main reinforcement shall be placed not less than 3 inches from any surface, except in slabs and in buildings.

(b) All main reinforcement in walls and slabs exposed to the weather and in fire-resistant construction, shall be placed not less than 1-1/2 inches from the surface in walls and slabs, 2 inches in floor beams and 2 inches in girders and columns. The covering of stirrups, spacer rods, and similar secondary reinforcement may be reduced by the diameter of such rods. The above dimensions shall be measured from the face of the reinforcement to the face of the forms.

(c) Where splices in reinforcement, in addition to those indicated, are necessary, there shall be sufficient lap to transfer the stress by bond as may be directed. Rods shall be lapped not less than 40 diameters and splices shall be staggered. The lapped ends of rods shall be separated sufficiently or connected properly to develop the full strength of rod.

c. Protection. - Steel reinforcement shall be new unrusted stock, free from loose scale. It shall be at all times satisfactorily protected from moisture until placed in final position. Ends of rods that are to be left projecting for a considerable time shall be protected from corrosion by heavy wrappings of burlap saturated with bituminous material.

6-19. Embedded items. - In addition to steel reinforcement, there shall be built into, or set, or attached to the concrete, steel beams, pipes, and other metal objects as shown on the drawings or ordered. All necessary precautions shall be taken to prevent these objects from being displaced, broken or deformed. Before placing concrete, care shall be taken to determine that any embedded or wood parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter. The embedding of wood in concrete shall be avoided whenever possible, metal being used instead. The concrete shall be packed tightly around pipes and other metal work so as to prevent leakage and secure perfect adhesion. Drains shall be adequately protected from intrusion of concrete into them. Payment for this work is included in the several items for drains and metal work.

6-20. Expansion and contraction joints. - a. Expansion and contraction joints shall be constructed at such points and of such dimensions as may be indicated or required. The method and materials used shall be subject to the approval of the contracting officer and the materials shall conform to current Federal Specifications wherever applicable. Unless otherwise indicated on the drawings, or required by the contracting officer, expansion joints shall be made by coating concrete surfaces with a coat of bituminous cement as specified in subparagraph b below, and then applying premoulded sponge rubber or compressed cork filler 1/2-inch thick which shall then be similarly coated. The 1/2-inch rubber or cork filler shall be used for the 2 feet adjacent to

top surfaces and one foot adjacent to vertical surfaces. In no case shall corner protection angles or other fixed metal embedded in the surface of the concrete and bonded, be continuous through an expansion joint. Payment for all expansion joint material shall be included in the contract unit price for concrete.

b. Bituminous cement shall be an internal set-up cement of asphaltic base, composed of a liquid asphaltic fluxing agent with an admixture of powdered asphalt, asbestos fiber and other suitable inorganic fillers. When mixed in the proper proportions, the cement shall be suitable for proper trowel application and shall harden to a consistency as specified in subparagraph (3) below:

(1) The material shall be supplied in containers of proper relative size to apportion batches with the desired troweling consistency. The liquid asphaltic fluxing agent shall be a smooth uniform mixture, not thickened or jelled, and showing no separation which cannot be easily overcome by stirring. The powdered cement shall be a uniform mix containing no matted lumps of fiber.

(2) When mixed in the proportions recommended by the manufacturer, the cement shall yield not less than 85 percent of non-volatile matter when 10 grams are heated in an oven at 105 to 110 degrees Centigrade for 24 hours.

(3) When tested in accordance with A.S.T.M. Specification D5-25 for "Penetration of Bituminous Materials" the above mixture shall have the following characteristics: Immediately after mixing, using a 5/8-inch diameter steel ball, 114 grams, 5 seconds, the mixture shall permit a penetration greater than 300. The same specimen, after a lapse of 24 hours at 25 degrees Centigrade under water, shall permit a needle penetration 100 grams, 5 seconds, of not more than 100. The same specimen, after a lapse of 30 days at 25 degrees Centigrade under water, shall permit a needle penetration 100 grams, 5 seconds, of not more than 50.

6-21. Measurement and payment. - a. Portland cement (Item 7). - (1) The quantity to be paid for under Item 7 will be the number of barrels of cement used in all parts of the work unless specifically excepted. For purposes of payment, a barrel of cement shall be considered 376 pounds net of cement. The contract unit price for the cement shall include payment for all expenses incidental to delivering the cement upon the work in which it is to be used.

(2) Only the cement furnished for concrete work to be done under Items 8 and 9 (see Paragraph 1-05) will be paid for at the contract unit price for Item 7, "Cement". Cement used for mortar and grout in pipe joints, brick and stone work and under other items will be included in the payment for those items.

b. Concrete (Items 8 and 9). - See Section VII.

c. Steel reinforcement. - (Item 10). - (1) The quantity to be paid for under Item 10 will be the number of pounds of steel placed in accordance with the drawings or as directed by the contracting officer, measured as specified. It will not include any waste material due to the fact that the lengths supplied are too long for their purpose. The quantity to be paid for will, however, include extra metal in laps, where authorized, due to the fact that single bars would be unreasonably long. In computing the weights, the theoretical weight of plain bars will be used as tabulated in Federal Specification QQ-B-71a for the lengths placed as required. Wire or metal clips, and other supports necessary to hold the steel in place will not be considered as reinforcement but shall be furnished by the contractor without additional compensation. The contract unit price for Item 10, "Steel Reinforcement," shall include furnishing, bending, cutting, placing, fastening in position, coating and protecting the reinforcement, and all other work and materials connected therewith. (See Paragraph 6-18 a).

(2) Partial payments up to 50 percent of the contract price will be made for all steel reinforcement delivered to the site of the work provided the quality of such material is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the material delivered to the site of the work. The material shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any steel reinforcement stored and partly paid for is not kept protected, no further partial payments will be made and the material will be protected by the contracting officer at the expense of the contractor.

6-22. Cinder concrete. - a. Where concrete is indicated as filler in the roof of the pumping station, it shall be mixed in the approximate proportion of 1 bag of cement to 2 cubic feet of sand and 4 cubic feet of cinders, mixed as required by the contracting officer. Test blocks of concrete shall be made by and at the expense of the contractor before the concrete is placed, to determine the correct proportions of the ingredients to obtain a cinder concrete of proper qualities for nailing and permanently supporting the roof surfacing. The cement and sand shall conform to the requirements for regular concrete herein. The cinders shall be coarse, clean and free from dust. The top surface of the concrete shall be given a smooth and even finish, and shall have a uniform slope to the gutters.

b. If so elected by the contractor and approved by the contracting officer, a substitute for cinders may be used. Any such substitute must be a commercial product of proven quality, prepared especially as a roof filler. When mixed and used as recommended by the manufacturer, the resulting product must have strength and nailing properties equivalent to that of cinder concrete and its unit weight shall not be in excess of that of cinder concrete of equivalent quality.

c. Payment for cinder concrete including cement will be included in the payment for Item 11, "Pumping Station Superstructure" (see Paragraph 8-16).

SECTION VII. CONCRETE STRUCTURES (Items 8 and 9)

7-01. General. - a. Description. - Concrete structures shall be constructed as shown on the drawings or in accordance with modifications designated by the contracting officer. Concrete shall conform to all the requirements of Section VI for concrete of the class specified. Surfaces of concrete shall be finished as specified in Paragraph 6-15, except as otherwise specified in this section or indicated on the drawings.

b. Measurement and payment. - The quantity to be paid for under Items 8 and 9, will be the number of cubic yards of concrete satisfactorily placed within the required limits. No deductions shall be made for openings having a cross-sectional area less than that of a 12-inch pipe, nor for the space occupied by reinforcing steel, miscellaneous metal, wood nailing strips, or by other materials required to be built into the concrete. The contract unit prices shall include payment for all costs of furnishing materials, erecting and removing forms, mixing and placing concrete and furnishing and installing expansion joint material, except that cement, reinforcing steel and other metal work are included under other items. (See Paragraph 6-21.)

7-02. Concrete-Class "A" (Item 8). - a. Description. - This classification includes the Class "A" concrete for the pumping station, and miscellaneous structures, placed between the limiting lines and grades as shown on the drawings or directed by the contracting officer. Forms for surfaces exposed to view shall be constructed in accordance with the provisions of Paragraph 6-17. Concrete fins formed on exposed surfaces shall be removed after the forms are stripped. Pipe drains and miscellaneous metal work shall be installed as provided for on the drawings. Any grouting of metal work shall be included as part of the concrete.

b. Measurement and payment. - The volume of concrete to be paid for will be the volume computed between the limiting lines and grades, as shown on the drawings or directed by the contracting officer. Payment will be made at the contract unit price for Item 8, "Concrete - Class 'A'."

7-03. Concrete-Class "B" (Item 9). - a. Description. - This classification includes the Class "B" concrete for the pumping station foundation as shown on the drawings or directed by the contracting officer. Piping and miscellaneous metal work shall be set and concreted in place as provided for on the drawings.

b. Measurement and payment. - The volume of concrete to be paid for will be the volume computed between the limiting lines and grades, as shown on the drawings or directed by the contracting officer. Payment will be made at the contract unit price for Item 9, "Concrete - Class 'B'."

SECTION VIII. PUMPING STATION SUPERSTRUCTURE (Item 11)

8-01. Work included. - The contractor shall furnish all labor, equipment and materials, except the plaque furnished by the Government (see Paragraph 8-14 b), and shall construct and complete, in accordance with the specifications and the drawings, the pumping station superstructure. Item 11 shall include all work incidental to the construction of the pumping station superstructure, and other miscellaneous work in the pumping station as shown on the drawings, except the furnishing and installation of such equipment as is specifically included in other items of the contract and the concrete work and reinforcing steel which will be paid for under Items 8 and 10. The work includes the concrete and reinforcing steel in the roof slab, the structural steel, consisting essentially of columns, roof beams, crane beams and rails, brick, glass-block and cast stone masonry, doors, door frames, louvers, builders' hardware, roofing, cast iron roof insulating sleeves, copper downspouts and cast iron boots, painting and other work included in the construction of the pumping station superstructure.

8-02. Structural steel. - a. All structural steel shapes, plates, bars, and their products shall conform to the requirements of Federal Specification QQ-S-711a for Steel; Structural (for) Bridges. The fabrication and erection of all structural steel shall conform to the requirements of the current American Institute of Steel Construction Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

b. Drawings for approval. - Before commencing fabrication, the contractor shall submit to the contracting officer for approval complete shop details in accordance with Paragraph 1-04 c.

