CONNECTICUT RIVER FLOOD CONTROL PROJECT

HARTFORD, CONN.

CONNECTICUT RIVER, CONNECTICUT

SPECIFICATIONS

FOR

LOCAL PROTECTION WORKS

ITEM Ht.5-7b—CONTRACT

RIVERFRONT, MORGAN ST. TO STA. 96+73

U.S. ENG. OFFICE
NEW ENGLAND DIV.
FEB 24 10 33 AM '48
BOSTON, MASS.

WAR DEPARTMENT, CORPS OF ENGINEERS, U.S. ARMY

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

1940

Invitation No. 699-40-385

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
PROVIDENCE, R. I.

July 17, 1940

ADDENDUM NO. 2 to Invitation No. 699-40-385, dated June 20, 1940 for the construction of dike and wall at Hartford along the Connecticut River, Item Ht. 5 and Ht. 7b, Hartford, Connecticut, bids to be opened July 23, 1940.

1. Page 40, Paragraph 4-07 h of the specifications: Delete reference to Item 12 c.

2. The quantities indicated in Paragraph 1-05 of the specifications and in the Standard Government Form of Bid are changed as follows for the indicated item:

Item No.	Designation	Unit	Quantity
12	Reinforced concrete piling		
	a. 14" size	lin.ft.	6,100
	b. 16" size	" "	16,600

3. On sheet No. 104 of the folio drawings change the "12-inch square pile" to "14-inch square pile", and the reinforcement from "four 7/8" round bars" to "four 1" round bars".

4. This addendum shall be attached to and made a part of your proposal, and the revised quantities will be used in comparing bids.

J. S. Bragdon

J. S. BRAGDON
Lieut. Col., Corps of Engineers
District Engineer

Invitation No. 699-40-385

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
PROVIDENCE, R. I.

July 6, 1940

ADDENDUM NO. 1, to Invitation No. 699-40-385, dated June 20, 1940 for the construction of Dike and Wall at Hartford along the Connecticut River, Item Ht.5 and Ht.7b, Hartford, Connecticut, bids to be opened July 23, 1940.

1. Paragraph 1-02 b (3) change Station 27+31.50 to 26+75.5
Paragraph 1-02 b (4) change Station 27+79 to 27+23
Paragraph 1-02 b (5) change Station 36+40 to 56+44
Paragraph 1-03 c change Station 36+40 to 56+44
Paragraph 3-01 d (4). Next to last sentence, substitute "shoring" for "showing".

2. Insert after the third sentence in Paragraph 3-08 c (1) "In the determination of the length of dredge pipe in excess of 4000 feet for use as a multiple of the quantity to be paid for under Item 8b, there shall be deducted from the actual length of dredge pipe as measured any portion considered to be excess length in the opinion of the contracting officer".

3. The quantities indicated in Paragraph 1-05 of the specifications and in the Standard Government Form of Bid are changed as follows for the indicated item:

Item No.	Designation	Unit	Quantity
9	Removal of existing structures		
	a. Brick	cu.yd.	20

4. This addendum shall be attached to and made a part of your proposal, and the revised quantity will be used in comparing bids.

J. S. Bragdon,
Lieut. Col., Corps of Engineers,
District Engineer

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR CONSTRUCTION OF

EARTH DIKE

ITEM HT.5 and HT.7B (CONTRACT)

HARTFORD, CONNECTICUT

MAY 22, 1940
(ISSUED JUNE 20, 1940)

CORPS OF ENGINEERS, U. S. ARMY

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

No._____ Bidder_____ Invitation No. 699-40-385
(Do not write above this line)

STANDARD GOVERNMENT FORM OF INVITATION FOR BIDS
(Construction Contract)

War Department
United States Engineer Office
Providence, R. I.
June 20, 1940

SEALED BIDS, in duplicate, subject to the conditions contained herein, will be received until 2:00 p.m., Eastern Daylight Saving Time, July 23, 1940, and then publicly opened, for furnishing all plant, labor and materials and performing all work required by the drawings and specifications for the construction of concrete flood walls, earth dikes, and appurtenant works, located on the Connecticut River below the Highway Bridge at Hartford, Connecticut.

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

Specifications for construction of Hartford Dike, Riverfront, Morgan Street to Station 96+73, 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 a deposit of $10.00 will be required to insure their return. This deposit should be in the form of a United States money order or a certified check, made payable to "The Disbursing Officer, U. S. Engineer Office, Providence, Rhode Island". The $10.00 deposit for each complete set of drawings will be refunded upon return of said drawings in good condition within 60 days after date of opening bids.

II. GUARANTEE 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) percent 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) percent 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) percent 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) percent 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 1-16 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 the entire work and shall have each blank filled.

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 hereinbefore described, within ten (10) days after the papers are presented to him.

IX. EXPERIENCE. - 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.

X. COMMENCEMENT AND COMPLETION. - Work shall be commenced within ten (10) calendar days after receipt of notice to proceed and shall be completed within 455 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, and proof of payment of such wages will be required. (See Articles 17 and 19 of the contract and Paragraph 1-34 of the specifications.)

XII. EIGHT-HOUR LAW. - The requirements of the Eight-Hour Law, Article 11 of the contract, 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 1-30 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 1-35 of the specifications as a part of the contract.

XV. INVESTIGATION OF CONDITIONS. - Samples of borings taken at the site can be seen at the U. S. Engineer Laboratory at Providence, R. I., 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 materials to be excavated from the borrow or structure excavations, the nature of the materials to be transported and placed in the embankment and the local conditions bearing on transportation, handling and storage of materials. They are also expected to make their own estimates of the facilities needed, the difficulties attending the execution of the proposed contract, including local conditions, availability of labor, uncertainties of weather, and other contingencies. In no case will the Government assume any responsibility whatever for any interpretation, deduction, or conclusion drawn from the examination of the site. At 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 of assuming all 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 prepared 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: Excavation, Steel Sheet Piling, Concreting, Earth Embankment, and Riprap. 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, 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 hereinafter reserved, the work will be awarded as a whole to one bidder. The right is reserved as the interest of the Government may require, to reject any and all bids and 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 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
Concrete Flood Wall and
Earth Dike on the
Connecticut River at
Hartford, Connecticut.
To be opened July 23, 1940.

(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. 699-40-385

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
PROVIDENCE, RHODE ISLAND

APPROPRIATION: 21X3113 Flood Control, General

DIKE AND WALL AT HARTFORD ALONG THE CONNECTICUT RIVER

ITEM HT.5 and HT.7B (CONTRACT)

HARTFORD, CONNECTICUT

SPECIFICATIONS

SECTION I. GENERAL PROVISIONS

1-01. Location. - The site of the work covered by these specifications is located on the west bank of the Connecticut River, in the central and south portions of the City of 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, and performing all work required for constructing concrete flood walls, earth dikes, and appurtenant structures complete in accordance with these specifications and the drawings forming a part hereof, together with such 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 concrete flood walls between Station 0+00 and Station 22+08.65, between Station 35+53.98 and Station 42+86.50, and between Station 79+86.50 and Station 92+30, complete with steel sheet piling cut-off.

(2) Construction of earth dikes between Station 22+08.65 and Station 35+53.98, between Station 42+86.50 and Station 79+86.50, and between Station 92+30 and Station 96+73.29, complete with steel sheet piling cut-off.

(3) Construction of a concrete discharge conduit at Station 27+31.50, complete with concrete gate structure, gate, and hoist.

(4) Construction of a concrete gate structure complete with gate and hoist for existing sewer outfall at Station 27+79.

(5) Reconstruction of the Masseek Street sewer outfall at Station 36+40, complete with backwater chamber and gate and construction of a gate house for existing gate on landside of proposed earth dike.

(6) Construction of stop-log structures at Stations 85+39 and 87+58.18.

(7) Construction of miscellaneous drainage structures, drains, headwalls, bulkheads, and all appurtenant structures.

c. During the prosecution of work under this contract, related work will be performed by others in and adjacent to the working areas shown on the drawings. Work to be performed by others includes, but is not limited to, the following general items:

(1) A conduit for the diversion of Park River. This conduit crosses the work area under this contract at Station 34+84.34 as shown on the drawings. The portion of the conduit in the area of the riverfront dike will be constructed by others and the Park River diverted through it before the fill in the existing bed of the Park River can be placed.

(2) Walls, a railroad tunnel, and pertinent work for the construction of a boulevard will be constructed in and adjacent to the work in the area approximately between Station 10 and Station 25. A plan showing the approximate extent of this work is on exhibit in the Providence District Office.

(3) Tracks of the New York, New Haven and Hartford Railroad, including sidings, will be relocated by others in the area approximately from Station 2 to Station 51 and also in the vicinity of the South Meadows Electric Station.

(4) A highway bridge to cross the Connecticut River is contemplated in the vicinity of Wawarme Avenue near Station 72. It is expected that bridge piers will be constructed approximately as shown on Sheet No. 20 of the drawings.

(5) The East Hartford Dike contractor shall have priority to the use of Borrow Area A3, indicated on the drawings. (See Paragraph 3-08 a (1).)

1-03. Description of the work. - a. The concrete walls will be constructed of reinforced concrete, will have a total length of approximately 4,185 feet, will be constructed with steel sheet piling cut-off, and will have top elevations varying from 49.91 feet m.s.l. to 44.0 feet m.s.l. Tile and gravel drains will be installed along the landside toe of the wall as indicated on the drawings.

b. The earth dike sections will be of a combined hydraulic and rolled fill type, total length about 5,490 feet at top elevation varying from 44.41 feet m.s.l. to 43.59 feet m.s.l., complete with steel sheet piling cut-off. The central and landside portions of the dike will be constructed of free draining river sand dredged in place. The cut-off and blanket on the riverside will be of selected impervious material backed with random material of a variable section rolled in place. The slopes of the dike will be sodded and seeded or riprapped as indicated on the drawings. The top of the dike will be covered with a layer of compacted gravel. Rock toes and a steel sheet pile bulkhead will be provided on the riverside of the dike as shown on the drawings.

c. Conduits, gate structures, backwater gate chambers, stop-log structures, and gate houses will be constructed of reinforced concrete. The reconstruction of the sewer outfall at Station 36+40 will utilize the existing reinforced concrete sewer pipe and timber piling will be driven as shown on the drawings.

1-04. Drawings. - a. The work shall conform to drawings marked "Hartford Dike, Riverfront, Morgan Street to Sta. 96+73," 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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1	Project Location and Index	CT-4-2470
2	General Plan	CT-4-2471
3	Hydrographs No. 1	CT-3-1171
4	Hydrographs No. 2	CT-3-1172
5	Subsurface Explorations No. 1	CT-2-1274
6	Subsurface Explorations No. 2	CT-2-1275
7	Subsurface Explorations No. 3	CT-2-1276

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9	Subsurface Explorations No. 5	CT-2-1278
10	Borrow Areas	CT-2-1279
10A	Borrow Area	CT-2-1299
11	Record of Borrow Explorations	CT-2-1280
11A	River Cross Sections	CT-2-1298
12	Plan and Profile No. 1	CT-4-2472
13	Plan and Profile No. 2	CT-4-2473
14	Plan and Profile No. 3	CT-4-2474
15	Plan and Profile No. 4	CT-4-2475
16	Plan and Profile No. 5	CT-4-2476
17	Plan and Profile No. 6	CT-4-2477
18	Plan and Profile No. 7	CT-4-2478
19	Plan and Profile No. 8	CT-4-2479
20	Plan and Profile No. 9	CT-4-2480
21	Plan and Profile No. 10	CT-4-2481
22	Plan and Profile No. 11	CT-4-2482
23	Plan and Profile No. 12	CT-4-2483
24	Typical Cross-sections No. 1	CT-4-2484
25	Typical Cross-sections No. 2	CT-4-2485
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27	Typical Cross-sections No. 4	CT-4-2487
28	Typical Cross-sections No. 5	CT-4-2488
29	Plan Details and Sections - Sta. 0+00 to Sta. 1+00	CT-4-2489
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31	Plan Details and Sections at Sta. 4+71	CT-4-2491
32	Wall - Dike Connection at Sta. 22+00	CT-4-2492
33	Plan and Profile - Keeney Lane and Potter St. Outlets	CT-4-2493
34	Conduit Details - Keeney Lane	CT-4-2494
35	Gate Structure Details - Keeney Lane	CT-4-2495
36	Gate Structure Details - Potter Street	CT-4-2496
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93	Wall - Sta. 17+11.19 to Sta. 18+71.19 - Steel Reinforcement	CT-4-2553
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110	Masseek Street Gate House and Conduit - Steel Reinforcement No. 1	CT-4-2570
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112	Wall Details - Sta. 79+86.5 to Sta. 85+17.5 - Steel Reinforcement	CT-4-2572
113	Stop-log Structure No. 1 - Steel Reinforcement No. 1	CT-4-2573
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115	Wall Details - Sta. 85+97.5 to Sta. 89+17.67 - Steel Reinforcement	CT-4-2575
116	Wall Details - Sta. 85+97.5 to Sta. 86+37.5 - Steel Reinforcement	CT-4-2576
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118	Stop-log Structure No. 2 - Steel Reinforcement No. 1	CT-4-2578
119	Stop-log Structure No. 2 - Steel Reinforcement No. 2	CT-4-2579
120	Wall Details - Sta. 89+17.67 to Sta. 90+91 - Steel Reinforcement No. 1	CT-4-2580
121	Wall Details - Sta. 89+17.67 to Sta. 90+91 - Steel Reinforcement No. 2	CT-4-2581
122	Wall Details - Sta. 89+17.67 to Sta. 90+91 - Steel Reinforcement No. 3	CT-4-2582
123	Wall Details - Sta. 90+91 to Sta. 91+33.01 - Steel Reinforcement	CT-4-2583
124	Wall Details - Sta. 91+33.01 to Sta. 92+30 - Steel Reinforcement	CT-4-2584
125	General Wall Details - Steel Reinforcement No. 1	CT-4-2585
126	General Wall Details - Steel Reinforcement No. 2	CT-4-2586