8-03. Brick masonry. - a. Brick. - All brick shall be whole, sound, straight, hard, uniform in structure, with true, even faces and sharp edges; and shall be uniform in size for their respective kinds. The facing of all exterior walls shall be standard size red shale brick in a full range of color to include reds, browns, hearts, bronzes, and blue-blacks. These brick shall be "A" grade, shall have a matt texture, and shall be similar and equal to brick as manufactured by the following companies: Claycraft Company, Columbus, Ohio, Hydraulic Pressed Brick Company, Washington, D. C., or Belden Brick Company, Canton, Ohio. The interior of the building and brick for backing up shall be best quality "Hard" grade sand-lime brick, approximate size 2-1/4 by 3-3/4 by 8 inches, conforming to the requirements of Federal Specification SS-B-681. The contractor shall submit to the contracting officer for approval, samples of all brick he proposes to use.

b. Mortar. - Mortar shall be composed of one part Portland cement, one-half part lime putty, and three parts sand by volume. Mortar shall be thoroughly mixed either by hand or in a mechanical batch mixer, and only in such q uantities that it can be used completely before it has

attained its initial set. The use of a continuous mixer or of retempered mortar will not be permitted. Only enough water shall be used to make a workable mix. All sand shall conform to the requirements of Paragraph 6-06 for fine aggregate and shall pass a No. 8 standard sieve. Sand used for the mortar for face brick shall be a natural, white or clear sand approved by the contracting officer. Lime shall conform to Federal Specifications SS-L-351 for Type "M" Hydrated Lime. Cement shall be Portland cement conforming to the requirements of Paragraph 6-05.

c. Laying brick. - (1) All brick masonry shall be accurately laid in courses as indicated on the drawings. All exposed surfaces shall be laid to lines that are plumb, true, straight, and level. Each brick shall be laid in a full bed of mortar and shall be shoved into place in the mortar, making joints that are full without subsequent slushing or filling. Except where otherwise indicated on the drawings, the brick course including mortar joint shall be 2-5/8 inches high. Vertical and horizontal mortar joints shall have the same thickness. The mortar joints of exposed face and sandlime brickwork shall be neatly underhand struck. Except where otherwise indicated, all exposed faces of brickwork shall be laid in common bond, with stretchers bonded every sixth course by a course of headers staggered for exterior and interior faces. Metal wall ties shall not be used for the bonding of brickwork, except where indicated on the drawings or authorized by the contracting officer. Care shall be taken to insure the weather-tightness of the brick masonry to its concrete foundation. The saturated fabric flashing shown on the drawings at the foundation of the brick walls shall be similar and equal to the through-wall flashings manufactured by Sandell Mfg. Corp., 70 Phillips St., Watertown, Mass., or to the Wasco copperfabric flashing, Type No. 2, manufactured by Wasco Flashing Co., Cambridge, Mass.

(2) The courses shall be laid to correspond exactly in height with the heads of doors and other openings without any cutting or chipping of the brick. Door frames and all other fixtures shall be built into the brickwork as it is laid. Brick masonry around glass block panels and door openings shall have jambs built true and plumb with the reveals at right angles and of the depth shown on the drawings; and the brickwork shall either be kept back a sufficient distance or raked out to permit a caulked joint as indicated on the drawings. The filling in or backing brickwork shall be kept level with the facing and each piece of facing material shall be backed up solid with brick and mortar so as to make a perfectly bonded homogeneous mass between wall lines. All walls shall be carried up together as nearly as possible on the same level. If during construction, the walls become displaced, damaged, or marred, by the contractor or his workmen, the contractor shall without additional compensation, execute all patching and repairing necessary to leave the entire work in perfect condition. The placing of putlogs in masonry walls is prohibited. The contractor shall place boards over all sills and projecting stone or water tables during construction.

(3) Care must be taken that the tops of all unfinished work are thoroughly covered or protected against inclement weather, by means of waterproof canvas and boards. Brick laid in warm weather shall be kept wet before laying and shall be wet when laid. Bricks laid in cold

weather shall be laid dry and warm. In winter the brick, sand, water, and other material shall be kept warm and if required by the contracting officer, shall be heated by steam pipes or other approved methods in order that the work shall proceed properly. The brickwork shall be carefully covered and protected to prevent freezing.

(4) The contractor shall carefully set or build in all door frames, wall plates, anchors, beams, bolts, or other iron work; bronze, or other incidental materials; and shall build all recesses and pipe chases, as indicated on the drawings, or directed by the contracting officer.

(5) After completion, all brickwork shall be cleaned and pointed where necessary. Before pointing, the joints shall be raked out, cleaned and well moistened. The caulking around all doors, louvers and ventilators shall be carefully checked, and the joints recaulked where necessary.

(6) The dimensions of the brickwork shown on the drawings may be varied slightly depending on the size of the brick used.

8-04. Glass block. - a. Glass block panels shall be installed as shown on the drawings. The blocks shall have a light transmission of not less than 70 percent of the incident light. The glass block shall be hollow, partially evacuated, water clear units of pressed glass construction of the best quality, similar and equal to the units manufactured by the Owens-Illinois Glass Company, Toledo, Ohio, or the Pittsburgh Plate Glass Company, Pittsburgh, Pa. Unless otherwise shown on the drawings, all glass block shall have a standard size of 7-3/4 by 7-3/4 by 3-7/8 inches. A sample of the type of glass block the contractor proposes to furnish shall be submitted for the approval of the contracting officer, with drawings showing the details of installation in accordance with the standard practice of the manufacturer of the glass block (see Paragraph 1-04 c).

b. Laying of block. - (1) Each block shall be set in a 1/4 inch to 13/32 inch layer of mortar composed of one part Portland cement, one part lime, and four parts sand by dry volume. The sand used in the mortar shall conform in quality to that specified in Paragraph 8-036. for sand used for mortar for face brick. Glass blocks shall be laid true to line and grade. Both head and bed joints shall be filled completely with mortar; after the mortar has reached its initial set, the joints on both surfaces shall be compressed and pointed with a metal pointing tool, leaving the finished surface of the joint smooth and non-porus. Blocks shall not be cleaned until after mortar has reached its final set.

(2) Horizontal mortar joints shall be reinforced with continuous 20-gauge expanded metal wall ties 2-3/8 inches wide or with wire wall ties of approved type and of a length suitable for the glass block panel, galvanized after forming. Ties shall run continuously by lapping 6 inches at ends; they shall be placed every course and shall not extend into brick masonry or pierce expansion joints.

(3) Expansion joints shall be provided at the head and jambs of all glass block panels, and all joints at head and jamb of panels shall be kept free from mortar and free from transmission of structural loads carried by adjacent masonry. Expansion joints shall consist of a pre-moulded waterproof expansion joint filler furnished and installed in accordance with the detailed drawings furnished by the contractor and approved by the contracting officer. After the glass block panels have been laid and the mortar has set, non-staining oakum shall be caulked between the sides of the block and the sides of the "chase" to within 1/2-inch from the finished surface. The 1/2-inch recess shall be filled flush with the finished surface with non-hardening waterproof caulking material similar and equal to "Vulcatex" manufactured by A. C. Horn Co., Long Island City, N. Y., "Kaukit" manufactured by L. Sonneborn Sons, Inc., New York, N. Y., or other approved elastic (or mastic) compound as shown on the drawings.

8-05. Chimney. - The chimney shall be constructed as shown on the drawings, and shall be lined with size 8-1/2 by 8-1/2 inch fire clay flue lining. The joints shall be well cemented and struck smooth inside. A suitable cast iron thimble shall be installed in the base of the chimney.

8-06. Stonework. - a. All stone work shall be of cast stone, light-gray, and shall be placed as indicated on the drawings. The stone shall be uniform in color, sound, and perfect throughout; and subject to inspection before being placed in the work. All exposed surfaces shall have a rubbed finish. The cast stone shall be similar and equal to that made by the Emerson and Norris Company, Boston, Mass. and conform in all respects to Federal Specification SS-S-721, for architectural cast stone, Type 1. The contractor shall submit samples of the precast stone proposed to be used, for the approval of the contracting officer. Samples shall be not less than 8 by 12 inches. The contractor shall also submit evidence satisfactory to the contracting officer that the manufacturer who will furnish the cast stone has had at least 10 years' experience in designing and manufacturing cast stone of satisfactory appearance and durability.

b. Before purchasing the stone, the contractor shall submit, for approval of the contracting officer, prints (in quadruplicate) of drawings showing in detail the sizes, coursing, and full details of trim. (see Paragraph 1-04c).

c. The casting, sizing, and coursing of all cast stone shall be done in accordance with the approved detail drawings. The stone shall be dressed and finished to a clean, smooth, uniform surface. Washes shall be cast or cut on the tops of copings, and drips on the undersides of projections where indicated on the drawings. All arrises shall be sharp and true. Anchors, cuts for accommodating steel work, and other incidental details shall be provided as required. Holes and sinkages shall be cast or cut in stones for all anchors, clamps, dowels, etc. Lewis holes shall be cut or cast in stones weighing more than 100 pounds. Lewis holes or other holes shall be not closer than two inches to exposed faces of stone, and holes on exposed faces of stone are prohibited. The cast stone shall be made to check in dimensions with all adjoining brickwork.

d. Mortar for setting the cast stone shall consist of one part Portland cement, three parts fine white sand, and 10 percent by volume of hydrated lime.

e. Setting stone. - (1) Just before setting, each stone shall be brushed clean and thoroughly drenched with clean water. The stone shall then be accurately set, by competent stone setters, true to line and level, with full flushed joints. Each stone shall rest on a full bed of mortar placed under the center of the stone; the amount of mortar being sufficient to fill all anchor holes and to fill out to the edges of the stone on all sides. All stone shall be set with 1/4-inch joints raked out at the face to a depth of one inch and left for future pointing. The backs of stone facings shall be pargeted with neat cement where shown on the drawings. Where required in connection with the setting of heavy stones and projecting courses, in order to arrest the squeezing out of mortar beds, tipping or uneven setting of the stone; and wherever required in connection with stone bedded on structural members, to prevent cracking or spalling from unequal pressure, the contractor shall provide and install lead pads or buttons. These pads or buttons shall be made of soft, sheet lead, either round or octagonal in shape, and of the same thickness as mortar joints. They shall be set not less than one inch back from the face of the stone, and have the mortar bed spread around them. Wherever practicable, heavy stones shall be set with derricks and lifted with lewis plugs or hoisting loops. Where lewis plugs or hoisting ropes cannot be used, the stone shall be set with clamps. The use of pinch bars, except on the embedded parts of the stones, is prohibited. No defective stones, and no broken, spalled, patched, or otherwise damaged stone shall be set in place. Rejected material shall be removed promptly from the work area.

(2) The contractor shall furnish and install all necessary anchors and dowels, as indicated on the drawings or as required by the contracting officer. Dowels other than bronze shall be coated with an approved dampproofing paint before being used.

(3) The contractor shall protect all cast stone work from damage of every description until all construction work is completed. Any damaged work shall be replaced at the contractor's expense.

(4) After the stone has been set, all work shall be gone over by a competent stone mason, thoroughly cleaned, and all joints brushed clean, soaked with clean water, filled solid with pointing mortar, and dressed. The use of wire brushes, or acids and solutions which might cause discoloration will not be permitted in cleaning stone.

(5) The mortar for pointing stone work shall consist of one part white "Medusa" cement or equal, two parts white sand, and 10 percent by volume of hydrated lime. The mortar shall be colored as directed by the contracting officer.

8-07. Doors. - a. Doors shall be of the type and design shown on the drawings. The contractor shall submit to the contracting officer, in accordance with the provisions of Paragraph 1-04 c, shop drawings showing the details of all doors.

b. The entrance door shall be of the vertical, double-leaf, ornamental type, supported at the jambs with butts as shown on the drawings. Stiles and rails shall be constructed of rectangular steel tubing, internally reinforced at all corners and joints. All mitre joints and butt joints shall be welded and ground smooth. The metal panels shall be not less than 1/16-inch thick. The quality of the material and workmanship shall in all respects be equal to the flush hollow metal door, type 2M, manufactured by the Richmond Fireproof Door Co., Richmond, Ind. Bronze weather stripping as indicated on the drawings shall be equal to the product of the Chamberlin Metal Weatherstrip Company.

c. The service door shall be similar and equal to the two-panel hollow metal door manufactured by the Richmond Fireproof Door Co., Richmond, Ind.

d. The doors shall be painted and finished at the shop in the color to be selected by the contracting officer in accordance with the standard practice of the manufacturer of the doors. The doors shall be cleaned and primed with one coat of approved rust resistant paint baked on, and one coat of mineral filler shall be baked on and rubbed before assembling. The doors shall be finished with two additional coats, baked on, the last coat being of the color selected. If the paint on the doors is marred in transit or during installation, the finish shall be replaced at the contractor's expense to the satisfaction of the contracting officer.

8-08. Door frames. - As shown on the drawings, the doors shall be provided with a suitable cast bronze saddle, properly fitted and secured in place with expansion bolts. All door frames shall be made of steel, accurately fitted, welded, and anchored in place as shown on the drawings. The door frames shall be similar and equal to products of the Richmond Fireproof Co., Richmond, Ind. Loose lintels, as indicated on the drawings, shall have not less than 6 inches of bearing at each end.

8-09. Builders' hardware. - a. The contractor shall furnish and install heavy bronze hardware for the entrance door, including locksets, butts, chain bolts, floor and wall bumpers, clamps, stops or checks, and all other details of a complete installation.

b. The hardware shall be secured in place with machine screws and reinforcing plates shall be provided where necessary. Grouting around the foot bolt keepers in the floor shall be brought flush with the top. The hardware shall be subject to approval of the contracting officer, shall be of the heavy solid bronze type, and of sufficient strength and size for the use intended. It shall conform to Federal Specifications FF-H series, where applicable, and shall be similar and equal to products of the P. & F. Corbin Hardware Co., New Britain, Connecticut, as shown on the drawings.

8-10. Roofing. - a. Deck. - The roof slab and beam covering shall be of concrete as indicated on the drawings and shall conform to the requirements for Class "A" concrete as specified in Section VI. Before taking its initial set the concrete shall be struck off approximately to grade and then

roughened with a broom. When directed by the contracting officer or in any event not less than 48 hours after the slab has been poured, the contractor shall thoroughly clean the slab, dampen it and place a filler slab of cinder concrete to the lines and grades indicated on the drawings (see Paragraph 6-22). The cinder concrete slab shall be provided with an expansion joint adjacent to the parapet at the location shown on the drawings, which shall conform to the applicable provisions of Paragraph 6-20. This slab of concrete shall be struck off and wood float finished to a surface with a reasonably smooth finish. Forms and shores under the roof slab shall not be removed or disturbed in less than 14 days after placing of the cinder concrete and then only upon specific authorization of the contracting officer.

b. The cinder concrete filler slab shall be covered with a built-up gravel roof as follows: Before the application of any roofing materials, the concrete slab shall be smooth, clean, firm, and dry. The entire surface of the slab shall then be coated uniformly with an approved asphalt primer, using not less than one gallon of primer for each 100 square feet of roof surface. Not less than 24 hours after the application of the priming coat the entire surface shall be coated uniformly with hot asphalt conforming to the Tentative Specifications for Asphalt for Use in Constructing Built-Up Roof Coverings (A.S.T.M. Designation: D 312-39T) of the American Society for Testing Materials. Into this coating, while hot, there shall be laid four layers of 15-pound, 36-inch asphalt-saturated felt over the entire surface of the roof, lapping each sheet 27-1/2 inches over the preceding one, lapping the ends of the sheets not less than 6 inches, and mopping with asphalt the full 27-1/2 inches so that in no place shall felt touch felt. The felt shall conform to Federal Specification HH-F-191 for Asphalt-Saturated Felt. At all vertical surfaces the roofing shall be carried up at least 6 inches and thoroughly mopped to the wall so that contact is obtained throughout. The layers of felt shall be laid so as to be free from wrinkles and buckles. Over the entire surface there shall be poured from a dipper a uniform coating of asphalt, into which, while hot, there shall be embedded not less than 400 pounds of gravel per 100 square feet. Not less than 160 pounds of asphalt shall be used for constructing each 100 square feet of the completed roof and the asphalt shall be applied at a temperature of approximately 350 degrees Fahrenheit. The roofing gravel shall be hard, durable, water worn, dry, and free from clay, loam, sand, or other foreign substances. All gravel shall pass a 1/2-inch square mesh sieve, not less than 80 percent shall pass a 3/8-inch square mesh sieve and shall be retained on a 1/4-inch square mesh sieve, and 100 percent shall be retained on a 1/8-inch square mesh sieve.

8-11. Flashings. - All copper flashings indicated on the drawings or otherwise required shall be 16-ounce copper conforming to Federal Specifications QQ-C-501, Type V. The chimney shall be flashed and counterflashed.

8-12. Louvers and ventilators. - a. Where shown on the drawings, louvers of the size indicated, shall be placed.

(1) The louver frames for the north elevation shall be of 32-ounce and the blades of 48-ounce cold rolled copper mounted on bronze bearings. The louver frames shall be constructed in such a manner that a watertight connection will be assured between the frame and the wall. They shall be equipped on the exterior with copper mesh screens of the size and type made by the same manufacturer who furnished the louvers. The louvers shall be similar and equal to the Beco adjustable louver manufactured by the H. H. W. Bergmann & Co., New York, N. Y.

(2) The louver frames for the east elevation shall be of 16- gage galvanized iron and shall be constructed in such a manner that will assure a watertight connection between the frame and the wall. They shall be equipped on the exterior with galvanized iron screens of the size shown on the drawings. The louvers shall be similar and equal to Type F-12 manufactured by the American Foundry and Furnace Co., Bloomington, Illinois. A 16-gauge metal duct with door shall be installed from the louver frame to the engine radiator. The contractor shall submit for approval detail drawings for the louvers, louver frames and hot air ducts he proposes to install in sufficient detail to check the design (see Paragraph 1-04 c).

b. The ventilator shall be of the Uno braced turbine, wind-driven-type, of standard galvanized iron construction as manufactured by the Uno Ventilator Company, Cliftondale Station, Saugus, Mass., or equal. The metal base supporting the ventilator shall incorporate drip gutters to carry off condensation. The contractor shall furnish detailed drawings for approval, showing method of anchoring the ventilator in place (see Paragraph 1-04 c).

8-13. Downspouts. - a. The contractor shall furnish and install under Item 11, the copper downspouts with leader heads, bronze beehive strainers and cast iron shoes, as located and shown on the drawings.

b. The contractor shall submit for approval detail drawing for the leader head he proposes to install in sufficient detail to check the design (see Paragraph 1-04 c).

8-14. Miscellaneous details. - a. The contractor shall furnish and install under Item 11, the bronze letters over the entrance door as shown on the drawings and shall submit for approval, template for setting the letters.

b. The contractor shall install under Item 11, at the location shown on the drawings, the plaque which will be furnished by the Government.

8-15. Painting. - The concrete floor of the pumping station, the concrete machinery bases and the side walls below the brick masonry shall be painted as specified in Paragraph 14-07. The cost of all painting shall be included in the contract price for Item 11 (see Paragraph 8-16).

8-16. Payment. - Payment for constructing and completing the pumping station superstructure in accordance with the specifications and the drawings will be made at the contract price for Item 11, "Pumping Station Superstructure."

SECTION IX. METALS AND EMBEDDED ITEMS (Items 12 to 14 incl.)

9-01. General. - All metals, unless otherwise specified, shall conform to applicable Federal Specifications, and, when not covered thereby, to applicable A.S.T.M. specifications. All castings shall have the pattern or mark number cast on them. Unless otherwise authorized by the contracting officer, the scale weights of each casting or forging after machining shall be within 5 percent of the weights as calculated from the dimensions specified or shown on the drawings. Castings shall conform, at the minimum section thereof, to the following dimensional tolerances: where embedded in concrete, to within 1/8 inch; where not embedded in concrete, to within 1/16 inch of the dimensions shown on the drawings.

9-02. Materials and workmanship. - a. The articles included in Items 12 to 14 inclusive, other miscellaneous materials, and all metal required in the work except as otherwise specified, shall meet the requirements of the following specifications where applicable to the use intended:

(1) Steel reinforcement shall be of new billet intermediate grade, open-hearth steel, deformed, and shall conform to the Federal Specification QQ-B-71a for "Bars, reinforcement, concrete, Type "B", Grade 2 (dated January 12, 1938)." Certified copies of any mill test required shall be furnished by the contractor and the steel shall be subjected to such tests as the contracting officer may consider necessary to establish its quality, including particularly the requirements of bending and elongation. The steel shall be free from oil, paint, dirt or excessive rust. Expanded metal reinforcement shall be used as shown on the drawings in the fire-proofing of steel beams. This reinforcement shall consist of a diamond-shaped steel mesh manufactured from open-hearth steel, by a cold drawn process which will cut and draw the material so that uniform strands are formed at regular intervals along the length of the sheet with the plate intact between successive strands. It shall possess ductile properties which will permit any strands to be bent through an angle of 180 degrees over one diameter, without fracture, and to have a yield point of not less than 55,000 pounds per square inch. The size of the diamond shall be approximately 1-1/2 inches, and the weight per square yard shall be not less than 1.8 pounds.

(2) Structural steel; - Federal Specification QQ-S-711a; shapes, plates, bars, pins and bolts shall be Class "A" and rivets shall be Class "C", unless otherwise required. Welding will be accepted only where specified or authorized, and approved only when done in accordance with the current requirements of the American Welding Society.

(3) Cold-rolled steel; - A.S.T.M. Specifications A-108-36 for "Commercial Cold-Finished Bar Steels and Cold-Finished Shafting". Unless otherwise specified this material shall be used for rods, pins, keys, and similar parts.

(4) Hot-rolled steel, for shafting, sleeves and rollers; - A.S.T.M. Specifications A-107-36 for "Commercial Quality Hot-Rolled Bar Steels."

(5) Machine steel; - same as for Hot-rolled steel.

(6) Steel, corrosion resisting; - Federal Specification QQ-S-763 or QQ-S-766.

(7) Steel forgings, shall be of hot-rolled open-hearth steel forging bars conforming to A.S.T.M. Specifications A-18-30 for carbon steel and alloy steel forgings, Class "C", except that shafts of this material not otherwise specified shall be S.A.E. No. 1045 hot-rolled, open-hearth steel forging bars.

(8) Steel castings; - Federal Specification QQ-S-681a.

(9) Iron castings, gray; - Federal Specification QQ-I-652, class as indicated. Tensile tests and chemical analysis will not be required.

(10) Malleable iron castings; - Federal Specification QQ-I-666, Type "A".

(11) Steel rail track and fittings, shall be standard A.S.C.E. sections and shall conform to the A.R.E.A. standard specification for carbon steel rails.

(12) Chains and attachments; - Federal Specification RR-C-271 of Type "A" and Grade "2" unless otherwise specified.

(13) Bolts, screws, and washers; - Appropriate Federal Specification and current standard practice, unless otherwise specified.

(14) Wrought iron bars and shapes; - Federal Specification QQ-I-686, Grade "B".

(15) Wrought iron pipe; - Federal Specification WW-P-441a.

(16) Cast iron pipe; - A.S.T.M. Specifications A-44-04, Class "A"; for soil pipe refer to Federal Specification WW-P-401.

(17) Black steel pipe and fittings; Federal Specification WW-P-403a, Type "A", and WW-P-521.

(18) Sheet copper; - Federal Specification QQ-C-501, Type "V", Class "A".

(19) Zinc coatings (hot galvanized); - Federal Specification QQ-I-696.

(20) Babbitt metal; - Federal Specification QQ-M-161.

(21) Lead: - Federal Specification QQ-L-171, Grade A.

(22) Solder: - Federal Specification QQ-S-551.

(23) Valves: - Federal Specification WW-V-76a.

b. Other items, unless otherwise specified, shall conform to current standard practice for the material required and use intended.

9-03. Galvanizing and painting. - a. Galvanized iron or steel articles shall be galvanized by the hot-dip process unless otherwise permitted. Injuries to the galvanizing shall be satisfactorily repaired. Provision shall be made for protecting threads either by counter-boring fittings, so as to cover threads or by cutting threads so as to make a very loose fit before galvanizing and carefully rerunning threads after galvanizing so as to leave a good coating all over threads. Hot galvanizing shall be of such quality as to endure at least 4 one-minute imersions in copper sulphate solution, in accordance with the requirements of the Preece test.

b. Except as otherwise specified all ungalvanized iron and steel to be exposed in the finished work shall be thoroughly cleaned and then thoroughly and evenly painted, in accordance with the provisions of Section XIV.