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 only. The contractor shall be responsible for furnishing 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 the best engineering practice, and 4 copies of each drawing shall be submitted to the contracting officer for approval. Each sheet of drawings submitted for approval shall be provided with a blank white space approximately 5 inches by 4 inches near the lower right-hand corner, just above the title, in which the contracting officer may indicate the action taken. After approval by the contracting officer, but before the work indicated on the contractor's drawings is commenced, one copy of each approved drawing will be furnished the contractor. These approved drawings shall form a part of the contract. The Government will not be responsible for minor errors or minor discrepancies of the contract drawings. Drawings furnished by the contractor for approval by the contracting officer shall be made with ink on tracing cloth. Upon completion of the project, the contracting officer shall be furnished with "Van Dyke" negatives of the contractor's drawings, corrected to show all revisions made during construction.

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

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 amount of the 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.

Item No.	Designation	Unit	Quantity
1	Preparation of Site	acre	36
2	Stripping		
	a. Common	cu.yd.	30,000
	b. Roadway	cu.yd.	1,600
3	Common Excavation, General	cu.yd.	70,000
4	Common Excavation, Impervious Borrow	cu.yd.	135,000
5	D E L E T E D		
6	Common Excavation, Cut-off Trench	cu.yd.	7,200
7	Common Excavation, Special Work at Power Stations	cu.yd.	10,400
8	Free Draining River Sand		
	a. Dredging Not Exceeding 4,000 Feet to Point of Disposal	cu.yd.	635,000
	b. Dredging for Each Additional 2,000 Feet to Point of Disposal	cu.yd.	50,000

Item No.	Designation	Unit	Quantity
9	Removal of Existing Structures		
	a. Brick	cu.yd.	-
	b. Concrete	cu.yd.	2,000
	c. Stone Masonry	cu.yd.	600
	d. Masseek Street Sewer	lin.ft.	70
10	Steel Sheet Piling		
	a. Permanent Cut-off	sq.ft.	293,700
	b. Temporary Sheeting	sq.ft.	6,000
	c. Permanent Bulkhead	sq.ft.	5,200
11	Timber Piling		
	a. Sheet Piling	sq.ft.	6,600
	b. Bearing Piles	lin.ft.	4,200
12	Reinforced Concrete Piling		
	a. 14" Size	lin.ft.	4,700
	b. 16" Size	lin.ft.	12,500
	c. 18" Size	lin.ft.	4,400
13	Impervious Fill, Placing and Rolling	cu.yd.	116,000
14	Random Fill, Placing and Rolling	cu.yd.	20,000
15	Screened Gravel	cu.yd.	14,000
16	Compacted Backfill	cu.yd.	22,600
17	Semi-compacted Backfill	cu.yd.	37,000
18	Dumped Rock Fill	cu.yd.	48,700
19	Riprap, Hand Placed	cu.yd.	21,500
20	Grouted Riprap	cu.yd.	260
21	Tile Drains		
	a. 12" V.C. Pipe	lin.ft.	1,700
	b. 15" V.C. Pipe	lin.ft.	900
	c. 18" V.C. Pipe	lin.ft.	800
22	Cast Iron Pipe		
	a. 16-inch	lin.ft.	70
	b. 18-inch	lin.ft.	170
23	Cement	bbl.	30,000
24	Class "A" Concrete	cu.yd.	21,900
25	Steel Reinforcement	lb.	2,563,000
26	Stone Masonry	cu.yd.	10
27	Gate House for Masseek Street Sewer	job	-
28	Flap Valves		
	a. 4-inch	each	1
	b. 6-inch	each	3
	c. 8-inch	each	3
29	Gate and Check Valves		
	a. 4" Gate Valve	each	1
	b. 6" Gate Valve	each	2
	c. 8" Gate Valve	each	1
	d. 8" Check Valve	each	1
30	Miscellaneous Iron and Steel	lb.	13,500
31	Copper Water Stops	lb.	5,700
32	Pipe Hand Railing	lin.ft.	64
33	Sluice Gates, Complete with Hoists	job	-

Item No.	Designation	Unit	Quantity
34	Timber Stop-logs	M.F.B.M.	3
35	Topsoil	cu.yd.	23,000
36	Sodding and Seeding	acre	19
37	Surfacing for Top of Dike	cu.yd.	1,500
38	Bituminous Surface Treatment	sq.yd.	2,000
39	Concrete Cribbing	cu.ft.	2,300
40	Backwater Gate, Complete with Hoist	job	-
41	Foundation Drain Wells	lin.ft.	8,400
42	Reconstruction of Existing Access Walkway	job	-

1-06. Physical data. - a. General. - Materials for constructing the earth dike are available in the vicinity of the work. Locations of borrow areas are shown on the drawings. Borings have been made in the vicinity of the proposed work with reasonable care and substantially at the places indicated on the drawings. Laboratory analyses have been made of the samples from many bore holes. Samples of materials taken from them, and records of laboratory analyses and other studies may be seen at the United States 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 the 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, riprap, and gravel for bedding and drains, 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 City of Hartford with main and branch 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 city. 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.

(3) Waterways. - A 15-foot channel with 94-foot minimum vertical clearance is maintained in the Connecticut River up to the highway bridge at Hartford, which is at the upper limit of the proposed work. Above the bridge there is limited draft and overhead clearance. For navigation data see U. S. C. & G. S. Charts Nos. 215, 254, 255, and 256. The normal river stage is 3.5 feet mean sea level at the Hartford bridge, and usually varies from a low stage of 1.5 feet mean sea level in August to a high stage of 20+ feet mean sea level in April. Freshets producing higher stages may occur at any month of the year as a result of heavy rainfall.

c. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 12 degrees to plus 101 degrees Fahrenheit. The mean annual precipitation at Hartford is 42.50 inches. The mean monthly precipitation varies from a low of 3.22 inches in June to a high of 4.20 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 within 455 calendar days after said date of receipt of notice to proceed. After the Park River has been diverted through the conduit by others, the contractor shall complete the fill for the abandoned Park River outlet to the limits of the first season construction, as shown on the drawings, within twenty (20) calendar days after date of receipt by him of notice to proceed with placement of said fill. Within sixty (60) days after completion of the first season fill at the mouth of Park River, the contractor shall complete the foundation drain wells at said location as shown on the drawings.

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 and ground moisture conditions are unfavorable. The contractor will be required to resume operations on written notice from the contracting officer terminating the suspension, provided that a minimum 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. With the exception of the fill in the abandoned Park River outlet, as required by the contracting officer, no earth work will be required during the period from December 20th to March 15th and the time allowed for completion of the entire work will not be affected by suspension of earth work in that period.

c. Liquidated damages. - 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 the following: For failure to complete the fill at the mouth of Park River to the limits of the first season construction as shown on the drawings within twenty (20) calendar days after date of receipt by him of notice to proceed with placement of said fill, the sum of fifty dollars ($50.00) for each calendar day of delay; for failure to complete the foundation drain wells located at the mouth of Park River within sixty (60) days after completion of the first season fill in said location as shown on the drawings, the sum of fifty dollars ($50.00) for each calendar day of delay; and for delay in completing the entire work under the contract within 455 calendar days, plus any additional time allowed under the terms of the contract, after said date of receipt of notice to proceed, the sum of one hundred dollars ($100.00) for each calendar day of delay until all work is completed or accepted.

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 Government 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 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 at the rate of progress stated in his bid and specified herein. 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 the 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 for work executed and completed as specified or otherwise required, and not included in any prior estimate, subject to the stipulations herein for estimating for partial payments, except that 10 percent of the amount of each estimate will be retained until the full completion and acceptance of all work covered by the contract, when final payment will be made.

1-11. Work covered by contract price. - The contractor shall, under his contract prices, furnish and pay for all material and labor, 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. - The contractor shall furnish all materials and equipment necessary to complete the work to be done under these specifications. The cost of unloading and loading, handling, hauling, storing, and caring for materials furnished by the contractor shall be included in the contract prices for the work to which the materials pertain. All materials, supplies, and articles delivered at the site shall be adequately housed or otherwise protected against deterioration and damage.

1-14. 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.

1-15. 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 5-14 c).

1-16. 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.

1-17. Grounds and right of way. - a. Grounds and right 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 right of way, but in case such delay retards the operations of the contract, the contracting officer will grant an extention of time for the completion of the work equal to the time 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.

1-18. Removal of rubbish. - The contractor shall keep the site free from rubbish. Suitable spoil areas for receiving refuse from the grounds shall be provided, 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.

1-19. 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 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 expense of these and other safety precautions shall be borne by the contractor.

1-20. 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 1-22. The inspectors will keep a record of work done, and see that the location and limit marks are kept in proper order. Work done without proper inspection may not be paid for. 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 1-36.

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 12 by 20 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 VIII and for temporary storage of concrete specimens. The room shall be protected from the weather, properly lighted, heated, and furnished with water, 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 1-33.

(3) The contractor shall furnish appropriate quarters for a Government field office. Such quarters shall be a room approximately 12 by 20 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.

1-21. 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 a bench mark located at the site of the work, the location, description, and elevation (in feet) of which is as follows:

> "Hartford - at north entrance to Post Office on east side of steps about 2 ft. above sidewalk - standard disc in the upper surface of granite guard block designated also as Tidal Bench Mark 5 - 62.417 feet above mean sea level."

1-22. Lines and grades. - a. The contractor shall keep the contracting officer informed a reasonable length of time in advance of the time and places 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.

1-23. 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 interpretation 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.

1-24. Water supply. - The contractor shall provide, at convenient points, ample supplies of water of proper quality for all the operations required under this contract.

1-25. 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 United States 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.

1-26. 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.

1-27. 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 lifesaving 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, gangplanks, 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, and for the protection of the contractor's forces adjacent to or within the railroad right of way.

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.

1-28. 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.

1-29. 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 outlined in Paragraph 1-02 c, related work will be performed by others in and adjacent to the working areas shown on the drawings. 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.

1-30. 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, place, or member can be definitely identified on the drawings.

1-31. 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.

1-32. 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, and instructions, or decisionsof 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.

1-33. 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.

1-34. Rate of wages. - a. In accordance with Article 17 of the contract, the minimum wages shown on 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	1.25
Carpenters	1.125
Cutters, acetylene	0.85
Electrical workers (outside)	1.125
Firemen, under 15 lbs. pressure	0.60
Firemen, 15 lbs. pressure and over	0.80
Jackhammer men	0.65
Laborers, common	0.50
Mason tenders	0.75
Mechanics (repairmen)	1.00
Operators of power equipment:	
Air compressors	0.65
Concrete mixers, 5 bags or over	0.85
Concrete mixers, under 5 bags	0.60
Cranes, derricks, draglines	1.50
Pumps	0.60
Shovels, 1/2 yd. or less	1.30
Shovels, over 1/2 yd.	1.50
Tractors, under 50 H.P.	0.75
Tractors, 50 H.P. or over, with attachments	1.30
Reinforcing rod setters	1.65
Structural iron workers	1.65
Truck drivers, 2 tons or under	0.60
Truck drivers, over 2 tons	0.65

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.