9-04. Miscellaneous iron and steel (Item 12). - a. Ladder rungs, anchors, and malleable iron pipe fittings and connections and other miscellaneous iron and steel items as shown on the drawings shall be furnished and installed. In accordance with the provisions of Paragraph 1-04c, the contractor shall submit for approval detailed drawings and data descriptive of the miscellaneous iron and steel work which he proposes to install. General requirements are as follows:

(1) Ladder rungs and hand grabs shall be of wrought iron shop bent or manufactured.

(2) All miscellaneous anchors shall be hot-dip galvanized after bending and welding.

b. Payment will be made as specified in Paragraph 9-07.

9-05. Miscellaneous pipe and fittings (Item 13). - a. Black steel or standard wrought iron pipe complete with malleable iron fittings and connections shall be furnished and installed on the structures where shown on the drawings. Pipe shall be of the size as shown on the drawings and shall conform to Federal Specifications WW-P-403a and WW-P-521. Pipe fittings and connections shall be malleable iron castings (see Paragraph 9-02a (10)), of ball pattern and pin-connected where required, post connections at the floor, and caps used on the bottoms of sleeves embedded in the concrete shall be standard screw type. All fittings shall be of Crane Company type or equal. Floor or wall flanges of screw type shall be anchored into the concrete with stud type expansion bolts consisting

of one primary and one secondary expansive unit similar and equal to that manufactured by Akerman Johnson Company. In accordance with the provision of Paragraph 1-04c, the contractor shall submit for approval detailed drawings and data descriptive of the miscellaneous pipe and fittings which he proposes to install.

b. Payment will be made as specified in Paragraph 9-07.

9-06. Steel trash rack (Item 14). - a. A steel trash rack, complete, including frames, angle iron guards and accessories shall be furnished and installed as shown on the drawings. The steel trash rack, nuts, bolts, rivets, and pipe spacers shall conform to the requirements of Federal Specification QQ-S-711a; shapes, plates, bars, and bolts shall be Class "A" and rivets shall be Class "C", unless otherwise shown. All frames and guards to be attached to the concrete shall have anchors as shown on the drawings or as directed. The steel shall be painted as provided in Paragraphs 14-03 and 14-06. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the steel trash rack and accessories which he proposes to install.

b. Payment will be made at the contract price for Item 14, "Steel Trash Rack," and shall include all costs of furnishing and installing the trash rack complete with frames, guards and accessories as specified.

9-07. Measurement and payment. - a. The quantities to be paid for under Items 12 and 13, will be the number of pounds respectively furnished and installed in accordance with the drawings and specifications. Wherever practicable, the quantities shall be determined by weighing the articles and materials. When weighing is not practicable, the actual weight of each part or item involved will be determined by the contracting officer, who will use for that purpose manufacturer's weights, catalog weights, and computed weights. The weight of all tare, packing, and blocking will be deducted, using only net weights for payment quantities; provided, that no payment will be made for any weight in excess of 5 percent more than the computed weight as determined from the drawings.

b. In calculating computed weights the following unit weights of the several materials will be used unless otherwise specified:

Structural Steel - 0.2833 pounds per cubic inch.
Cast Iron - 0.2604 pounds per cubic inch.
Wrought Iron Pipe - The weight per linear foot shown in Table I of Federal Specification WW-P-441a.
Black Steel Pipe - The weight per linear foot shown in Table I of Federal Specification WW-P-403a.

c. Payment will be made at the applicable contract unit prices for Items 12 and 13, (see Paragraph 1-05).

SECTION X. ELECTRIC LIGHT AND POWER SYSTEM (Item 15)

10-01. Work included. - a. The contractor shall furnish and install complete and ready for operation all equipment, conduits, and wiring for the electric light and power system of the pumping station as indicated on the drawings and as required by these specifications, including outlets, pull boxes, incoming service feeder, interior lighting fixtures, lamps, exterior ornamental lights, portable floodlight, meterboard, lighting and power distribution panelboard, service switch and battery charging system. The contractor shall make all necessary connections to sump pump motor, motors for heating equipment, and other electrical equipment.

b. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings, dimensioned when necessary, and data descriptive of the lighting distribution panelboard, switches, battery charger, portable floodlight, lighting fixtures, conduits and conduit layouts, wiring and accessories which he proposes to install.

10-02. General description. - a. The lighting and power system includes interior lighting fixtures, lighting and power distribution panelboard, control equipment, convenience outlets, exterior ornamental lights, conduits, wires, portable floodlight, service entrance switch, pull box, incoming underground feeder, and all wire connections of circuits to the several parts of the operating equipment.

b. The emergency lighting system includes fixtures, conduits, wires, lamps, fuse box and switches for 12-volt lighting supplied from the engine batteries as indicated on the drawings.

c. The battery-charging system includes conduit, wire, and battery charger with controls and ammeter for charging the battery on each gasoline engine through the wire and conduit brought up to each engine panel and properly connected.

d. The pumping station will be supplied with electrical energy at 115 and 230 volts, single-phase, 3-wire, 60-cycle AC from an outside source. The contractor shall furnish and install the incoming service feeder, as covered by Paragraph 10-05 b, from the service entrance box in the pumping station to and up the Power Company's pole from which power will be supplied to the pumping station. The cable up the pole shall be installed in conduit in accordance with The Hartford Electric Light Company's standard.

e. The electrical equipment in the pumping station will be subject to extreme conditions of fog, moisture, and changes of temperature, and shall be suitable for such service conditions.

10-03. Standard rules and specifications. - a. Unless otherwise specified, all electrical materials, workmanship, and tests shall conform to the current standard rules, regulations and specifications of the following authorities.

(1) American Institute of Electrical Engineers, 33 West 39th Street, New York, N. Y.

(2) National Board of Fire Underwriters, National Electrical Code, 85 John Street, New York, N. Y.

(3) National Electrical Manufacturers Association, 155 East 44th Street, New York, N. Y.

(4) Bureau of Standards, National Electrical Safety Code, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

(5) Insulated Power Cable Engineers Association, 420 Lexington Avenue, New York, N. Y.

(6) Federal specifications cited herein (Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.).

(7) The Hartford Electric Light Company, Hartford, Conn.

b. Copies of these rules, regulations, and specifications may be procured at the addresses given, or may be seen at the U. S. Engineer Office, Providence, R. I.

10-04. Conduits. - a. Conduits shall be located as indicated on the drawings or as directed by the contracting officer.

b. The conduits shall be hot-dip galvanized or sherardized on both inside and outside, and shall meet the requirements of Federal Specification WW-C-581a for "Conduit, Steel, Rigid, Zinc Coated". Conduit fittings or bodies shall be galvanized, sherardized, or cadmium plated high-test alloy castings of the types and sizes specified or shown on the drawings, or required for the work to be done. They shall be approved by the National Board of Fire Underwriters, and be similar and equal to those manufactured by the Crouse-Hinds Company. Conduit sizes shall meet the requirements of Article 346 of the 1940 edition of the National Electrical Code with the exception that no conduits smaller than 3/4-inch shall be used.

c. The installation of conduits shall comply with Article 346 of the 1940 edition of the National Electrical Code. All wires and cables shall be run in rigid conduits forming a complete raceway from the cabinet or panel to the last outlet in the system. Conduits shall be run concealed in the floors, ceilings and walls except as indicated on the drawings. Conduits in masonry walls and floors shall be built-in complete with all necessary fittings at the time the masonry is being placed. Any exposed conduits shall be securely fastened and anchored to the structural portions of the building and shall be run parallel with or at right angles to the walls. All conduits shall be run with long-radius bends where possible, and not more than three quarter bends shall be used on any run. All bends shall have a minimum radius of six diameters. If more than

three bends are required, pull boxes shall be installed at points approved by the contracting officer. All conduit ends shall be reamed to remove burrs and obstructions after the threads have been cut. All conduit joints shall be made watertight with an approved sealing compound. At all conduit terminals there shall be provided approved bushings or conduit fittings. All metal conduit runs shall have electrical continuity. Open conduit ends shall be capped in approved manner to exclude dirt and moisture. No threadless fittings or running-thread couplings shall be used on runs of conduit. As soon as possible after the concrete has set, each conduit shall be cleaned, inspected, and tested by the contractor to ascertain its mechanical and electrical continuity and freedom from obstructions. Any defects in material or workmanship shall be remedied immediately as directed by the contracting officer. After each duct line is completed, the contractor shall inspect and test the conduit in an approved manner and the conduit ends shall be capped.

10-05. Wiring. - a. The contractor shall furnish and install all wire and cable, terminals, junction boxes, supports, hangers, make all connections, grounds, and properly place, arrange, and identify all material as specified or directed by the contracting officer. All wiring shall be in rigid conduit unless otherwise specified, shown on the drawings, or directed by the contracting officer.

b. The service feeder from the utility company's pole to the service entrance shall be a metallic Parkway-Type cable, rubber insulated, with a protective covering made up of a lead sheath, layers of asphalted jute and asphalt compound and a double flat-band-steel armor, in accordance with standard practice. The cable will be #6 A.W.G. 3-conductor designed for 600 volts, 60 cycles, A. C. service. Where applicable, Federal Specifications JC-71 will govern the quality of materials and the methods of sampling, inspection and tests. The service feeder shall be buried in earth 2-1/2 feet deep, and covered with a 2" x 10" creosoted wood plank. A conduit with weatherproof entrance cap, suitable to the utility regulations, shall be provided on the pole to protect the cable.

c. All wire used shall be copper, soft drawn and annealed, and having not less than 95 percent conductivity. Wire sizes shall comply with Article 300 of the National Electrical Code. No wire shall be used that is smaller than No. 12 A.W.G. Insulation for all wires and cables shall be flame-retarding and moisture proof and shall conform to Federal Specifications J-C-106a for "Cable and Wire: Rubber Insulated Building Type, Heat Resistant Grade (0 to 5,000-Volt Service)".

d. All wire and cable shall be shipped on reels or in coils, plainly marked for complete identification, including the wire or cable size, number of conductors, length, weight, thickness, and character of the insulation and the name of the manufacturer.

e. Materials used in the wiring shall conform to the following requirements:

(1) Solder for splicing or wiping shall conform to Federal Specification QQ-S-571, for "Solder Tin Lead", Grade A , for sweat conductor joints.

(2) Solder for brazing shall conform to Federal Specifications QQ-S-551, for "Solder, Brazing", Composition B.

(3) Silver solder shall conform to Federal Specifications QQ-S-561b for "Solder, Silver", Grade O.

(4) Rubber tape shall conform to Federal Specifications HH-T-111 for "Tape, Rubber Insulating".

(5) Friction tape shall conform to Federal Specifications HH-T-101 for "Tape, Friction", Grade A.

(6) Cotton tape shall conform to United States Navy Department Specifications 17-T-15 for "Tape, Insulating, Linen, Finish, Plain", thickness .007 inch.

10-06. Grounding. - Permanent and effective ground connections shall be provided for all enclosures of electrical equipment, for equipment frames and housings, continuous runs of metal conduit, for the neutral conductor of the service entrance, and elsewhere to comply with Article 250 of the National Electrical Code, and as specified or directed by the contracting officer. The contact area of all joints in grounding circuits shall provide a current-carrying capacity not less than that of the connecting wire or cable, and the joints shall be bolted or brazed, as specified or directed. All ground connections to equipment that may require removal for maintenance or repair shall be bolted to the equipment.

10-07. Lighting and outlets. - a. The lighting panelboard, lighting fixtures, plug receptacles, switches, lamps and outlet boxes shall be installed as specified and at locations indicated on the drawings and shall be in accord with the description as shown on the Bill of Material.

b. The ornamental fixtures on the front of the pumping station shall be moisture-proof octagonal lanterns attached to the pumping station by the brackets furnished with the fixtures. The fixtures shall be the lantern and bracket type, complete with glass, lamp, and wiring devices, catalog No. 1796, Murlin Manufacturing Company, Philadelphia, Pa., or equal, solid bronze, dark oxidized finish. The fixture for the rear of the pumping station shall be furnished complete with globe, lamp and wiring devices, and shall be catalog #1463, Murlin Manufacturing Company, Philadelphia, Pa., or equal, cast iron with bronze finish.

c. Lamps, except for emergency lights, shall be rated at 115 volts and of the watt rating shown or specified, and shall conform to Federal Specification W-L-101c for "Lamps, Electric, Incandescent, Large, Tungsten-Filament".

d. Lamps for emergency lighting shall be rated at 100 watts, 12 volts, D. C., and shall be similar or equal to Maxda A-19 for aviation service. Where applicable, Federal Specification W-L-101c shall govern the quality of material and general construction of these lamps. Each lamp shall be furnished with a lamp socket extension to bring the lamp filament to the focal point of the fixture for the emergency lighting outlet.

e. All lighting fixtures shall be installed as specified and at locations indicated on the drawings and shall be similar or equal to that specified in the Bill of Material.

f. Portable floodlight. - The contractor shall furnish, complete with bulb, a portable 150-watt floodlight on a rust-proofed telescoping stand with at least an 18" diameter base. The light shall be easily adjustable through a wide angle and to any desired height from 1'0" to 6'0" above the floor. The light shall have an aluminum reflector with adjustable beam spread, moisture-proof gaskets, heat-resisting glass cover, rust-proof wire guard and heavy duty rubber covered two conductor service cord with a weather-proof plug for a threaded receptacle. The weatherproof plug shall be Crouse-Hinds #WP 722 or equal. The portable floodlight shall be similar and equal to Benjamin catalog #5787.

g. All sockets, switches, and receptacles shall be National Electric Code Standard and shall be in accord with the Bill of Material.

10-08. Miscellaneous electrical equipment. - a. A battery charger of approved make, similar and equal to the product of the General Electric Company, shall be installed as shown on the drawings. The charger shall be designed to operate at 230 volts, single phase, 60 cycles, A. C., and shall be fed from the lighting panelboard. The charger shall have sufficient capacity to charge two 12-volt batteries in parallel with positive terminals grounded at a charging rate of 12 amperes each. It shall be provided with a control device for varying the charging rate from zero to maximum in at least 20 steps and shall be equipped with an ammeter to indicate the direct current output. Both shall be mounted on the front panel of the charger. The output side shall be provided with a suitable switch and fuse or circuit breaker.

b. The lighting distribution panelboard shall have 125/250 volt, 60 cycle, single phase, 3 wire, solid neutral mains, with a two pole, 50 ampere, 600 volt A. C. automatic air circuit breaker in the main leads. It shall have four 115 volt, 2 wire branch lighting circuits, with single pole, 15 ampere, 250 volt, A. C. automatic air circuit breakers in the live side, and two 230 volt, 2 wire branch power circuits, with 2 pole, 15 ampere, 250 volt, A. C. automatic air circuit breakers. The panelboard cabinet front, trim and door shall be of Code grade galvanized sheet steel, finished a dull black over a priming coat or binder. The panelboard shall be for flush mounting with proper width trim and shall be in accordance with Federal Specifications W-P-131. It shall be similar and equal to Catalog #NA1B06-3AB050, of the Westinghouse Electric and Manufacturing Company. Branch circuit breakers shall be of the air break type rated at

250 volts, 60 cycles A. C. manually operated, trip-free, with thermal overload trip. The main breaker shall be of the air break type, rated at 600 volts, 60 cycles A. C. manually operated, trip free, with thermal overload and instantaneous overload trips. The circuit breakers shall be similar and equal to type AB of the Westinghouse Electric and Manufacturing Company or type AF1 of the General Electric Company.

c. The service entrance metering switch shall be of the steel, safety-enclosed, "dead accessible fuse" type mounted in a dust-resisting enclosure designed for mounting on an ebony asbestos panel and provided with an e xternal operating handle interlocked with the cover. The switch shall be single-throw, fusible type, rated to carry 60 amperes continuously at 230 volts, 60 cycles, A. C. The case shall be of welded steel construction, cadmium-plated and painted black, and shall be provided in accordance with The Hartford Electric Light Company's standard switch for this type of service.

d. The connections of the battery-charging system and the emergency lighting system to the engine batteries shall be made in a workmanlike manner using conduit fittings, and two-conductor flexible BXL armored conductors shall be installed from the batteries to the conduit boxes on the engine base and to the engine panel switch box.

e. All fuses shall comply with Federal Specification W-F-791 for "Fuses, Cartridge, Inclosed, Non-Renewable".

f. The pull box for the incoming underground service feeder shall be similar and equal to the standard product of the Thomas & Betts Company, Inc., Elizabeth, N. J., and shall be in accord with the Bill of Material.

10-09. Motor control. - The control for the sump-pump motor shall consist of an enclosed magnetic across-the-line starter similar and equal to the Westinghouse Electric and Manufacturing Company's Class 11-200, push-button operated, and arranged to provide thermal overload and under-voltage protection to the motor.

10-10. Payment. - Payment will be made at the contract price for Item 15, "Electric Light and Power System", for furnishing, installing, testing, and placing in operation the lighting and power system as required by the specifications and shown on the drawings.

SECTION XI. TRAVELING CRANE, COMPLETE (Item 16).

11-01. Work included. - The contractor shall design, furnish and install one traveling crane, complete. The crane shall be mounted on the track in the pumping station ready for operation, in accordance with the drawings and the specifications.

11-02. General description. - The crane shall be hand operated, and shall have a working capacity of not less than 4 tons carried on one trolley. The distance from center line to center line of crane rails shall be 25 feet 4 inches. The distance from operating floor to top of crane rail shall be 13 feet 0 inches. Clearance limitations are shown on the drawings.

11-03. Detailed description. - a. The hoist and trolley shall be similar or equal to the combined geared "Army" type as manufactured by the Yale and Towne Manufacturing Company, Philadelphia, Pa., or David Round and Son, Cleveland, Ohio. The hoist shall be equipped with hoisting chain and shall provide for a vertical lift of 28 feet. The gearing for the hoist shall be accurately machine cut and shall be of ample strength and fully enclosed with safety guards. The hoist shall be self-locking, and integral with the trolley. The hoist and trolley traverse shall be operated by chains from the operating floor. Trolley wheel bearings shall be antifriction bearings of ample capacity. Provision shall be made to support the hoist lifting chain clear of the floor when the crane hook is in the raised position.

b. The bridge shall consist of one I-beam girder of ample section to provide rigidity against excessive vertical deflection and side sway. The girder shall be securely attached and braced to the end trucks. The end trucks shall be of rigid construction and shall be provided with double-flanged wheels. One wheel of each end truck shall be geared to a cross shaft operated by a pendant hand chain and suitable gearing. The hand chain shall provide for one-man operation of the bridge traverse from the operating floor, and shall be located near the end of the main girder adjacent to the rear wall of the pumping station. The end truck wheels shall be equipped with roller bearings. The cross shaft bearings shall be either smoothly finished gray iron or bronze bushings. Four crane stops shall be provided for attachment to the crane rails.

11-04. Design. - a. The detailed design of the traveling crane shall be in accordance with the clearances indicated on the drawings and with these specifications. All working parts shall be readily accessible for inspection and repair, properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall not be greater than one-fifth of the ultimate strength of the material used.

11-05. Drawings. - In accordance with Paragraph 1-04 c, the contractor shall submit for approval detail drawings for the traveling crane he proposes to install, in sufficient detail to enable a check on the design. These drawings shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article, the contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Thickness of plates and sizes of structural shapes must be shown either on the part or in the itemized list of parts. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details and by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications, shall be supplied by the contractor, whether or not it is included on the drawings, the list of parts, or in the requirements of these specifications. Approved drawings submitted by the contractor shall become a part of these specifications.

11-06. Materials and workmanship. - The traveling crane shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished by the contractor and approved by the contracting officer and shall conform to the Provisions of Section IX, where applicable. All metal workmanship shall be of approved standard quality.

11-07. Installation. - The traveling crane shall be assembled and installed in the pumping station, as shown on the drawings.

11-08. Inspection and tests. - The traveling crane will be tested by the Government as soon as practicable after installation. The field tests will include complete operation of the crane throughout all its functions. Acceptance and final payment will not be made until such tests are completed to the satisfaction of the contracting officer.

11-09. Painting. - Shop painting shall be in accordance with the provisions in Paragraph 14-04. Such retouching as may appear necessary, in the opinion of the contracting officer, shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust preventative compound. Field painting of all exterior parts, except brass, bronze or finished surfaces shall include one coat of metal filler, one shop coat of red lead, one field touch-up coat of red lead if found necessary by the contracting officer, and two coats of selected engine enamel.

11-10. Payment. - a. Payment for designing, furnishing, installing and painting the traveling crane will be made at the contract price for Item 16, "Traveling Crane Complete", and includes all necessary accessories not included in any other item.

b. Partial payment up to 50 percent of the contract price will be made when the traveling crane is delivered to the site of the work provided the quality of the equipment is satisfactory to the contracting

officer, but in no case will the payment to the contractor exceed the cost of the equipment delivered to the site of the work. The traveling crane shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

SECTION XII. MISCELLANEOUS EQUIPMENT (Items 17 to 20 incl.)

12-01. Sump pump (Item 17). - a. Description. - The contractor shall furnish and install one vertical centrifugal sump pump of the submerged type with discharge piping, as indicated on the drawings. The pump shall have a capacity of 50 gallons per minute against a total head of 35 feet. The pump shall have a cast iron casing and a bronze impeller of either the closed or open type capable of passing coarse or fibrous material. The shaft shall be of stainless steel enclosed in a wrought iron support pipe. The upper bearing shall be of the combined radial and thrust type, grease lubricated anti-friction bearing. The lower and intermediate bearing shall be made up of a non-seizing, non-scoring high lead bronze bearing bushing with a grease reservoir. The reservoir shall be connected through suitable piping to an Alemite or Zerk fitting above the pit cover. The pump shall be bolted or welded to a small cover plate which in turn shall be bolted to the pit cover. The pump shall be driven by a 230-volt, 1-phase, 60-cycle, 1750 r.p.m., vertical, drip-proof, capacitor motor with normal starting torque characteristics. The motor shall be rated not less than one horsepower with a limiting temperature rise of 40 degrees C., and shall have a special moisture resisting treatment for all insulation in accordance with the N.E.M.A. standards. In accordance with the provisions of Paragraph 1-04c, the contractor shall submit for approval detailed drawings and data descriptive of the sump pump, complete with motor, controller and piping, which he proposes to install.

b. Payment. - The contractor will be paid the contract price for Item 17, "Sump Pump", for furnishing and installing the sump pump.