1-35. 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.

1-36. 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 8-11).

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.

1-37. 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 caused by operations under these specifications shall be repaired promptly by the contractor without cost to the Government.

1-38. Interference with traffic on New York, New Haven and Hartford Railroad. - a. Construction of the work near the New York, New Haven and Hartford Railroad shall be conducted in such a manner that there will be no interference with train service. Construction operations within and adjacent to the right of way area of the Railroad, including all work necessary to support the track during construction, shall be conducted with respect to time and method as may be required by the Railroad. All necessary relocation of the railroad and work incidental thereto, except for the installation of the temporary steel sheeting under Item 10b (see Paragraph 4-03), shall be done by others.

b. A separate agreement will be entered into between the Government or the City of Hartford and the Railroad to provide inspection, the services of necessary flagmen, and expenses incidental to work on rails, ties, and ballast, which work will be performed by the Railroad at no expense to the contractor.

1-39. Interference with operation of utilities. - The contractor shall maintain access roads for the use of local concerns over or around construction work where required by the contracting officer. Construction of the work on the properties of the Dutch Point plant and the South Meadows plant of the Hartford Electric Light Company shall be conducted in such a manner that there will be no interference with the operations of these plants. Construction operations at and adjacent to these plants shall be conducted with respect to time and method as may be required by the Hartford Electric Light Company. All work and material shall be provided and paid for by the contractor (see Paragraph 3-07).

1-40. Final acceptance and payment. - As soon as practicable 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.

1-41. Approval. - This contract will be subject to the written approval of the Division Engineer, North Atlantic Division, and shall not be binding until so approved.

SECTION II. PREPARATION OF SITE (Item 1)

2-01. Work included. - Clearing, grubbing, and disposal of materials shall be done as directed by the contracting officer, within the limits shown on the drawings or as staked in the field. The work shall include the cutting off of existing timber piles, bulkheads, and steel sheet piling to approved grade, and the removal of existing timber cribbing and steel sheet piling to the extent shown on the drawings or as directed, between Station 0+00 and Station 96+73.

2-02. Clearing. - a. The areas to be cleared shall include: (1) the area within the limits of the foundation of the required earth dikes, (2) borrow areas, (3) the areas within the limits of the foundations of the required concrete flood walls or other structures, and (4) any other areas designated by the contracting officer within the limits shown on the drawings.

b. Trees and other obstructions shall be removed by the contractor from the sites of the proposed structure excavations and borrow areas when and as directed by the contracting officer, and may be removed from other areas only to the extent directed or permitted. The contractor shall preserve and protect from injury all trees not required to be removed.

c. All timber, undergrowth, brush, logs, woods, and debris of any nature which, in the opinion of the contracting officer, are unsuitable for foundations of the dikes, flood walls, and other structures shall be removed to such depths and limits as directed by the contracting officer.

2-03. Grubbing. - a. The areas to be grubbed shall include the areas previously cleared within the limits of the earth dikes or as may be directed by the contracting officer.

b. All such areas shall be thoroughly grubbed of all stumps, roots, buried logs, and other objectionable matter. Tap roots and other projections over 1-1/2 inches in diameter within the limits of the dike, gate house, and flood wall foundations, shall be grubbed out to a depth at least three feet below the foundation surface unless otherwise directed by the contracting officer.

2-04. Removal of structures. - The removal of existing structures and utilities required to permit the orderly prosecution of the work covered by these specifications shall be accomplished by local agencies unless otherwise shown on the drawings. Whenever a telephone or telegraph pole, pipe line, conduit, fence, sewer or other utility is encountered and must be removed to permit completion of the work, the contracting officer will notify the proper local authorities, and the designated utility or structure will be removed promptly (see Paragraphs 1-38 and 1-39).

2-05. Disposal of materials. - All materials removed, as specified above, shall be disposed of by burning or by removal to approved disposal areas as directed. No material shall be thrown into or left along the bank of the river. The disposal of material shall closely follow the operations of clearing. At no time shall material be placed on land adjacent to the construction area. No damage of any nature shall be inflicted upon adjoining property owners by unwarranted entry or disposal of material on adjacent property.

2-06. Measurement and payment. - The quantity to be paid for under Item 1 will be the number of acres prepared in accordance with the specifications and drawings. Payment for all work in connection with the preparation of the site as above specified, including the loading, hauling, and disposal of the materials, will be made at the contract unit price for Item 1, "Preparation of Site."

SECTION III. EXCAVATION (Items 2 to 9 incl.)

3-01. General provisions. - a. Scope of work. - The location, 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. - (1) Material from the excavations, except stripping, shall be used, if possible, in the permanent construction as directed by the contracting officer. No material, except stripping, shall be wasted unless specifically authorized by the contracting officer. If, at the time of excavation, it is not possible to place the material in the proper section of the permanent construction, it shall be stockpiled in approved areas for later use. Materials from the excavation that are unacceptable for use in the permanent construction shall be wasted in spoil areas shown on the drawings as directed by the contracting officer. After completion of all excavation, the spoil areas shall be neatly dressed, smoothly graded, sloped for drainage, and left in a sightly condition, all as directed by the contracting officer.

(2) Topsoil and sod obtained from the stripping operation shall be stockpiled in approved locations to be used later in the locations shown on the drawings, unless otherwise authorized by the contracting officer.

c. Measurement. - (1) Excavation for structures 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 embankment or spoil areas, including any stockpiling and rehandling, and the grading of spoil areas.

(2) Construction roads. - The construction and maintenance of roads and bridges for the contractor's use will not be paid for under a separate item in the contract but 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; the contractor will be required to backfill any such excess excavation with approved material, or with concrete where excavated surfaces are in contact with 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 as soon as the construction does not require its use. No payment will be made for temporary showing 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. The contractor shall make provision for maintaining free discharge from the Masseek Street Sewer and the Potter Street Pumping Station outlets.

(6) Additional payments. - Additional payment will be made to replace portions of the river bank and dike washed out by flooding or scouring, or that required to be removed on account of slides, or for the removal and disposal of all objectionable materials; provided such replacement of material was not caused by negligence of the contractor. Quantities for additional payment will be measured as directed by the contracting officer, and payment will be made at the applicable contract prices.

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

a. Common excavation shall include the removal of all materials not otherwise classified, required to complete the work as shown on the drawings or as directed by the contracting officer.

b. Detailed classification is as follows:

(1) Stripping (see Paragraph 3-03).
Common (Item 2a).
Roadway (Item 2b).

(2) Common Excavation (see Paragraphs 3-04 to 3-07 inclusive).
General (Item 3).
Borrow Area (Item 4).
Cut-off Trench (Item 6).
Special Work at Power Stations (Item 7).

(3) Free Draining River Sand (see Paragraph 3-08).
Dredging not Exceeding 4,000 Feet to Point of Disposal (Item 8a).
Dredging for Each Additional 2,000 Feet to Point of Disposal (Item 8b).

(4) Removal of Existing Structures (see Paragraph 3-09).
Brick (Item 9a).
Concrete (Item 9b).
Stone Masonry (Item 9c).
Masseek Street Sewer (Item 9d).

3-03. Stripping (Items 2a and 2b). - a. Definitions. - The areas shown on the drawings shall be stripped to a depth as shown on the drawings or as directed by the contracting officer. The unsuitable materials to be removed shall include the existing macadam road surface as shown on the drawings, and any other objectionable material. The maximum depth of excavation classified as "stripping" shall be 3 feet. Any additional excavation required to remove unsuitable material shall be classified as "common excavation, general," unless otherwise directed by the contracting officer.

b. Disposal of materials. - The provisions of Paragraph 3-01 b shall apply.

c. Measurement and payment. - Measurement will be made in accordance with Paragraph 3-01 c. Payment for all work in connection with stripping, including the loading, hauling, disposal of the materials, and all rehandling required, will be made at the applicable contract unit prices for Item 2a, "Common Stripping," or for Item 2b, "Roadway Stripping" (see Paragraph 3-01 d).

3-04. Common excavation - general (Item 3). - 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 concrete walls and conduit and for the earth dike additional to that included under Items 1, 2, 6, and 7, 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 proper sheeting, bracing and form work where necessary. Foundations for the concrete flood wall 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 of 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 bulkheads, drains, etc., to prevent running water from coming in contact with newly placed concrete or concrete being placed in excavated areas.

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.

f. Measurement and payment. - See Paragraph 3-06 d.

3-05. Common excavation - borrow areas (Item 4). - a. Work included. - The contractor shall excavate in the indicated borrow areas or other approved areas, the impervious materials to be used within the prescribed limits of the dike or miscellaneous fills. Excavation shall include the transportation of the material to the point of disposal. Stripping and disposal of objectionable topsoil containing roots or other debris, and the removal and the disposal of any other objectionable material as designated by the contracting officer will be measured and paid for as borrow area excavation. To provide suitable fill materials excavations shall be made to the depths and in the locations as directed by the contracting officer. During and after excavation the borrow areas shall be graded so that all surface water will drain readily from them. The borrow areas shall be dressed smoothly and evenly, left in a neat condition satisfactory to the contracting officer, and shall be graded so that the slopes blend into the surrounding topography. The bottom of borrow area "H" shall be sloped upward from the highway on a 1 percent grade as directed by the contracting officer.

b. Description. - Under Item 4 shall be included the excavation from the borrow area "H" as shown on the drawings. The limit of excavation in the vicinity of the earth dike shall be that shown on the drawings or expressly directed by the contracting officer. No borrow excavations shall be permitted within 100 feet of the toes of the dike.

c. Disposal of materials. - The provisions of Paragraph 3-04 e shall apply.

d. Measurement and payment. - See Paragraph 3-06 d.

3-06. Common excavation - cut-off trench (Item 6). - a. Work included. - The contractor shall excavate and dispose of the materials in the cut-off trench for the earth dike, both above and below the mean water level in the river to the lines and grades shown on the drawings, or as otherwise directed by the contracting officer. The required depth of the cut-off trench at all points cannot be known with certainty until the area is fully developed by the construction operations. The lines and grades shown on the drawings shall include any necessary adjustment to field conditions.

b. Pumping and draining. - The contractor shall do all pumping and draining necessary to perform the excavation in the dry, and to keep the cut-off trench unwatered until it has been satisfactorily backfilled with suitable material.

c. Disposal of materials. - The provisions of Paragraph 3-04 e. shall apply.

d. Measurement and payment. - Measurement for excavation work under Items 3 to 6, inclusive, will be made in accordance with Paragraph 3-01 c. Payment for all work in connection with excavation under Items 3 to 6, inclusive, including the loading, hauling, and disposal of the materials, temporary protection, bulkheads and drains, unwatering and shoring will be made at the contract unit price for Items 3, 4, and 6, respectively, for the several items of excavation (see Paragraph 1-05).

3-07. Common excavation - special work at power stations (Item 7). - a. Work included. - (1) The contractor shall excavate as shown on the drawings and dispose of the materials classified as "Common Excavation, Special Work at Power Stations," between Station 38 + 47.63 and Station 41 + 02.63, and between Station 85 + 17.5 and Station 90 + 05.34, on the riverside of the Dutch Point plant and the South Meadows plant of the Hartford Electric Light Company. Excavation shall be made to the neat lines and grades as shown on the drawings and shall be performed in accordance with a schedule of operations approved by the contracting officer and in such a manner as not to interfere with the continuous operation of the above-mentioned plants. The work shall include excavation for the foundation of the concrete walls, discharge flume, stop-log structures, and any other required common excavation. Existing pipes and conduits, as shown on the drawings or as directed by the contracting officer, shall be maintained in service, removed, or relocated as required (see Paragraph 1-39).

(2) In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit to the contracting officer for approval, drawings showing the proposed method of handling the work required under Item 7.

b. Description. - The contractor shall install miscellaneous pipe, conduit, and fittings required to maintain or extend existing facilities during the construction operations. All connections shall be made tight with screwed, flanged, cemented, or caulked and leaded joints as indicated or directed. The pipe conduit and fittings shall be purchased by the contractor in the amounts, type, and class of material approved by the contracting officer. The foundation walls of the Dutch Point power plant, against which backfill is to be placed, shall be cleaned and given two coats of an approved bituminous waterproofing compound.

c. Measurement and payment. - Measurement for payment of the work required under Item 7 will be the number of cubic yards of excavation required. Payment will be made at the contract unit price for Item 7, "Common Excavation, Special Work at Power Stations," and shall include all costs of loading, hauling, and disposal of materials, temporary protection, bulkheads and drains, unwatering and shoring, installing and connecting pipe, conduit, and fittings, removing or relocating existing pipe and conduit, and any other incidental costs applicable to the work and not included under any other item. Additional payment for furnishing miscellaneous pipe, conduit and fittings will be made on the basis of certified receipted bills for materials delivered in Hartford. The amount of the additional payment will be the net amount of the bills submitted as above, and approved by the contracting officer and shall include all costs of furnishing pipe, conduit, and fittings at the site of the work, except that the furnishing of miscellaneous hardware, packing and caulking materials shall be included in the contract unit price for Item 7.

3-08. River sand excavation, dredging and stockpiling (Items 8a and 8b). - a. Work included. - (1) The contractor shall dredge sand from the river in the areas and to the limits shown on the drawings or as directed by the contracting officer. Priority in the use of Borrow Area A3 for dredging purposes shall be given to the contractor on the East Hartford Dike contract. The work shall include the dredging of suitable material directly to its final position in the earth dikes and in the existing Park River area as shown on the drawings, the stockpiling of suitable materials for use at dike-wall connections, backfill of structures and elsewhere as directed, and the disposal of unsuitable materials in spoil areas (see Paragraph 3-01 b(1)). No assurance of the distribution of suitable material within the limits of the borrow areas can be given.

(2) The work shall also include the filling of abandoned drains, wells, and miscellaneous excavations in the foundation area of the dike as directed by the contracting officer.

b. Description. - (1) Care shall be taken to dredge only approved free draining material, and to the extent required for the permanent embankment construction. Provision shall be made to bypass from the discharge pipe any clay or other unsuitable material that may be encountered in the dredging operations. Unsatisfactory materials such as large stones, clay chunks, wood or other debris shall be removed or otherwise disposed of as directed by the contracting officer. Suit-

able provision shall be made for draining water from the embankments and stockpiles back to the river, with a minimum loss of approved material, and with no gullying or washing of any portion of the constructed embankments. The navigation channel in the river (see Paragraph 1-06 b (3)), shall be kept unobstructed, and the contractor shall install a submerged section of dredge pipe approximately 200 feet long to transport material across the navigation channel, unless otherwise directed by the contracting officer.

(2) For dredging directly to final position in the required embankments, the discharge pipe shall be located at the landside face of the embankment to secure a suitable gradation of material as directed by the contracting officer, with the coarser material adjacent to the landside face of the embankment. The construction operations shall insure that the dredged material shall be placed to line and grade for the full width of the pervious section of the embankment as directed by the contracting officer, and for a length of embankment section not exceeding 300 feet unless otherwise directed by the contracting officer. Sufficient baffle-boards and "trap" pipe or other means shall be used to control the operation. The material required for the random portion of the pervious section of the embankment shall be furnished and satisfactorily spread and compacted as required for work under Item 14 according to the provisions of Section V.

(3) Dredging of various quantities of material may be required from two or more borrow areas in the river. So far as practicable, dredging shall be restricted to one area at a time or the dredged materials from the various areas shall be segregated in the sections of permanent embankment or in separate stockpiles, for accurate determination of quantities for payment under the respective pay items (see Paragraph 3-08 c(2)).

c. Measurement and payment. - (1) The quantities of sand fill to be paid for will be the number of cubic yards of approved material satisfactorily placed in the embankment sections to the established lines and grades and measured in accordance with Paragraph 5-14b. The quantity to be paid for under Item 8a will be the total number of cubic yards of dredged material placed in the embankment as above required. The quantity to be paid for under Item 8b will be determined from the actual length of the dredge pipe measured from the dredge to the point of disposal, and will be computed by multiplying the number of cubic yards of material handled through a dredge pipe exceeding 4000 feet in length, and placed as above required, by the required number of units of 2000-foot lengths and fractional part thereof of dredge pipe in excess of 4000 feet. Payment shall include the work of dredging, stockpiling and rehandling, preparing the base, trimming to line, and shall include all labor and materials incidental to completing the pervious section of the embankment, not specifically included under other items. Payment will be made at the contract unit prices for Items 8a and 8b, as applicable.

(2) The provisions of Paragraph 5-14 c shall apply.

3-09. Removal of existing structures (Item 9). - a. Work included. - (1) The contractor shall excavate, stockpile, or dispose of the materials in the existing foundations, walls, sewers, and other brick, concrete, or masonry structures as shown on the drawings, and classified as follows (see Paragraph 1-05):

9a. Brick
9b. Concrete
9c. Stone Masonry
9d. Masseek Street Sewer

The concrete and stone masonry fragments shall be broken to sizes suitable for use in rock fill under Item 18 (see Paragraph 6-05).

(2) Under Item 9c, the contractor shall also salvage for replacement or disposal, the granite facing, blocks and parapet in the retaining wall at Memorial Bridge as shown on the drawings or as directed by the contracting officer.

(3) Under Item 9d, the contractor shall remove and replace a portion of the Masseek Street reinforced concrete sewer pipe as shown on the drawings or as directed by the contracting officer.

b. Blasting. - (1) Blasting and the use of explosives shall be conducted as provided for in Paragraph 1-25.

(2) Blasting will be permitted only when proper precautions are taken for the protection of all persons, the work, and the property. All damage done to the work or the property shall be repaired. All operations of the contractor in connection with the transportation, storage, and use of explosives shall be as approved by the contracting officer. The contractor shall be liable for all injuries or deaths of persons or damage to property caused by the blasting operations.

(3) Explosives of such quality and power shall be used in the locations which will, in the opinion of the contracting officer, neither crack nor damage the structures outside the lines of excavation. Blasting shall be done only to the lines and grades shown on the drawings or approved by the contracting officer. The surfaces shall be finished by drilling, picking, barring, wedging, or similar methods which will leave the structures in a solid and unshattered condition.

(4) Approval by the contracting officer of the method of blasting or the strength and amount of the explosive used, will not relieve the contractor of his responsibility in the blasting operations.

(5) Generally, the faces of masonry excavations shall be scaled to a tolerance not exceeding one foot each way from the designated neat-line for excavation shown on the drawings.

c. Disposal of materials. - As directed by the contracting officer all excavated materials shall be stockpiled or disposed of in

designated spoil areas as provided in Paragraph 3-01 b, or, when approved by the contracting officer, may be used in the work as riprap or rock fill. Some stockpiling and rehandling may be necessary.

d. Measurement and payment. - (1) The quantities to be paid for under Items 9a, 9b, and 9c will be the number of cubic yards excavated and satisfactorily disposed of or replaced in accordance with the drawings or as directed. Measurement will be made to the neat-lines of the structure, before removal. Payment for all work in connection with excavation under Items 9a, 9b, and 9c, including the loading, hauling, stockpiling and disposing of the materials, will be made at the applicable contract unit prices for Items 9a, 9b, and 9c (see Paragraph 1-05).

(2) The quantity to be paid for under Item 9d will be the number of linear feet of reinforced concrete pipe removed and replaced in accordance with the drawings or as directed. Payment for all work in connection with Item 9d will be paid for under Item 9d, "Masseek Street Sewer", except the excavation, timber piling, concrete and backfilling which will be paid for at the applicable contract unit prices (see Paragraph 1-05).

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SECTION IV. PILING (Items 10 to 12 incl.)

4-01. Classification. - Piling shall be classified as follows:

a. Steel Sheet Piling

Permanent Cut-off (Item 10 a) (see Paragraph 4-02).
Temporary Sheeting (Item 10 b) (see Paragraph 4-03).
Permanent Bulkhead (Item 10 c) (see Paragraph 4-04).

b. Timber Piling

Sheet Piling (Item 11 a) (see Paragraph 4-05).
Bearing Piles (Item 11 b) (see Paragraph 4-06).

c. Reinforced Concrete Piling (Item 12) (see Paragraph 4-07).

4-02. Steel sheet piling, permanent cut-off (Item 10 a). - a. Work included. - The contractor shall construct the steel sheet-piling cut-off under the concrete walls and earth dikes as shown on the drawings. The cut-off shall be constructed of piles of varying lengths, including specials, driven to grade, between the limits as shown on the drawings or as directed by the contracting officer. Care shall be taken to avoid damage to existing sewers or electric cables and conduits which may be encountered in the work.

b. Type and properties. - The piles shall be of approved commercial type and shall have a minimum thickness of metal of 3/8 inch, except that a reasonable reduction for shaping the joints of the interlock will be permitted. The piles shall provide a section modulus of not less than 5.4 inches cubed per linear foot of cut-off. The interlocked joints shall develop a strength in direct tension of not less than 8,000 pounds per linear inch of interlock without rupture. The piles shall be continuously interlocked throughout their entire length and shall be provided with standard pulling holes. The type and dimensions of the piles the contractor proposes to furnish shall be submitted to the contracting officer for approval before any piles are delivered to the work.

c. Material. - Steel for sheet piling shall conform to Federal Specification QQ-S-751a for "Steel: Structural (Including Steel for Cold Flanging) and Steel: Rivet (for) Ships other than Naval Vessels, Structural Grade," except that:

(1) Tensile strength shall be not less than 70,000 pounds per square inch, except that fabricated sections such as corner piles, toe piles and other special sections shall be of steel having a tensile strength of not less than 60,000 pounds per square inch.

(2) Elongation in 8 inches, percent minimum

$$\frac{1{,}400{,}000}{\text{tensile strength.}}$$

(3) Bend Test Specimens shall withstand bending 180 degrees around a pin with a diameter twice the thickness of the specimen without fracture on the outside of the bend.

d. Driving. - The piles shall be driven to form a continuous interlocking diaphragm down to the elevation established for the bottom of the cut-off, as shown on the drawings. Special care shall be taken to avoid damage to sewers encountered in the work. A protecting cap shall be used in driving. The hammers shall be of a suitable size and type, either steam or air operated. The use of a water jet may be permitted at the discretion of the contracting officer. Piles shall be driven without injury to them, as true to line and grade as possible, and shall be cut off, where necessary, to the top elevation of the sheet-piling cut-off as shown on the drawings. Proper precautions shall be taken to prevent rupture at the interlocks. Piles ruptured at the interlock or otherwise injured shall be removed and replaced by new piles at the contractor's expense.

e. Measurement and payment. - (1) The quantity of steel sheet piling to be paid for will be the number of square feet of sheet piling actually in place as specified below the top elevation of the sheet-piling cut-off, as shown on the drawings. The area for which payment will be made will be the area of the sheet piling in place projected to the vertical plane of the driving line shown on the drawings. Payment will be made at the contract unit price for Item 10 a, "Steel Sheet Piling, Permanent Cut-off" and shall include the costs of all labor, materials, equipment and incidentals required to construct the sheet-piling cut-off as specified, (see Paragraph 4-04 f).

(2) Should it be found impracticable to drive piling to the depths shown on the drawings, the contractor will be paid for that portion of each pile cut off and removed by direction of the contracting officer, at the rate of 2 cents per pound, computed weight, determined by reference to applicable manufacturers' standard tables - Provided, that the length of the cut-off portion of any pile to be paid for shall not exceed the difference between the length specified or directed to be driven below the cut-off elevation and the length actually driven below that grade. Cut-offs shall become the property of the contractor and shall be removed from the work.

4-03. Steel sheet piling, temporary sheeting (Item 10 b). - a. Work included. - (1) The contractor shall furnish and install the temporary steel sheeting required for support of the railroad track during construction of the concrete flood wall at the locations shown on the drawings or as directed by the contracting officer.

(2) The contractor shall remove the temporary sheeting as directed by the contracting officer when the sheeting is no longer required for the safety of the work, except that any portion of the sheeting may be left in place if approved by the contracting officer.