12-02. Gasoline tank and piping (Item 18). - a. The contractor shall furnish and install one gasoline storage tank together with fill and vent pipes, fill box, gasoline gage, and supply and drain piping to the gasoline engines as shown on the drawings. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the gasoline tank, piping, and gage which he proposes to install.

b. The gasoline tank shall be of welded steel construction, and shall comply with the legal requirements of the Town of East Hartford, Connecticut.

c. All piping outside the pumping station shall be wrought iron pipe conforming to Federal Specification W W-P-441a. Fittings shall be malleable iron screwed fittings conforming to Federal Specification WW-P-521. All piping inside the pumping station shall be copper tubing conforming to Federal Specification WW -T-799, installed with flared fittings. The foot valves on the suction lines inside the gasoline tank shall be of the Single Poppet type similar and equal to Amco Figure 438. The vent pipes shall be securely clamped to the concrete wall.

d. The gasoline gage shall be installed on the wall of the engine room as shown on the drawings. It shall be capable of indicating the amount of gasoline in the storage tanks and shall be of the automatic remote reading type similar and equal to that manufactured by the Liquidometer Corporation of Long Island City, New York. It shall be float operated, the motion of the float operating against sylphons of a closed hydraulic system, and the system shall be filled with a liquid for the purpose of transmitting the motion of the float to the indicator sylphons. The indicator shall be installed in a protecting case not less than 12 inches by 12 inches and provided with a scale graduated to 900 gallons. The flexible tubing for connecting the indicator with the float mechanism shall be protected by a metallic armor. The connection between the gasoline tank and the gage line shall be protected by a structural steel box of suitable size.

e. Payment. - The contractor will be paid the contract price for Item 18, "Gasoline Tank and Piping", for furnishing and installing the gasoline tank, gage and piping in accordance with the drawings and specifications.

12-03. Float gage. - (Item 19). - a. Description. - The contractor shall furnish and install an indicating dial type float gage. The float gage well shall be of 6-inch, standard weight, genuine wrought iron pipe installed at the location and in the manner shown on the drawings. The float, tape, and counterweight shall be made of corrosion-resisting metal. The dial shall be 12 inches in diameter and graduated from 0 to 10 feet in tenths of a foot. The equipment shall be similar and equal to the No. 639 Dial Indicator manufactured by the W. and L. E. Gurley Company of Troy, New York. The protection grille for the tape shall be baked enamel wire-mesh of 1/8-inch wire, with 1-1/2-inch diamond shaped mesh complete with ferrule for attaching the grille to the pumping station wall. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the float gage and accessories w hich he proposes to install.

b. Payment. - The contractor will be paid the contract price for Item 19, "Float Gage," for furnishing and installing the float gage and well in accordance with the specifications and drawings.

12-04. Heating system (Item 20). - a. Work included. - The contractor shall furnish and install the heating system which shall consist essentially of an oil burning heating furnace of the warm air type, with built-in electrically-driven blower, fuel pump, and a 180-gallon fuel oil storage tank as shown on the drawings or as directed by the contracting officer. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the heating furnace, fuel pump, fuel tank and piping which he proposes to install.

b. Heating furnace. - The heating furnace shall be a Duo-Therm oil burning furnace, Model No. 807-0, as manufactured by the

Duo-Therm Division, Motor Wheel Corporation, Lansing, Michigan, or its equal. It shall have a heating capacity of not less than 70,000 b.t.u. per hour at the bonnet. It shall be furnished complete with enameled metal jacket of a color to be determined by the contracting officer, automatic draft regulator, smoke pipe, constant level oil valve, electrically-driven blower and an outlet cowl with directional louvers. Provision shall be made for manual control of the burner and blower. The blower motor shall be suitable for operation on 115-volt, 60-cycle current, single-phase and the blower shall have a capacity of 1000 C.F.M. of warmed air. Directing louvers shall be attached to the furnace, properly designed to distribute warmed air to all parts of the engine room.

c. Fuel tank and piping. - The fuel oil tank shall be a 180-gallon, 1/4 -inch welded steel tank, 30 inches in diameter and 60 inches long set on concrete supports underground and suitably anchored as indicated on the drawings. The fill line and vent line shall be of standard weight galvanized wrought iron pipe with galvanized mealleable iron fittings. A vent cap shall be provided on the vent line and the fill pipe shall have a lock type fill connection. The oil lines from the tank to the fuel pump shall be 1/2-inch (5/8-inch O.D.) Type K soft copper tubing conforming to Federal Specification WW-T-799 and installed with flared fittings. The feed line from pump to burner shall be 3/8-inch (1/2 inch O.D.), Type K, soft copper tubing, fitted with a shut-off valve at the pump, and a Ryan fusible valve, or equal, at the burner. Unless otherise specified, all fuel oil piping materials, workmanship and tests shall be in conformity with the current standard rules, regulations and specifications of the National Board of Fire Underwriters, Chicago, Illinois.

d. Fuel oil pump. - The fuel oil pump shall be similar and equal to the Trumbull oil pump No. 522, manufactured by the Trumbull Electric Manufacturing Compa ny, Plainville, Connecticut, and shall be suitably mounted on the engine-room wall as shown on the drawings.

e. Payment. - The contractor will be paid the contract price for Item 20, "Heating System," for furnishing and installing the heating system in accordance with the specifications and drawings.

SECTION XIII. INSTALLATION AND TESTING OF EQUIPMENT

13-01. Work included. - a. The contractor shall install all of the equipment furnished by him under the contract, and shall also install under Item 21 the following equipment to be furnished by the Government:

(1) Two 20-inch pumps, including intake and discharge piping and valves.

(2) Two gasoline engines with silencers and exhaust piping.

(3) Two right angle gear units.

b. The equipment to be furnished by the Government shall be installed under the supervision of a representative of the manufacturer. This supervision will be paid for by the Government.

13-02. Delivery. - a. The embedded items and anchor bolts for all equipment to be furnished by the Government will be available as follows: Anchor bolts approximately 30 days after notice to proceed and other embedded items approximately 100 days after notice to proceed; and the remainder of the equipment 150 days after notice to proceed. The contractor shall notify the contracting officer of the desired date of delivery (see Paragraph 1-14).

b. The contractor shallpromptly unload the materials and equipment from railroad cars and trucks, and will be held responsible for any demurrage charges incurred due to failure to unload promptly the cars or trucks. The contractor shall transport the materials and equipment from the point of delivery to the site of the work and shall store them in a suitable warehouse until they are incorporated in the work. The cost of unloading, handling, hauling, storage, and caring for materials and equipment furnished by the Government shall be included in the contract price for Item 21.

c. The contractor shall check the quantity and condition of all materials and equipment when delivered to him and in case there is any damage to, or shortage of, material or equipment, he shall so report to the contracting officer, in writing, within 24 hours.

13-03. Packing and shipping. - All of the equipment that is to be furnished by the contractor and installed under the contract shall be adequately protected during shipment and shall be brought to the site of the work in good condition, free from damage, corrosion, or other defects. The apparatus shall be boxed, crated, or otherwise protected so as to prevent damage during shipment. Before shipment, all the apparatus shall be thoroughly cleaned, unfinished iron and steel surfaces shall be painted as required in Section XIV, and all finished surfaces that might be subject to rust or corrosion prior to assembly shall be coated with a suitable, easily removable, rust-preventing compound (see Paragraph 1-13).

13-04. Installation. - The contractor shall install, erect, attach or build into the structures all the machinery, piping, and other metal work in a workmanlike manner as shown on the drawings or directed by the contracting officer. Wherever possible, all parts shall be made accurately to standard gauge to facilitate replacement and repair. All work of the installation of the equipment shall follow the best modern practice in the installation of machinery of this type, notwithstanding any omission from these specifications. All work of installation shall be done by mechanics skilled in their various trades. The equipment shall be anchored to concrete foundations by means of steel anchor bolts. The anchor bolts shall be set at the time of placing the concrete foundations as shown on the drawings. The concrete foundations for the equipment shall be constructed to the dimensions shown on the drawings or as recommended by the equipment manufacturer and shall be securely attached to the structural concrete floor slab by means of steel dowels. The equipment shall be given a touch-up coat of paint as required before the finish painting is done. (See Section XIV.)

13-05. Pumps, gear units, discharge piping, valves and accessories. - Two 20-inch vertical mixed flow pumps complete with intake and discharge piping, gate valves, check valves, gear units, anchor bolts and accessories shall be installed in the pumping station at the locations as shown on the drawings. The complete pumping units shall be set accurately plumb and anchored to the concrete floor slab by means of anchor bolts. The contractor will be permitted to grout in the wall section of each pump after the pump is assembled. The anchor bolts shall be set at the time the concrete is placed. The gate valves and horizontal discharge piping will be supported by concrete bases as shown on the drawings. All discharge piping shall be securely anchored as shown on the drawings at the section extending through the pumping station wall.

13-06. Gasoline engines. - Two gasoline engines with silencers and exhaust piping, anchor bolts and accessories shall be installed in the pumping station at the locations shown on the drawings. The contractor shall furnish and install a 2-inch insulation similar and equal to Keasbey and Mattison "Hy-Temp," Johns Manville "Superex" or Carey "Hi-Temp," with an 8-ounce canvas jacket for exhaust pipe assembly insulation as shown on the drawings. The gasoline engines shall be set accurately and anchored to the floor slab by means of anchor bolts. The anchor bolts shall be set at the time the concrete is placed.

13-07. Pipe fitting. - All pipe connections and joints shall be made tight and shall conform to local laws and regulations. Pipe threads shall be coated with Crane thread lubricant or equal so as to insure a tight joint. Sleeves for all pipes through floors and walls shall be extra strong, black wrought iron pipe conforming to Federal Specification WW-P-441a for Wrought Iron Pipe. A lead joint shall be caulked between the pipe and the sleeve to form a watertight joint. Before any piping is covered up, it shall be tested for leaks and made tight. All piping tests shall be conducted as directed by the contracting officer and in the presence of his authorized representative.

13-08. Operation of equipment. - a. Equipment furnished by the contractor. - (1) After installation, all of the equipment and apparatus furnished and installed under the contract shall be placed in operation by the contractor and operated for a sufficient length of time and in such a manner as to satisfy the contracting officer that the equipment has been properly installed and that it meets all of the other requirements of the specifications. The contractor shall also perform such field tests as are required by the specifications and as may be directed by the contracting officer, relating to the following equipment:

Electric lightand power system (see Section X).
Traveling crane (see Paragraph 11-08).
Miscellaneous equipment (see Section XII).

(2) In the event the operation or testing of the equipment by the contractor discloses any defects or failure to comply with the specifications, the equipment shall be immediately shut down and said defect or failure shall be corrected by the contractor to the satisfaction of the contracting officer, and the equipment shall again be placed in operation (see Paragraphs 1-37, 13-10 b and 13-11 a).

b. Equipment furnished by the Government. - After installation, all of the equipment furnished by the Government (see Paragraph 13-01 a), and installed under the contract shall be placed in operation by the contractor and operated for a sufficient length of time and in such a manner as to satisfy the contracting officer that the equipment has been properly installed. In the event the operation of the equipment by the contractor discloses any defect due to faulty or improper installation, the equipment shall be immediately shut down and said defect shall be corrected by the contractor to the satisfaction of the contracting officer. All field tests of this equipment will be conducted by the Government (see Paragraphs 1-37, 13-10 and 13-11 b).

13-09. Fuel and lubricants. - All fuel, electric energy, and lubricants necessary to place the equipment furnished under these specifications in operation and to perform the required field tests shall be furnished by the contractor. All oil reservoirs and grease containers shall be filled to their proper operating level. All fuel, lubricants, and other materials furnished by the contractor shall be those recommended by the manufacturer of the equipment in which it is to be used and shall meet the a pproval of the contracting officer. The Government will furnish all fuels and lubricants necessary to place in operation the equipment furnished by the Government.

13-10. Tests. - a. Installation. - Special care shall be exercised when aligning gear unit and pump shafts to insure free running in the bearings without binding. The shafts shall be turned by hand for at least 50 complete revolutions of the pump impeller. After the pump unit is completely installed it shall be given a thorough check for alignment and anchorage. The gate valves shall be opened and closed to insure free travel from the fully closed to the fully open positions. The check valve shall be swung open and shut without causing any undue binding.

b. Final operations. - After complete installation of pumping station equipment the contractor shall operate the equipment for sufficient duration to ascertain that all equipment is in good running condition. Any changes or adjustments necessary to secure satisfactory operation shall be made by and at the expense of the contractor. Provided that if any part of the equipment is found to be defective due to no fault of the contractor as determined by the contracting officer, the contracting officer may order the contractor to correct such defects and payments therefor will be made to the contractor under the provisions of Article 3 of the contract.