(3) The work shall also include the provision of miscellaneous shoring and maintenance of railroad track that may be required (see Paragraph 1-38), and the subsequent removal of such shoring, as directed by the contracting officer.

b. Material. - The steel sheeting shall conform to the provisions of Paragraphs 4-02 b and c, to the extent necessary in the opinion of the contracting officer. Previously used material suitable for the use intended and the conditions of the work may be used if approved by the contracting officer.

c. Installation. - The sheeting shall be driven as true as possible to the lines and grades necessary to accomplish the excavation, without injury to the piling, and shall be cut off where necessary. Necessary wales and bracing shall support the sheeting in a manner satisfactory to the contracting officer.

d. Measurement and payment. - (1) Payment for all steel sheeting installed as shown on the drawings or as directed by the contracting officer will be for the number of square feet of steel sheeting installed. Payment will be made at the contract unit price for Item 10 b, "Steel Sheet Piling, Temporary Sheeting," (see Paragraph 4-04 f).

(2) The wales and bracing will not be measured for payment but the cost thereof, together with the cost of all hardware, the removal of such sheeting as the contracting officer may direct, and all other incidental work shall be included in the contract unit price for the sheeting.

(3) Additional payment at the rate of $40.00 per ton (2,000 pounds) will be made to the contractor for all steel sheeting required to be left in place.

4-04. Steel sheet piling, permanent bulkhead (Item 10 c). - a. Work included. - The contractor shall construct the steel sheet piling bulkhead complete with wales, anchors, tie rods and fittings, as shown on the drawings. The bulkhead shall be constructed of piles, including specials, driven to grade, between the limits as shown on the drawings or as directed by the contracting officer.

b. Type and properties. - The piles shall conform to the provisions of Paragraph 4-02 b except that they shall provide a section modulus of not less than 38.3 inches cubed per linear foot of bulkhead.

c. Materials. - The provisions of Paragraph 4-02 c shall apply.

d. Driving. - The applicable provisions of Paragraph 4-02 d shall apply.

e. Measurement and payment. - The applicable provisions

of Paragraph 4-02 e shall apply. Payment will be made at the contract unit price for Item 10 c, "Steel Sheet Piling, Permanent Bulkhead."

f. Partial payments up to 50 percent of the contract price will be made when the steel sheet piling is 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 steel sheet piling shall be stored and kept protected from damage in a manner satisfactory to the contracting officer. If any material 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.

4-05. Timber sheet piling (Item 11 a). - a. Work included. - The contractor shall furnish and install the permanent timber sheet piling, required for the support of the railroad track and other structures during construction of the concrete flood wall at the locations shown on the drawings or as directed by the contracting officer, including all necessary wales, braces and miscellaneous hardware. Except for the removal of such bracing as may be approved by the contracting officer, the timber sheet piling installed shall be left in place. (See Paragraph 4-03 a (3)).

b. Material. - The sheet piling shall be of the dimensions shown on the drawings. Timber for wales and braces not shown on the drawings shall be of economical dimensions, acceptable in modern practice, and as approved by the contracting officer. All timber used shall be of sound and of good quality, and shall meet the approval of the contracting officer. Bolts and other hardware shall conform to current standard practice for the material required and use intended.

c. Installation. - The sheeting shall be driven true to line and grade so as not to encroach on the neat-line of the structure as shown on the drawings, without injury to the piling, and shall be cut off, where necessary, to the top elevation as shown on the drawings. Necessary wales and bracing shall be installed as shown on the drawings or as directed by the contracting officer.

d. Measurement and payment. - The quantity to be paid for will be the number of square feet of timber sheet piling actually in place as specified below the top elevation shown on the drawings. Payment will be made at the contract unit price for Item 11 a, "Timber Sheet Piling."

4-06. Timber bearing piles (Item 11 b). - a. Work included. - The contractor shall furnish all labor, material, and equipment, and do all work required for driving timber piling in structure foundations as shown on the drawings. The piles shall be driven at the locations shown on the drawings. The length of piles to be furnished shall be as determined from the results of actual test piles.

b. Material. - Timber piles shall be oak, hickory, white ash, beech, rock elm, yellow birch, sugar maple, locust, black walnut, pecan persimmon or dense (close-grain) southern yellow pine conforming to the tentative specifications of the American Society for Testing Materials for "Timber Piles," serial designation D25-35T, "Class 'C' Piles," except that the minimum tip diameter for any length pile shall be 8 inches. Other approved species of wood may be used provided the butt and tip dimensions are such that resistance to shock and bending stresses shall be equal to the above specified southern yellow pine. The piles shall be peeled entirely free from bark.

c. Installation. - The piles shall be driven (tip or small end down) with an air or steam hammer of suitable size and type to properly drive the piles without injuring them. All timber bearing piles shall be driven to such a depth that the bearing capacity computed in accordance with Paragraph 4-06 d shall be 20 tons per pile. Piles shall be driven plumb to a tolerance of 1/4 inch per foot of length and a spacing tolerance of 6 inches. If necessary to prevent splitting or brooming, metal driving caps or collars shall be provided. After being driven, the top ends of all piles shall be sawed off to the required elevation and trimmed so as to leave no horizontal projection outside the cap. If any piles are raised by the subsequent driving of others they shall be redriven. Piles injured by driving, or those driven out of place, shall be pulled out or cut off and replaced by new piles. Piles shall be of the full length required and lengthening by means of splices or butt joints will not be permitted.

d. The safe bearing capacity for each timber bearing pile shall be not less than 20 tons. The bearing capacity shall be determined by the following formulas:

$$P = \frac{2\,WH}{S + 0.1} \quad \text{for single acting steam hammer}$$

$$P = \frac{2\,E}{S + 0.1} \quad \text{for double acting steam hammer}$$

Where P = load in pounds, W = weight of falling hammer in pounds, H = height of fall in feet, S = average penetration in inches per blow for the last few blows (5 to 10 blows for single acting hammers and 10 to 20 blows for double acting hammers). E = energy in foot pounds per blow as listed by the manufacturer for the given number of strokes per minute.

The above formulas are applicable when:

(1) The hammer has a free fall.
(2) The head of the pile is free from broomed or crushed wood fibre.
(3) The penetration is at a reasonably quick and uniform rate.

(4) There is no appreciable bounce after the blow. Twice the height of the bounce shall be deducted from "H" to determine its true value in the formula.

The hammer shall be of such size and capacity that the indicated bearing capacity of the pile calculated by the above formulas, when s = zero, shall be not less than 50 percent greater than the required bearing capacity of the pile.

e. Measurement and payment. (1) The quantity to be paid for will be the number of lineal feet of timber piling satisfactorily placed below the elevation of cut-off as shown on the drawings. Length of piles to be paid for shall be determined after cut-off. Payment will be made at the contract unit price for Item 11 b, "Timber Bearing Piles." No payment in addition to the contract price per lineal foot below cut-off (Item 11 b) will be made for test piles but any additional cost applicable thereto shall be included in the contract unit price for Item 11 b.

(2) Additional payment will be made for any required cut-off of piles in excess of 3 feet, at the rate of 20 cents per lineal foot, provided that the length of the cut-off portion of any length of piling to be paid for shall not exceed the difference between the length directed to be driven below the cut-off elevation and the length actually driven below that grade. Cut-offs shall become the property of the contractor and shall be removed from the work.

4-07. Reinforced concrete piling (Item 12). - a. General. - The contractor shall furnish and place reinforced concrete piling, as indicated on the drawings. The reinforced concrete piling shall be either precast or cast-in-place piles approved by the contracting officer, and shall be of such sizes and lengths required to produce the safe bearing capacities shown on the drawings.

b. Work included. - The contractor shall furnish all labor, material, and equipment and do all work required for driving concrete piling in structure foundations as shown on the drawings. The piles shall be driven at the locations shown on the drawings. The length of piles shall be determined from the results of actual test piles (see Paragraph 4-07 f).

c. Precast piles. - (1) Precast piles shall have the dimensions and reinforcement as shown on the drawings. The concrete shall conform to the requirements of Section VIII for Class "A" concrete, except that the cement content of the concrete shall be at least 7 bags per cubic yard. The reinforcing steel shall conform to the provisions of Paragraph 11-02 a (1).

(2) All piles shall be plainly marked with the casting date, shall be protected against frost and other damage, and shall be

cured in conformity with the provisions of Paragraph 8-16. No piles shall be moved from their casting position in less than 5 days nor driven within 30 days after casting. Piles shall not be racked in banks under 14 days and banks shall not be over 3 piles high.

(3) Forms shall be tight and rigid and the piles shall be free from injurious cracks or spalls. Piles shall be handled carefully, using special slings if required, avoiding dropping or jarring while in the horizontal position. After driving, the top ends of piles which are too high, or which have been cracked or spalled, shall be cut off so as to provide a level sound section. Piles shall be of the full length required and lengthening by means of splices or butt joints will not be permitted. The contractor shall, at his own expense drive test piles or make such other explorations as are sufficient to predetermine as far as possible the length of piles required to secure the specified bearing in the various areas of the work. These tests or explorations shall be made far enough in advance so that pile driving can continue without interruption.

d. Cast-in-place piles. - (1) Piles cast-in-place shall be formed by driving a shell to the required bearing, leaving the shell permanently in place and filling it with concrete. The shell shall be of sufficient strength to withstand the pressure of surrounding materials and shall be watertight when placed. Shells driven without a mandrel shall be not less than No. 5 gage. No shell containing water shall be filled with concrete, nor when, in the opinion of the contracting officer, it is leaking sufficiently to damage green concrete. Shells shall taper uniformly not less than 1 inch in 8 feet and shall have a minimum diameter of 11 inches at the tip. No shell shall be filled with concrete until after the adjacent shells within a radius of 10 feet have been driven to the required bearing and the shell approved. Concrete for cast-in-place piles shall conform to the requirements of Section VIII for Class "A" concrete.

(2) Steel reinforcement of cast-in-place piles, exclusive of the steel shell, shall amount to at least 1-1/2 percent of the cross sectional area of the pile.

e. Driving. - (1) No piles shall be driven until after the excavation in the respective areas they are to occupy has been completed. Piles shall be driven plumb to a tolerance of 1/4 inch per foot of length, and the top ends of the piles brought to or cut off at a point not higher than the elevation indicated; if lower, the pile cap shall be increased in depth a like amount.

(2) Piles shall be driven by a single-acting steam hammer and the driving shall be continuous for each pile until the required penetration has been reached. The contractor shall keep an accurate and detailed log of each pile showing the depth to which driven, the penetration under a series of final blows of the hammer and the general driving conditions. For precast piles, records of the time

of casting shall also be kept.

(3) All concrete piles shall be driven to rock or to such a depth that the bearing capacity shall be as shown on the drawings. The safe bearing capacity for each pile shall be not less than that determined from the schedule shown on the drawings unless otherwise directed by the contracting officer. The bearing capacity shall be determined by the following formula:

$$P = \frac{2\ WH}{S + 0.1}$$ for single acting steam hammer in which

P = the bearing value of each pile in pounds.

W = the weight of the ram in pounds.

H = the stroke of the ram in feet.

S = the average penetration of each pile in inches under the last 10 blows.

The weight of the pile driver ram shall be not less than 10,000 pounds.

(4) All pile driving equipment and pile head cushions shall be subject to the approval of the contracting officer. No free-swinging leads will be permitted and the equipment shall provide adequate support to hold the pile firmly in correct position while being driven. Any piles which rise after driving, due to adjacent operations, shall be redriven to the required resistance without additional compensation.

f. Pile tests. - (1) If piles do not drive to rock, but bearing values are determined by formula, the contractor shall make load tests on not over five separate piles, as selected by the contracting officer. These piles shall be loaded by means of a suitably balanced platform with an initial load equal to the design load for the piles. After 24 hours, the load shall be increased 50 percent. Precast piles shall be tested 2 days after being driven; cast-in-place piles shall be tested 7 days after the concrete has been placed.

(2) During the test, accurate readings of settlement shall be taken with an instrument, once before loading; when the initial load is completely in place; when the second increment is in place; and 24 hours later. Settlement under the initial load shall not exceed 1/4 inch and that under the final load 3/8 inch.

g. Damaged piles. - Should any pile be damaged in the course of driving or be found to be of insufficient length to develop required resistance, or be unduly distorted or diverted from its proper position in driving, or otherwise not conform with the specifications, this pile shall be withdrawn and another pile driven in its place.

If it is not possible to withdraw defective piles, compensating piles shall be driven as near as practicable to the damaged pile which shall be cut off below the level of the footing, and the contractor shall make any necessary changes in the cap design and construction to suit the new arrangement without additional cost to the Government.

h. Measurement and payment. - (1) The quantity to be paid for under Items 12a, 12b, and 12c will be the number of linear feet of reinforced concrete piling of the specified sizes satisfactorily placed below elevation of cut-off as shown on the drawings. The measurement of quantity shall be made after cut-off. Payment will be made at the contract unit prices for Items 12a, 12b, and 12c, as applicable (see Paragraph 1-05), and shall include the cost of tests made on piles and all costs of furnishing and installing the piling.