13-11. Payment. - a. Equipment furnished by the contractor. - Payment for installing and testing the equipment and apparatus furnished by the contractor shall be included in the applicable contract prices. (See Sections X to XII, incl.)

b. Equipment furnished by the Government. - Payment for installing the equipment furnished by the Government (see Paragraphs 1-14 and 13-01 a) will be made at the contract price for Item 21, "Installing Equipment Furnished by the Government," and shall include the cost of unloading and hauling from the point of delivery, storing, handling, erecting, cleaning, placing, painting, testing and maintaining said equipment until final acceptance of the work by the contracting officer, and for furnishing and installing gasoline engine exhaust pipe insulations, as specified.

c. Coordination of the work. - It is the intention of these specifications to provide for the construction of a complete and finished pumping station, ready for operation, and the prices named in the contract shall include all labor, equipment, material, expenses, and costs which are not properly to be classified under any other item or items, and which may be necessary completely to perform the work to be done under said item in the manner herein set forth and specified. The contractor shall, without additional compensation therefor, coordinate and join together all of the various subdivisions of the work and complete the pumping station in accordance with the drawings and specifications.

SECTION XIV. PAINTING

14-01. Work included. - The contractor shall do all shop and field painting of equipment, and all other painting required at the pumping station, except that shop painting of equipment furnished by the Government as provided in Paragraph 1-14 will be done by others. All exposed iron and steel work not galvanized, all unfinished iron or steel parts of the equipment, all doors, door frames, and louvers, and the finished concrete surfaces of the engine-roof floor and side walls shall be painted.

14-02. Paint materials. - a. All paint and paint materials shall conform, where applicable, to Federal Specifications of Group TT.

b. Priming coats for metal work shall be pure red lead paint, except that priming coats for standard manufactured articles and equipment may conform to the manufacturer's standard practice when approved by the contracting officer. Red lead paint shall be mixed in approximately the following proportions:

Paste red lead.....	100 lbs.
Raw linseed oil.....	1-7/8 gals.
Turpentine.....	2-1/2 pints (max.)
Drier.....	2-1/2 pints (max.)

c. Except as otherwise provided, finish painting above the engine-room floor shall be done with pure lead and oil paint of a composition and color as specified herein or approved by the contracting officer. With the exception of color pigments, the only pigments used in the paint shall be lead carbonate, zinc oxide, and titanium dioxide. No lithopone or fillers shall be used in the paint. Samples of all paint shall be submitted to the contracting officer for approval and selection.

14-03. Painting steel. - a. All ungalvanized structural and miscellaneous steel work not to be encased in concrete shall be given one shop coat and one field coat of red lead paint. After the shop fabrication has been completed and accepted, all material shall be cleaned of rust, loose scale, dirt, oil, grease, and other foreign substances, by wiping with gasoline or benzene, or by other approved means. After cleaning, the steel shall be given one shop coat of red lead paint. Surfaces which will not be accessible after assembly, but not in contact in riveted connections, shall be given a second shop coat.

b. Aftererection, the steel shall be touched up by painting over all spots where the shop coat has been scratched, knocked off, or otherwise damaged. After touching up, the steel shall then be given a field coat of red lead paint. Either the shop coat or field coat shall contain a small amount of lamp black so that the field coat may be readily differentiated from the shop coat.

c. Steel above the engine-room floor shall be given one finishe coat of approved paint (see Paragraph 14-02 c). Finish painting of steel below the engine-room floor shall be one coat of an asphalt paint similar and equal to "Anchor" asphalt paint manufactured by the Barrett Company of New York, and shall meet the requirements of Federal Specification TT-V-51, Type B, for Asphalt Varnish.

14-04. Painting equipment. - a. The equipment furnished by the Government will be painted by the equipment manufacturer. After installation, the contractor shall touch up all painted surfaces of equipment below the engine-room floor as found necessary by the contracting officer with the same type and color of paint as originally used by the manufacturer. Equipment above the engine-room floor shall be given one coat of approved paint (see Paragraph 14-02 c).

b. All unfinished iron and steel parts of the equipment furnished by the contractor shall be given one shop priming coat, one field touch-up priming coat, and two finish coats of approved paint (see Paragraph 14-02 c).

14-05. Painting pipe. - All exposed, ungalvanized iron and steel pipe, valves, and fittings shall be given one shop priming coat, one field priming coat, and two finish coats of approved paint. Cast iron pipe and other pipe below the engine-room floor shall be finished with black asphalt paint as specified in Paragraph 14-03 c. Unless otherwise directed by the contracting officer, pipe insulation shall be sized and painted with two coats of an approved lead and oil paint.

14-06. Painting tanks and trash rack. - a. That portion of the trash rack that is not encased in concrete shall be thoroughly cleaned and given one coat of red lead paint after installation. The finish painting shall consist of two coats of black graphite paint. Painting shall be similar and equal to Detroit Graphite Company's Iron-Gard System for underwater steel structures.

b. The gasoline and oil tanks shall be painted in the shop with one coat of red lead paint and two coats of black graphite paint as specified in subparagraph a above. After installation any spots on the tanks where the paint has been damaged shall be touched up with graphite paint.

14-07. Painting concrete. - The concrete floor and equipment foundations of the engine-room and the walls below the brick masonry shall be painted with two coats of an approved lead and oil paint. Before painting, the concrete shall be thoroughly cleaned of all dirt, oil, grease, and other foreign material by scrubbing with soap-suds and flushing with clean, warm water. After washing, the concrete shall be treated with a weak solution of muriatic acid and again flushed with clean water. The concrete shall then be allowed to become thoroughly dry before painting. No painting shall be applied to concrete for at least 30 days after the concrete is placed.

14-08. Application of paint. - Paint may be applied by either brushing or spraying, provided satisfactory results are obtained. No paint shall be applied on damp or frosted surfaces and material painted under cover in damp or cold weather shall remain under cover until dry. Painting shall be done in a neat and workmanlike manner and all joints and crevices shall be thoroughly coated.

14-09. Payment. - No direct payment will be made to the contractor for painting, but all compensation desired therefor shall be included in the contract prices for the several contract items involved.

SECTION XV. MISCELLANEOUS (Items 22 to 26, incl.)

15-01. Placing topsoil and seeding (Items 22 and 23). - a. Work included. - The contractor shall furnish and place topsoil in the earth fills as shown on the drawings, and on other areas as required by the contracting officer. Under Item 22, acceptable topsoil shall be placed to the required depth over the required areas. Under Item 23, the prepared topsoil surface shall be seeded when and as directed by the contracting officer.

b. Placing topsoil. - After the backfill has been completed to the required dimensions, the contractor shall apply the stored topsoil (see Paragraph 3-01 b) or additional acceptable topsoil if necessary, to the specified depth when compacted, over the backfill to the limits shown on the drawings. The topsoil shall be lightly rolled or tamped and any unevenness of surface shall be corrected to conform to finished grades.

c. Seeding. - (1) Preparation. - All grass or cover crop seed shall be sown, when directed by the contracting officer, so as to secure the greatest possible protection against erosion. The finished surface grade shall be maintained in a true and even condition during the seed-sowing operation, and the contractor shall rake the soil to a depth of three-quarters of an inch (3/4") by using iron rakes immediately previous to sowing seed. All raking shall be done in a direction parallel to the contour lines on the slope and not uphill or downhill. All sticks, stones, weeks or trash appearing on the surface shall be removed.

(2) Seed mixture. - The following mixture will be approved for each acre of seeding:

Perennial Rye Grass	7 lbs.
Orchard Grass	15 lbs.
Hard Fescue	4 lbs.
Kentucky Blue	6 lbs.
Sheep Fescue	6 lbs.
Timothy	7 lbs.
Perennial Red Clover	4 lbs.
White Clover	4 lbs.
Red Top	7 lbs.
Total per acre	60 lbs.

For all seeded areas, about 15 pounds of oats per acre shall be added if the planting is done between the middle of June and the middle of September, and about 15 pounds of winter rye per acre shall be added if the planting is permitted and done in the late season after the middle of September.

(3) Method of seeding. - The contractor shall take advantage of favorable weather and shall employ a method of sowing

satisfactory to the contracting officer. The seed shall be raked in and the whole surface then lightly rolled. Seeding shall be done immediately after the preparation of the earth surface unless otherwise directed. If there be any delay, and if weeds grow in and with the grass, such weeks shall be cut before they go to seed or at such time as directed by the contracting officer. If any loam is washed away or any portions of the seeded areas are not covered by grass, the contractor shall replace the topsoil, fertilize and re-seed.

(4) Maintenance. - The contractor shall maintain the areas sown to grass seed on each section of the project, until all work on the entire contract has been completed and accepted by the contracting officer. This maintenance shall consist of occasional mowing with a scythe or mechanical mower, watering during periods of drought, and removal of conspicuous weeds, or any other similar operations whenever required by the contracting officer. The turf areas shall be fertilized with an acceptable commercial lawn fertilizer of a quality equal to Vigoro or Scott's lawn fertilizer at the customary quantity per acre recommended by the manufacturer.

d. Measurement and payment. - (1) The quantity of topsoil to be paid for under Item 22 will be the number of cubic yards actually placed in accordance with directions, measured after compacting, whether obtained from stockpiles or from other sources at the expense of the contractor. Payment shall include the costs of all labor, materials and expenses incidental to furnishing and placing the topsoil. Payment will be made at the contract unit price for Item 22, "Topsoil".

(2) The quantity to be paid for under Item 23 will be the number of square yards seeded as directed. The measurement will be the actual superficial areas seeded. Payment shall include all costs for seeding as specified in subparagraph c above, and for all materials and expenses incidental thereto. Payment will be made at the contract unit price for Item 23, "Seeding".

15-02. Gate valve and miscellaneous pipe (Item 24). - a. Work included. - The contractor shall furnish and place a gate valve and miscellaneous cast iron and wrought iron pipe of various sizes, including specials, as shown on the drawings or required by the contracting officer.

b. Materials. - (1) The gate valve shall be a Crane Co. No. 490-1/2 or equal and shall conform to the requirements of current American Water Works Association specifications applicable to the size and use intended.

(2) The 4-inch cast iron pipe shall have a bell end where connecting to the 4-inch V.C. pipe and a flange end where connecting to the 4-inch gate valve inside the pumping station.

(3) The 4-inch cast iron pipe connecting the 4-inch V.C. pipe to the valve chamber shall have bell and spigot ends.

(4) The 6-inch extra heavy wrought iron pipe extends through the pumping station wall as a sleeve through which the 4-inch cast iron pipe extends.

(5) The 2-1/2-inch wrought iron pipe extends through the pumping station wall as a sleeve for a future water connection and shall be capped on the outside end.

(6) All cast iron pipe shall meet the requirements of current American Water Works Association specifications for standard weight pipe, Class A, where applicable, shall be asphalt coated inside and outside and shall have bell-and-spigot or flanged joints as shown on the drawings or as directed by the contracting officer. Flanged cast iron pipe shall have flanges faced and drilled to the 125-pound American standard and the bolts used in the installation of the pipe shall conform to appropriate Federal Specifications.

(7) All wrought iron pipe shall conform to Federal Specification WW-P-441a where applicable.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 3-04. Pipe trenches shall have the dimensions shown on the drawings. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least 2 inches up each side. Where encountered, rock or boulders shall be removed to a depth sufficient to clear the underside of the pipe and the voids backfilled with well compacted suitable material.

d. Laying pipe. - (1) All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury. The pipe shall be carefully bedded, and properly connected and jointed. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field. The interior of the pipe shall be carefully cleaned after laying to remove dirt and other obstructions.

(2) Bell-and-spigot joints shall be fully fitted together and shall be made fast by first adjusting the spigot end with wedges to obtain a uniform joint space, and then thoroughly packed with oakum or jute and caulked with lead. Flanged joints shall be carefully jointed and connected, and suitable lead or other gaskets shall be used as directed by the contracting officer to prevent rupture in tightening bolts. Before backfilling, the pipe shall be tested for leakage by a suitable water pressure test where required and as directed by the contracting officer.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe to the limits shown on the drawings or as directed by the contracting officer. Hand tamping shall be done as directed.

f. Payment. - (1) Payment will be made at the contract price for Item 24, "Gate Valve and Miscellaneous Pipe", and shall include all costs of furnishing and installing the gate valve and miscellaneous cast iron and wrought iron pipe, including specials and any concrete required, except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 2 (see Paragraph 3-03 f). Payment for earth backfill will be made at the applicable contract unit prices for Items 3 and 4 (see Paragraph 1-05).

15-03. Gravel for roads (Item 25). - a. Work included. - The contractor shall furnish and place gravel, or crushed stone if approved by the contracting officer, of the sizes and quality specified or directed for surfacing of roads, to the lines and grades shown on the drawings.

b. Material. - The gravel or crushed stone shall be composed of hard, durable stones, free from thin or elongated pieces. The gravel or crushed stone shall be of such sizes for the bottom layer that all will pass a 3-inch screen with square openings and not less than 50 percent will be retained on a 1-1/4-inch screen with square openings; and for the top layer, all will pass through a 1-inch screen with square openings, and not less than 50 percent will be retained on a 1/4-inch screen with square openings; and for either layer it shall be uniformly graded. The finer material shall consist of sand or other suitable binding material encountered in bank-run gravel and approved by the contracting officer. Should the material as received for the work fail to maintain suitable proportions of coarse and fine particles, or should the coarse particles not be uniformly graded between the maximum and minimum sizes as specified, it shall be screened or mixed in such a manner as to furnish a material to meet the above requirements.

c. Placing. - The 8-inch gravel base shall be placed in two layers, a bottom layer and a top layer each 4 inches thick after compaction. After the subgrade or foundation shall have been properly prepared and compacted and proper drainage provided, the bottom layer of material shall be spread evenly by means of approved spreader vehicles or trucks. The material as spread shall be well-graded with no pockets of fine material or segregation of large and fine particles. After being spread evenly, the material shall be thoroughly compacted, by rolling with a self-propelled three-wheel roller weighing not less than ten tons, until a firm even surface is obtained. After the bottom layer has been properly and satisfactorily compacted, the top layer shall be spread and compacted to the required thickness. If at any time the material does not contain a sufficient amount of moisture to insure binding of the material, water shall be added by any approved method in a sufficient amount to obtain the desired results.

d. Measurement and payment. - The quantity to be paid for under Item 25 will be the number of cubic yards furnished and placed

in accordance with the drawings or as directed by the contracting officer. The material will be measured in place after compacting. Payment will be made at the contract unit price for Item 25, "Gravel for Roads," and shall include payment for all expenses incidental to furnishing, placing, and compacting the gravel or crushed stone.

15-04. Carbon dioxide fire extinguishing equipment (Item 26). - a. Description. - The contractor shall furnish and install two portable, 15-pound, carbon dioxide fire extinguishers, each with three feet of hose, a nozzle, and a permanent shut-off of the seat type. Each portable extinguisher shall be mounted on a wall bracket and located as directed by the contracting officer. The equipment shall be similar and equal to that manufactured by Walter Kidde and Company or the C-O-Two Equipment Company. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the carbon dioxide fire extinguishing equipment which he proposes to install.

b. Payment. - The contractor will be paid the contract price for Item 26, "Carbon Dioxide Fire Extinguishing Equipment" for furnishing and installing the carbon dioxide fire extinguishing equipment as required by the specifications.

15-05. Cleaning up. - a. Work included. - The contractor shall remove all construction equipment and all temporary structures built or used by him, shall remove rubbish of all kinds from the site of the work, and from any grounds which he shall have occupied within the limits of the work, and shall leave the site of the work in a clean condition satisfactory to the contracting officer. All materials salvaged shall be the property of the contractor.

b. Payment. - For all work, materials and incidentals required to clean up as set forth in a above, the contractor will receive no direct payment, but payment shall be considered as having been included in the contract prices for Items 1 to 26, inclusive.

United States Engineer Office
Providence, Rhode Island
April 30, 1941

STANDARD GOVERNMENT FORM OF BID
(Construction Contract)

The District Engineer
U. S. Engineer Office
819 Industrial Trust Bldg.
Providence, Rhode Island

Place _____

Date _____

In compliance with your invitation for bids dated April 30, 1941, and subject to all the conditions thereof, (see Paragraph XIX a) the undersigned,

_____

a corporation organized and existing under the laws of the State of

_____

a partnership consisting of _____

_____

or an individual trading as _____

_____

of the City of _____ hereby proposes to furnish all plant, labor, and materials, except the equipment and materials specified in Paragraph 1-14 and Section XIII of the specifications, and perform all work required for the construction of the Cherry Street and Pitkin Street Pumping Stations and appurtenant structures on the Connecticut River at East Hartford, Connecticut, including all work indicated on the drawings, or required by the specifications, and such incidental work as needed or ordered in writing by the contracting officer, in strict accordance with the specifications, schedules, and drawings, for the consideration of the following prices:

SCHEDULE 1.

SCHEDULE OF PRICES FOR THE CONSTRUCTION OF CHERRY STREET PUMPING STATION

Item No.	Designation	Unit	Quantity	Unit Price	Amount
1	Control of Water and Sewage	job	-		
2	Common Excavation - General	cu.yd.	1,800		
3	Compacted Backfill	" "	5		
4	Semi-Compacted Backfill	" "	1,250		
5	4-Inch V. C. Pipe	lin.ft.	64		
6	24-Inch Cast Iron Pipe	" "	14		
7	Cement	bbl.	290		
8	Concrete - Class "A"	cu.yd.	160		
9	Concrete - Class "B"	" "	90		
10	Steel Reinforcement	lb.	25,000		
11	Pumping Station Superstructure	job	-		
12	Miscellaneous Iron and Steel	lb.	3,180		
13	Miscellaneous Pipe and Fittings	"	330		
14	Steel Trash Rack	job	-		
15	Electric Light and Power System	"	-		
16	Traveling Crane, Complete	"	-		
17	Sump Pump	"	-		
18	Gasoline Tank and Piping	"	-		
19	Float Gage	"	-		
20	Heating System	"	-		
21	Installing Equipment Furnished by the Government	"	-		
22	Topsoil	cu.yd.	90		
23	Seeding	sq.yd.	540		
24	Gate Valve and Miscellaneous Pipe	job	-		
25	Gravel for Roads	cu.yd.	6		
26	Carbon Dioxide Fire Extinguishing Equipment	job	-		
	TOTAL FOR SCHEDULE 1.				

SCHEDULE 2.

SCHEDULE OF PRICES FOR THE CONSTRUCTION OF PITKIN STREET PUMPING STATION

Item No.	Designation	Unit	Quantity	Unit Price	Amount
1	Control of Water and Sewage	job	-		
2	Common Excavation - General	cu.yd.	900		
3	Compacted Backfill	" "	50		
4	Semi-Compacted Backfill	" "	70		
5	4-Inch V. C. Pipe	lin.ft.	40		
6	30-Inch Cast Iron Pipe	" "	14		
7	Cement	bbl.	338		
8	Concrete - Class "A"	cu.yd.	190		
9	Concrete - Class "B"	" "	100		
10	Steel Reinforcement	lb.	29,000		
11	Pumping Station Superstructure	job	-		
12	Miscellaneous Iron and Steel	lb.	3,100		
13	Miscellaneous Pipe and Fittings	"	310		
14	Steel Trash Rack	job	-		
15	Electric Light and Power System	"	-		
16	Traveling Crane, Complete	"	-		
17	Sump Pump	"	-		
18	Gasoline Tank and Piping	"	-		
19	Float Gage	"	-		
20	Heating System	"	-		
21	Installing Equipment Furnished by the Government	"	-		
22	Topsoil	cu.yd.	100		
23	Seeding	sq.yd.	600		
24	Gate Valve and Miscellaneous Pipe	job	-		
25	Gravel for Roads	cu.yd.	5		
26	Carbon Dioxide Fire Extinguishing Equipment	job	-		
	TOTAL FOR SCHEDULE 2.				

SCHEDULE 3

DEDUCTION FOR COMBINED AWARD

Item 1. If awarded both Schedule 1 and Schedule 2 the bidder agrees that the Government may deduct from the total amount thereof the sum of _____ Dollars ($_____).

Note: All amounts and totals given herein will be subject to verification by the Government. In case of variation between unit bid price and totals shown by bidder, the unit price will be considered to be his bid.

PLANT TO BE USED

(See Invitation for Bids and Paragraph 1-09 of the specifications.)

Note: Use separate line for each major item.

No.	Name	Kind	Capacity	Age and Condition
		Material Handling Equipment		
		Pumping Equipment (Construction)		
		Excavating Equipment		
		Concreting Equipment		
		Miscellaneous Equipment		

EXPERIENCE. - (See Invitation for Bids)

DATA SHEETS

The bidder shall submit with his proposal the following information regarding the equipment he proposes to furnish. Statements so made by the bidder are intended to be, and are, express warranties. Award of this contract shall not be construed as a guarantee by the Government that the materials or supplies listed in the Bid Form are approved.

Cherry Street

DATA SHEET

TRAVELING CRANE

a. Manufacturer _____

b. Capacity _____ tons

c. Type _____

Pitkin Street

DATA SHEET

TRAVELING CRANE

a. Manufacturer _____

b. Capacity _____ tons

c. Type _____

DATA SHEET

SUMP PUMP

1. Pump:

   a. Manufacturer's name _____

   b. Model or type _____

   c. Capacity at 32 ft. head at rated speed _____

   d. Shut-off head _____

   e. Pipe size of discharge connection _____

2. Electric motor:

   a. Manufacturer's name _____

   b. Type and rating _____

DATA SHEET

SUMP PUMP

1. Pump:

   a. Manufacturer's name _____

   b. Model or type _____

   c. Capacity at 35 ft. head at rated speed _____

   d. Shut-off head _____

   e. Pipe size of discharge connection _____

2. Electric motor:

   a. Manufacturer's name _____

   b. Type and rating _____

It is hereby warranted that in the event award is made to the undersigned there will be used in the performance of the work covered by the contract only such unmanufactured articles, materials and supplies as have been mined or produced in the United States and only such manufactured articles, materials, and supplies as have been manufactured in the United States all from articles, materials, or supplies mined, produced or manufactured, as the case may be, in the United States, except as noted below or otherwise indicated in this bid or authorized in the specifications.

The undersigned agrees, upon receipt of written notice of the acceptance of this bid within 60 days after the date of opening of the bids, to execute the standard form of Government contract, in accordance with the bid as accepted, and to give the required bonds with good and sufficient surety or sureties for the faithful performance of the contract and for the protection of all persons supplying labor and materials in the prosecution of the work, within 10 days after the prescribed forms are presented for signature.

Performance will begin within 10 calendar days after the receipt of notice to proceed and will be completed within 250 calendar days after date of receipt of said notice to proceed.

_____
(Bidder)

_____
(Address)

By_____
(Name) (Title)

NOTE: Read Standard Government Instructions to Bidders before preparing this bid.