(2) Partial payment up to 50 percent of the contract price will be made when the precast concrete piling is delivered to the site of the work provided the quality of the piles 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 concrete piling shall be stored and kept protected from damage in a manner satisfactory to the contracting officer. If any material so 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.

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SECTION V. EARTH DIKE (Items 13 and 14).

5-01. Definitions. - The term "embankment" as used in these specifications includes earth fill of two types for the earth dike and cut-off trench, and all other specified or directed earth fills within the limits of the dike necessary to complete the embankment. As shown on the drawings, the two types of earth fill are "selected impervious" under Item 13, for the cut-off trench and the riverside blanket of the dike; and the "random" under Item 14, adjacent to the riverside blanket.

5-02. Work included. - a. The contractor shall grade and consolidate materials required for the embankment, to the elevation, lines, grades and cross sections shown on the drawings, with such increased height and width as may be deemed necessary by the contracting officer to allow for later shrinkage or settlement. The contractor shall use suitable materials as approved by the contracting officer and excavated from the required excavations and approved borrow areas shown on the drawings.

b. The previous material required for the earth dike or elsewhere as shown on the drawings, is included under Item 8 a or 8 b (see Paragraph 3-08).

5-03. Materials. - a. General. - All materials from required excavations will be used, if, as excavation proceeds, they are found suitable by the contracting officer for use in the embankment. Brush, roots, sod, any type of organic materials, and other perishable or unsuitable material as determined by the contracting officer shall not be placed in the embankment. Materials shall not be wasted except by specific instructions from the contracting officer.

b. Borrow. - Other suitable materials shall be borrowed from locations shown on the drawings in accordance with Paragraph 3-05. The origin of any material from either structure or borrow excavations does not definitely determine where it will be used in the embankment. Materials from two or more excavation or borrow areas may be required to be used at the same time and in the same part of the embankment, mixing being done in the process of placing by systematic dumping, spreading and bulldozing. Materials from one area may be required to be used in different parts of the embankment.

c. Test requirements. - The various types of earth fill defined in Paragraph 5-01 shall conform to the test requirements and approved classification established by the Soils Laboratory, U. S. Engineer Office, Providence, R. I. The contractor shall furnish the necessary labor and facilities for taking test samples which will be removed from the embankment by representatives of the contracting officer and subjected to field tests or boxed for shipment to the Soils Laboratory. Test samples will be taken at such intervals as will give, in the opinion of the contracting officer, a comprehensive knowledge of the

material and its placement and compaction in each section of the embankment.

5-04. Scarifying. - Immediately prior to the placing of materials in the embankment, the entire foundation of the embankment shall be thoroughly scarified (see Paragraph 5-06 d(2)).

5-05. Filling of excavations in embankment area. - a. - General. - The cut-off trench, stump holes, and other excavated areas within the limits of the embankment and as otherwise shown on the drawings shall be filled with random or impervious materials in the dry as directed by the contracting officer. The fill shall be placed in layers, moistened, and rolled in accordance with Paragraph 5-06 whenever, in the opinion of the contracting officer, it is possible to do so. Material which cannot be compacted by roller equipment on account of clearances, shall be spread in 4-inch layers and compacted with hand or power tampers which shall give the degree of compaction required for the embankment. As the fill is brought up, the side slopes of the cut or hole shall be scarified by equipment or by hand if it is required, in the opinion of the contracting officer, in order to provide a bond between the fill and the original ground material (see Paragraph 5-06 d (2)).

b. Stump holes. - The sides of stump holes shall be broken down with bulldozers or a disc harrow so as to flatten out the slopes, and the hole then filled with approved material and properly rolled or tamped in place.

c. Cut-off trench. - The fill for the cut-off trench shall be placed in the dry and rolled in accordance with Paragraph 5-06. The water shall be drained to a sump and removed by pumps. The fill shall be made by working the materials toward the sump and sloping the surface of the fill longitudinally toward the sump. Well points may be used for drying up the foundation when approved by the contracting officer.

5-06. Rolled fill. - a. General. - (1) The selected impervious and random sections of the embankment shall be constructed with a crown running with the center line of the dike and with slopes approximately on a 2 percent grade toward the edges of the embankment except as otherwise specified in subparagraph (2) below. This slope shall be maintained until the completion of the embankment, thus bringing up together the impervious and random sections, unless otherwise directed by the contracting officer. As soon as practicable, the embankment shall be brought to a nearly uniform grade for the entire length.

(2) For the method of construction under Item 8, which required dredging pervious material from the river directly to its final position in the embankment sections, the provisions of subparagraph (1) above shall not apply. The pervious section shall be constructed by hydraulic methods to such height and extent as may be directed by the contracting officer (see Paragraph 3-08 b(2)), before the construction of

the selected impervious section is begun. The selected impervious section shall be constructed in accordance with the provisions for rolled fill as directed by the contracting officer, and carefully bonded to the previously constructed portion of the embankment. As soon as practicable, the embankment shall be brought to a nearly uniform grade for the entire length.

b. Furnishing and placing. - (1) The contractor may use power shovels, drag lines, or any type of excavating machinery which is capable of excavating the materials in dry condition. The contracting officer will specify the location of the borrow areas and the depth to which excavation shall be made. The contractor may use any approved method of transporting materials in natural dry condition. The dumping of the successive loads shall be at locations as directed by the contracting officer. When two or more different materials are being moved into a section of the embankment they shall be spotted and dumped systematically so that in any area of the section there are approximately the required proportions of the materials. After dumping, the materials for the impervious sections shall be bulldozed or otherwise spread in approximately 8-inch layers and rolled (see Paragraph 5-06 d). The random material shall be spread in layers approximately 12 inches in thickness as determined by the contracting officer and rolled (see Paragraph 5-06 d). Should the material for the various sections of the embankment be too high in water content when dumped, it shall be bulldozed or otherwise spread and harrowed or stirred for a sufficient time to allow the surplus water to dry out before being rolled. If, in the opinion of the contracting officer, the rolled surface of any layer of the materials is too smooth to bond properly with the succeeding layer or, if the materials have dried out sufficiently to cause cracks in the surface, it shall be roughened or loosened by a disc harrow, or other approved means, and dampened, if required, before the succeeding layer is placed thereon. All roots, trash, and debris shall be promptly removed from the embankment and disposed of to the satisfaction of the contracting officer. Stones greater than 6 inches in diameter shall be removed from the impervious and random sections. The entire surface of the embankment shall be maintained in such condition that construction equipment can travel thereon. Routing of construction equipment on the embankment shall be subject to direction by the contracting officer.

(2) Any embankment material lost, or loosened, after being placed in the embankment and before the completion of the contract and acceptance of the completed work, because of any operation of the contractor or for other causes that in the opinion of the contracting officer were avoidable or under the control of the contractor, shall be replaced by the contractor to the satisfaction of the contracting officer and without cost to the Government. For payment for additional material required through no fault of the contractor, see Paragraph 5-14 c.

(3) The contractor shall cease work on the embankment at any time when, in the opinion of the contracting officer, satisfactory work cannot be done on account of rain, high water, cold weather,

or other unsatisfactory conditions.

c. Moisture control. - To obtain the desired degree of compaction for the varying kinds of materials used, the moisture content of the material being placed shall be the optimum required for satisfactory compaction, as determined by the contracting officer. If required, the compacted surface shall be sprinkled as directed immediately before placing each new layer. The moisture content shall be sufficient to dampen the fill materials as required, but the amount of sprinkling shall be controlled so that no free water will appear on the surface during or subsequent to the rolling. An adequate supply of water shall be available. Jets shall not be directed at the embankment material with such force that the finer materials are washed out.

d. Compaction. - (1) Tamper type roller. - Rolling for the impervious section of the embankment shall be done by a tamper type twin roller such as a "sheeps-foot" roller, water or sand ballasted, having tamper feet uniformly staggered over its cylindrical surface, and equipped with cleaners; or other satisfactory type of tamper roller as approved by the contracting officer. Each tamping foot shall project approximately 7 inches from the roller's cylindrical surface and shall have a face area of not less than 5 and not more than 7 square inches. The spacing shall be such as to provide a minimum of two tamping feet for each square foot of cylindrical surface. Addition or reduction in the number of tamping feet shall be made when directed by the contracting officer. The total weight of the roller in pounds divided by the total area of the maximum number of tamping feet in one row parallel to the axis of the roller shall be not less than 115 pounds per square inch tamping foot area with the drum empty, and not less than 200 pounds per square inch tamping foot area with the drum ballasted. The design and operation of the tamping roller shall be subject to the approval of the contracting officer.

(2) Rolling impervious section. - When the moisture content and condition of the spread impervious layers of the embankment are satisfactory to the contracting officer, the contractor shall roll the impervious section of the embankment with tamper type twin rollers. Each set of twin rollers shall be pulled by a crawler type tractor of suitable power, weighing not less than 20,000 pounds, manufacturer's standard weight, at a speed of approximately 2-1/2 miles per hour. Each square foot of each layer of the embankment material shall be compacted by not less than six passes of the rollers, and ordinarily not more than nine passes as required by the contracting officer. Successive trips of rollers shall overlap by at least 2 feet. Failure to comply with this requirement for careful rolling will be a cause for additional trips at the contractor's expense. Where new material abuts old material, either in place or in embankment, the old material shall be cut or broken by machine or hand methods approved by the contracting officer, until it shows the characteristic colors of undried materials, and the rollers shall work on both materials, bonding them together. Portions of the

earth fill which the roller cannot reach for any reason shall be thoroughly compacted in 4-inch layers by tamping with hand or power tampers. The degree of compaction for such portions of the earth fill shall be equivalent to that obtained by sprinkling and rolling as specified for the other portions of the earth fill.

(3) Rolling random section. - Rolling of the random section of the embankment shall be the same as specified above except that a minimum of 3 passes of the rollers will be required. If, in the opinion of the contracting officer, better compaction can be obtained by the use of a plain cylindrical roller, or a Parson's disc tamping roller, the use of such a roller may be required. The disc tamping roller shall weigh not less than 1100 pounds per linear foot. When conditions of the work so require, at the direction of the contracting officer, rolling may be done by a crawler type tractor weighing not less than 20,000 pounds; in such cases a maximum of four passes of the tractor treads on each square foot of embankment area will be required.

(4) Tests for compaction. - Samples of all embankment materials for testing, both before and after placing and compaction, will be taken at frequent intervals under the supervision of the contracting officer. Corrections, adjustments, modifications of methods, selection of material and moisture content will be made from these tests to secure the maximum density of the materials in the embankment (see Paragraph 5-03 c).

e. Impervious fill. - Impervious fill shall be selected and secured from required excavations and borrow areas as directed by the contracting officer, and shall be placed in the select impervious section of the embankment throughout the entire length.

f. Random fill. - Random fill shall be selected and secured from required excavations and borrow areas as directed by the contracting officer, and shall be placed in the random section of the embankment. In general, this material shall be placed so the coarser portions are toward the landside edge, and the finer portions near the select impervious section, so that a gradational transition is effected from the impervious to the pervious section.

5-07. Removal of objectionable material. - The contractor shall, when directed by the contracting officer, excavate, remove and dispose of any material from the embankment sections which the contracting officer considers objectionable in such locations, and refill the area as directed in accordance with Paragraph 5-05.

5-08. Slides. - In case of slides in any part of the embankment during the construction or after completion, but prior to the final acceptance of the work, the contractor shall cut out and remove the area specified by the contracting officer and then rebuild the excavated area in accordance with these specifications. In case it is determined that the slide was caused through the fault of the contractor, the foregoing

shall be performed at no cost to the Government.

5-09. Frozen materials. - No earth shall be placed upon a frozen surface, nor shall frozen earth, snow or ice be placed in the embankment. In cases of emergency the contracting officer may require frozen material to be stockpiled for later use in the embankment.

5-10. Shrinkage or settlement. - No measurement will be made of additional material placed on account of settlement of the foundation or shrinkage during construction. The cost of placing and compacting such additional material shall be included in the contract prices for the various items of fill. Measurement and payment for all required fill material excavated and transported to point of placement will be in accordance with Section III.

5-11. Temporary drains and ditches. - The contractor shall maintain the site of the work and the grounds immediately adjacent thereto, free from collected surface water if, in the opinion of the contracting officer such collected water affects the safety or condition of the work. Such temporary drains and ditches shall be constructed as are deemed necessary and directed by the contracting officer.

5-12. Topsoil and sodding. - a. Placing topsoil. - Unless otherwise authorized by the contracting officer, a suitable topsoil shall be placed on the slopes of the earth dike as shown on the drawings. Payment for placing topsoil will be made at the contract unit price for Item 35 (see Paragraph 14-02).

b. The areas upon which topsoil has been placed shall be sodded and seeded as specified in Paragraph 14-02. Payment for sodding and seeding will be made at the contract unit price for Item 36. Measurement and payment will be made as specified in Paragraph 14-02 e.

5-13. Surfacing for top of dike. - Unless otherwise directed by the contracting officer, the top of the dike shall be surfaced with a layer of gravel as shown on the drawings. Measurement and payment will be made as specified in Paragraph 14-03 e.

5-14. Measurement and payment. - a. The quantities to be paid for under Items 13 and 14 will be the number of cubic yards placed as directed, measured in place after compacting. Payment shall include the work of preparing the base, spreading in layers, wetting, rolling or tamping, trimming to line, and shall include all labor and materials incidental to completing the embankment, not specifically included under other items. Payment will be made at the contract unit prices for Items 13 and 14 as applicable (see Paragraph 1-05).

b. To determine the quantities to be paid for, a survey will be conducted prior to the beginning of the placing of the fill. The true surface condition will be shown by cross sections and profile and the measurement of the quantities will be based upon this survey.

The quantities will be the volume between the original surface at the beginning of the work, and the slope lines and grades as indicated on the drawings, as staked in the field, or as directed by the contracting officer at the completion of the work.

c. Additional payment will be made to replace embankment washed out by flooding or scouring, or that required to be removed on account of slides, or the removal and disposal of all objectionable materials placed at the direction of the contracting officer; provided such replacement of embankment was not caused by negligence or carelessness of the contractor. Quantities for additional payment will be measured as directed by the contracting officer, and payment will be made at the applicable contract unit prices.

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SECTION VI. MISCELLANEOUS FILL AND BACKFILL (Items 15 to 18 incl.)

6-01. Definitions. - "Screened Gravel", Item 15, includes the gravel or crushed stone required for tile drains and riprap bedding. "Compacted Backfill", Item 16, and "Semi-Compacted Backfill", Item 17, includes the backfills required for conduit, walls and other structures as shown on the drawings or otherwise directed by the contracting officer. "Dumped Rock Fill", Item 18, includes the rock fill required at the riverside toe of the earth dike.

6-02. Screened gravel (Item 15). - a. Work included. - The contractor shall place gravel or crushed stone of the specified quality required for drains and for riprap bedding at the locations shown on the drawings or as directed by the contracting officer.

b. Materials. - (1) Screened gravel shall consist of suitable coarse clean gravel satisfactorily graded within the specified limits. Unless otherwise directed, not more than ten percent by weight shall pass a sieve having 10 meshes to the inch, and all shall pass a 2-inch square mesh screen. The material shall be approved by the contracting officer before delivery is made to the site of the work.

(2) Subject to the approval of the contracting officer, crushed stone may be used in place of gravel. Crushed stone shall consist of angular fragments of uniform quality throughout, free from soft or disintegrated stone, dirt, or other objectionable matter. The stone shall be uniformly graded within the specified limits. Unless otherwise directed, not more than 10 percent by weight shall pass a No. 4 sieve, and all shall pass a 2-inch square mesh screen. The material shall be approved by the contracting officer before delivery is made to the site of the work.

c. Placing. - The material shall be placed as shown on the drawings or as directed, and with such hand-placing as may be necessary to trim to the required slopes. The contractor will not be required to tamp or roll the material, but will be required to consolidate it with water to the extent directed so that no settlement or voids will later result.

d. Measurement and payment. - The quantity to be paid for under Item 15 will be the number of cubic yards of gravel or crushed stone furnished and placed to the limits, lines and grades shown on the drawings or ordered. Payment will be made at the contract unit price for Item 15, "Screened Gravel".

6-03. Compacted backfill (Item 16). - a. Work included. - The contractor shall place, grade, and consolidate materials required for backfill of the various structures as shown on the drawings and elsewhere as directed.

b. Materials. - Materials shall be borrowed 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 in the opinion of 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 sections. Each layer shall be compacted thoroughly with a crawler type tractor weighing not less than 20,000 pounds or as directed by the contracting officer. A minimum of four passes of the tractor treads on each square foot of backfill area will be required for satisfactory compaction. Portions of the backfill area which the compacting equipment cannot reach for any reason shall be compacted thoroughly in 4-inch layers 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.

(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 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 any settlement. Payment for all work in connection with furnishing and placing compacted backfill will be made at the contract unit price for Item 16, "Compacted Backfill."

6-04. Semi-compacted backfill (Item 17). - a. Work included. - The contractor shall place, grade and consolidate materials required for semi-compacted backfill at the locations shown on the drawings, and at other locations as directed by the contracting officer.

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 materials shall be free from stumps, roots, sod, rubbish or other unsuitable materials or substances.

c. Placing. - The material shall be placed in 12-inch horizontal layers with only such hand-placing as may be necessary to trim to the required slopes. The contractor will not be required to roll the material, but will be required to consolidate it with water to the extent directed so that no settlement or voids will later result. Hand tamping shall be done where required by the contracting officer.

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 any settlement. Payment for all work in connection with placing semi-compacted backfill will be made by the cubic yard under Item 17, "Semi-compacted Backfill".

6-05. Dumped rock fill (Item 18). - a. Work included. - (1) The contractor shall furnish all equipment and labor required to construct the dumped rock fill at the riverside toe of the earth dike. The rock fill shall be to the limits, lines and grades shown on the drawings or as directed by the contracting officer, at or below the low water level of the river.

(2) The contractor shall do all the preliminary grading and other incidental work, not included in any other item, required to prepare the site for the rock fill.

b. Material and placing. - (1) Rock fill shall be composed of durable stone or concrete fragments of acceptable sizes. Suitable rock, boulders and large cobbles from borrow areas or quarries, and stone or concrete fragments from the required excavations (see Paragraph 3-09), shall be used. The rock fill shall consist of fragments of stone or concrete of which none shall be smaller than one cubic foot, except that 10 percent of the total volume may be spalls which shall be placed adjacent to the riverbank, and of which those exceeding one-half cubic yard shall constitute at least 50 percent of the volume, except as otherwise authorized by the contracting officer. The rock fill shall be constructed of the thickness and to the extent shown on the drawings or directed. The average surface of the rock fill shall satisfactorily approximate the lines and grades shown on the drawings. The rock shall be carefully dumped in place with the larger rocks at the outer faces and the smaller rocks and spalls adjacent to the riverbank.

(2) Generally the maximum allowable size of single pieces of rock or concrete shall be one cubic yard.

c. Measurement and payment. - (1) The quantity to be paid for under Item 18 will be the number of cubic yards of rock fill furnished and placed to the specified lines or grades in the completed work. (See Paragraph 5-14 b). Payment will be made at the contract unit price for Item 18, "Dumped Rock Fill". The contract unit price shall include payment for all equipment, labor and incidentals required to construct the rock fill.

(2) Should it be impracticable, in the opinion of the contracting officer, to determine the quantity of rock fill as specified in (1) above, then the quantity to be paid for will be determined from the scale weight in tons of rock fill delivered to the work and placed as specified. One cubic yard of rock fill will be allowed for every 1.3 tons (of 2,000 pounds), for that portion of the rock fill so estimated for payment.

SECTION VII. RIPRAP, DRAINS, AND CULVERTS (Items 19 to 22 incl.)

7-01. General. - "Riprap - Hand-Placed," Item 19, will be required for the canal slopes of the dike as shown on the drawings or as directed by the contracting officer. "Grouted Riprap," Item 20, will be required along the roadways and at other locations as shown on the drawings. "Tile Drains", Item 21 will be required at the landside toe of the earth dike, at the toe of the concrete flood wall, and elsewhere as shown on the drawings or as directed by the contracting officer; "Cast Iron Pipe", Item 22, will be required for the drainage system as shown on the drawings or as directed by the contracting officer.

7-02. Riprap - hand-placed (Item 19). - a. Work included. - The contractor shall furnish all materials, equipment and labor required to construct hand-placed riprap to the lines and grades shown on the drawings and elsewhere as required by the contracting officer.

b. Materials. - Riprap shall be of durable rock of acceptable sizes, with a specific gravity of not less than 2.65. Rock shall be approved by the contracting officer, before delivery to the site of the work. Rock for riprap shall be angular and of a uniform shape so as to furnish a reasonably smooth, even surface. Not more than 5 percent by weight of the rock shall be smaller than one-half cubic foot in volume and at least 75 percent of the rock used shall be from 1 to 2 cubic feet in volume with one dimension approximately equal to the depth of the riprap course.

c. Placing. - The riprap shall be laid to the lines and grades shown on the drawings or as directed. A tolerance of 3 inches above or below the slope line shown on the drawings will be allowed for the finished slope surface of the hand-placed riprap. The rock shall be closely laid on a base of gravel or crushed stone bedding (see Paragraph 6-02), with the dimension approximately equal to the depth of the riprap course normal to the slope, and with joints broken where possible. The joints on the surface of the riprap shall be filled with tightly driven spalls. Large rock shall be well bedded at the edges of the riprap to prevent undermining.

d. Measurement and payment. - The quantity to be paid for under Item 19 will be the number of cubic yards of riprap satisfactorily placed in the completed work to the specified or ordered lines and grades. The contract unit price shall include payment for furnishing, hauling and placing the riprap. Payment will be made at the contract unit price for Item 19, "Riprap - Hand-placed."

7-03. Grouted riprap (Item 20). - a. Work included. - (1) The contractor shall place hand-placed riprap for the gutter paving to the lines and grades shown on the drawings or elsewhere as directed by the contracting officer.

(2) The contractor shall furnish and place the grout for surface grouting all hand-placed riprap in the gutters.

b. Material and placing. - (1) Riprap shall be of durable rock of acceptable sizes. Rock shall be approved by the contracting officer before delivery is made to the site of the work. The riprap shall be laid to the lines and grades shown on the drawings or as directed. The rock shall be hand-placed, to a tolerance of one inch above or below the finished surface shown on the drawings. No individual rock shall be less than 10 pounds or more than 30 pounds in weight, and at least 75 percent of the rock used shall be at least 20 pounds in weight. The rock shall be closely laid on a base of gravel or crushed stone bedding (see Paragraph 6-02), with the dimension approximately equal to the depth of the riprap course normal to the slope, and with joints broken where possible.

(2) Grouting shall be done on clean riprap surfaces with a grout mixture of 1 part Portland cement and 2-1/2 parts sand by volume combined with water to a suitable consistency. Cement and sand used in the grout shall be obtained from sources approved by the contracting officer and shall conform to Paragraphs 8-05 and 8-06. The grout shall be worked into the joints of the riprap surface with brooms or other means so as to fill the voids completely.

c. Measurement and payment. - The quantity to be paid for under Item 20 will be the number of cubic yards of riprap placed to the specified lines and grades in the completed work. Payment shall include all costs for furnishing, hauling, placing, and grouting the riprap, including cement. Payment will be made at the contract unit price for Item 20, "Grouted Riprap."

7-04. Tile drains (Items 21a, 21b, and 21c). - a. Work included. - The contractor shall furnish and lay tile pipes, including specials of the required diameters for the drainage system as shown on the drawings, or as directed. The contractor shall connect the tile drains as shown on the drawings. Existing sewers and drains encountered in the work and not removed, shall be connected to the drainage system as directed by the contracting officer.

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 3-06. Pipe trenches shall have a depth of not less than 2 feet and a width at least 2 feet greater than the outside diameter of the pipe. 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. All rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids backfilled with well compacted suitable material.

d. Laying pipe. - All pipe shall be placed in position immediately after the bedding for the pipe is completed. 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. Pipe shall be laid in gravel or crushed stone and shall be true to the lines and grades shown on the drawings or as established in the field, with bells upgrade and with spigot ends fully entered into the bells. A strip of burlap at least 6 inches in width and 36 inches in length shall be carefully and securely wrapped around the pipe joints. Perforated pipe shall be laid in accordance with the details shown on the drawings.

e. Backfilling. - Backfill material shall be natural, suitably graded gravel or crushed stone having a maximum size of 2 inches, and conforming to the requirements of Paragraph 6-02. The gravel or crushed stone shall be compacted around and over the pipe to the limits shown on the drawings or as directed. Tar paper shall be furnished and placed as shown on the drawings, to prevent filtering of fine material into the drain.

f. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe of the size installed. Payment for pipe will be made at the applicable contract unit prices for Items 21a to 21c, inclusive, "Tile Pipe," for the various sizes installed, and shall include all costs of furnishing and installing the pipe including specials, except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 3 (see Paragraph 3-04). Payment for earth backfill will be made at the contract unit price for Item 16 or 17, as applicable (see Paragraphs 6-03 and 6-04). Payment for gravel or crushed stone backfill will be made at the contract unit price for Item 15 (see Paragraph 6-02).

7-05. Cast iron pipe (Item 22). - a. Work included. - The contractor shall furnish and lay cast iron pipes, including specials, of the required diameter for the drainage system on the landside of the earth dike and concrete flood wall as shown on the drawings. The contractor shall connect the cast iron drains properly to existing sewers or other drains, as shown on the drawings.

b. Materials. - Cast iron pipe shall be bell-and-spigot, conforming to the requirements of current American Water Works Association specifications for standard weight pipe, Class "A".

c. Excavation. - The provisions of Paragraph 7-04 c shall apply.

d. Laying pipe. - The applicable provisions of Paragraph 7-04 d shall apply, except for joints. Cast iron pipe shall be laid with the bell end pointing in the direction opposite to the flow of the water. Lead joints, where called for on the drawings, shall be made tight with pure oakum caulked into the bell of the pipe until one-third full, and the remaining two-thirds of the bell shall be poured full of molten pig lead and caulked flush with the hub.

e. Backfilling. - The provisions of Paragraph 7-04 e shall apply.

f. Measurement and payment. - The applicable provisions of Paragraph 7-04 f shall apply. Payment for pipe will be at the contract unit prices applicable to the various sizes installed (see Paragraph 1-05).

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SECTION VIII. CONCRETE (Items 23 to 25 incl.)

COMPOSITION, CLASSIFICATION AND STRENGTH

8-01. 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.

8-02. Classification. - Except where required to meet special conditions all concrete shall be Class "A" as designated in Section IX 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.

8-03. Strength. - The mixes will be designed to secure concrete having at least the following compressive strength 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

8-04. 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.

8-05. Portland cement (Item 23). - 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 Paragraph 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 Specifications 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, N. Y. 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 promptly removed 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 Specifications 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 the 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.

8-06. 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 -	Per cent by weight
No. 4 sieve	95 - 100
No. 16 sieve	45 - 75
No. 50 sieve	10 - 25
No. 100 sieve	1.5 to 7

(2) Deficiencies in the percentages 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 8-08 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 1 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 mixture, unless otherwise specifically authorized by the contracting officer.

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

	Per cent by weight
Clay lumps	1
Material removed by decantation from aggregates not more than	3
Shale	0.5

e. Mortar strength. - Mortar specimens made with the fine aggregate shall have a compressive strength at 28 days of at least 100 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 8-07 d), to determine conformity with all requirements of these specifications.

8-07. Coarse aggregate. - a. Composition. - Coarse aggregate shall be washed gravel or 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%

The total quantity of deleterious substances shall not exceed 5%. When the material removed by decantation consists essentially of crusher dirt the maximum amount permitted may be raised to 1-1/2 percent. 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. 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.

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, the maximum size mesh screen for the aggregate shall be 1 inch.

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

	(Per cent 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.

8-08. Material added for workability. - a. The use of any material added to the mix to improve workability (see Paragraph 8-06 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 re-

quired 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.

8-09. Water. - The water used in mixing concrete shall be fresh, clean and free from injurious amounts of oil, acid, alkali, or organic matter.

8-10. 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 8-07 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.

8-11. 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, N. Y., 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

8-12. 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.

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.

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 8-06 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 stength and provided

further that such increase does not exceed 1 gallon per cubic yard.

f. Aggregate content. - The total volume of aggregates 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.

8-13. 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 150 cubic yards of concrete per 8 hours. The plant shall include not fewer than two complete mixers with separate power plants, having a minimum capacity of 3/4 cubic yard each. The equipment shall provide adequate facilities for the accurate measurement and control of each of the materials entering the concrete. The complete plant assembly, including provisions to facilitate the inspection of all operations at all times and the adequacy and dependability of each of its parts shall be subject to the approval of the contracting officer and shall conform to the following requirements:

(1) It shall be capable of ready adjustment for compensating for the varying moisture content of the aggregates and for changing the proportionate batch weights.

(2) It shall be capable of controlling the delivery of all material within 1 percent by weight of the specified amounts.

(3) It shall be arranged to permit the convenient removal of the material in excess of the specified tolerances.

(4) It shall include a visible dial or any suitable device which will accurately register the scale load at any stage of the weighing operations from zero to full capacity.

(5) The accuracy of the weighing equipment shall conform to the requirements of the U. S. Bureau of Standards and shall be tested monthly or otherwise when required at the expense of the contractor.

(6) It shall include a device for accurately measuring and indicating the quantity of water entering the concrete, and the operating mechanisms must be such that no leakage will occur when the valves are closed.

(7) It shall include a device for accurately and automatically measuring and indicating the time required for mixing which may be interlocked to prevent the discharge of concrete from the mixer before the end of the mixing period.

(8) It shall include a device for properly recording and indicating the number of batches handled.

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

3/4 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) Unless otherwise specifically authorized or directed, concrete in mass structures shall be placed in monoliths not exceeding 40 feet in length or width. The layout of all monoliths shall be as directed or approved by the contracting officer before concreting is commenced.

(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 8-15), 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.

o. Vibrating. - (1) 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, and except as provided in Paragraph 8-13 o(2) it shall not be transmitted through the forms. 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 into place. The vibration shall be of sufficient duration to accomplish thorough compaction as approved by the contracting officer. 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.

(2) Where internal vibration is not practicable external vibrators shall be attached to or held on the forms in such a manner as to transmit the vibration to the concrete effectively and shall be raised in lifts as filling of the forms proceeds, each lift being not more than the height of concrete visibly affected by the vibration. They shall be placed horizontally at distances not greater apart than the radius through which the concrete is visibly affected.

(3) Vibration shall be supplemented by forking and spading by hand adjacent to the forms on exposed faces that cannot be effectively vibrated. 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 shown on the drawings or directed by the contracting officer. Horizontal joints shall be formed as shown on the drawings, or, where horizontal pressure is always in one direction, with stops. 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 that 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 12 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. In water. - When specifically authorized, concrete may be deposited in water having a temperature above 45 degrees F. The methods and equipment used shall be subject to the approval of the contracting officer. When deposited by the tremie method, the tremie shall be watertight and sufficiently large to permit a free flow of concrete. The discharge end shall be kept continuously submerged in the concrete and the shaft kept full of concrete to a point well above the water surface. When the bottom-dump-bucket method is used, the bucket shall not be dumped until after it has come to rest on the surface upon which the concrete is to be deposited. The bucket shall be provided with a suitable cover, and the bottom doors, when tripped, shall open freely. The bucket shall be completely filled and slowly lowered in order to avoid backwash, and when tripped it shall be slowly withdrawn until entirely free of the concrete. With either method, concreting shall proceed without interruption until the top of the concrete is well above the water surface.

h. Cold weather. - Concrete shall not be placed when the ambient atmospheric temperature is below 35 degrees F., nor when the concrete is likely to be subject to freezing temperatures before final set has occurred, unless specifically authorized by the contracting officer in writing. 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 F. nor more than 70 degrees F. All methods and equipment for heating shall be subject to the approval of the contracting officer.

i. 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 con-

tracting 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.

8-14. Test specimens. - a. Number. - Test specimens, to determine whether the compressive strength of the concrete is in accordance with that specified in Paragraph 8-03, will be taken by the inspector. At least 1 set of 3 specimens will be made for every major pour and in general for every 200 cubic yards of concrete placed, but in any event, 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, N. Y. All costs of transportation and testing of specimens will be borne by the Government.

8-15. Finishing. - Immediately after placement, the concrete shall be properly forked back along the faces 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, to a depth of not less than 2 inches, and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely to the other work. One anchor shall be placed for each 64 square inches of area and the sides of the cut areas shall be generally rectangular. This concrete shall be drier than the usual mixture and shall be thoroughly tamped into place behind forms securely fastened. Unless otherwise specified, 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 additional 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.

8-16. 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 water-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 F. and 70 degrees F. 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 F. 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

8-17. Forms. - a. Materials. - Forms shall be subject to the approval of the contracting officer and shall be constructed of tongue and groove lumber of uniform width, unless otherwise authorized by 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 sanded 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 in the concrete will not be permitted. The type of internal wall tie shall be subject to the approval of the contracting officer. 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 exposed edges at expansion or other joints as may be required by the contracting officer.

c. Coating. - Forms for exposed surfaces shall be coated with a nonstaining mineral oil which shall be applied shortly before the concrete is placed. 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 ap-

proval 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 3 days for stem and wall forms and 48 hours for footing forms 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.

8-18. Furnishing, bending, and placing steel reinforcement. - (Item 25). - a. Work included. - (1) The contractor shall furnish, cut, bend and build into the concrete, in accordance with the drawings and directions, all steel reinforcement of deformed bars, dowels, or anchors, or any other plain steel for similar purposes. Material shall be as specified in Paragraph 11-02 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, 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, in slabs or buildings exposed to the weather and in fire-resistant construction, shall be placed not less than 1 inch from the surface in walls and slabs, 1-1/2 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 for 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.

8-19. Embedded items. - In addition to steel reinforcement, there shall be built into, or set, or attached to the concrete, gates, pipes, catch-basin and manhole frames and covers, 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 metal 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 gravel drains and metal work.

8-20. Expansion and contraction joints. - 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 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 two coats of approved asphaltic emulsion or a single coat of bituminous cement to which premoulded sponge rubber or compressed cork filler 1/2 inch thick shall be applied and such filler thoroughly covered with asphaltic emulsion or bituminous cement as specified above. In no case shall corner protection angles or other fixed metal embedded in the surface of the concrete and bended, be continuous through an expansion joint. Payment for all expansion joint material shall be included in the contract unit price for concrete.

8-21. Measurement and payment. - a. Portland cement (Item 23). - (1) The quantity to be paid for under Item 23 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 work to be done under

Item 24 will be paid for under Item 23. Cement used for mortar or grout under other items will be included in the payment for these items.

b. Concrete (Item 24). - See Section IX.

c. Steel reinforcement (Item 25). - (1) The quantity to be paid for under Item 25 will be the number of pounds of steel placed in accordance with the drawings or orders, 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 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 ordered. 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 25 shall include the furnishing, bending, cutting, placing, fastening in position, coating and protecting the reinforcement, and all other work and materials connected therewith (see Paragraph 8-18 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.

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SECTION IX. CONCRETE AND MASONRY STRUCTURES (Items 24 and 26).

9-01. Class "A" concrete (Item 24). - a. Description. - Concrete shall be constructed as shown on the drawings and in accordance with modifications designated by the contracting officer (see Paragraphs 1-02 and 1-03). Concrete shall conform to all the requirements of Section VIII for concrete. Forms for exposed surfaces shall be constructed in accordance with the provisions of Paragraph 8-17. Concrete fins formed on exposed surfaces shall be removed after the forms are stripped. Piping and miscellaneous metal work shall be set and concreted in place as provided for on the drawings. Any grouting of metal work shall be included as part of the concrete. Surfaces of concrete shall be finished as specified in Paragraph 8-15, except as otherwise specified in this section or indicated on the drawings. The floor of the gate house for the Masseek Street sewer will not require the mortar finish specified in Paragraph 8-15 b. In all concrete walls, vertical construction joints shall be provided for and spaced not to exceed 30 feet apart.

b. Measurement and payment. - The quantity to be paid for under Item 24 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 price shall include payment for all costs of furnishing materials, erecting and removing forms, mixing and placing concrete, except that cement, reinforcing steel and other metal work are included under other items (see Paragraph 8-21. Payment will be made at the contract unit price for Item 24, "Class 'A' Concrete".

9-02. Stone masonry (Item 26). - a. Work included. - The contractor shall furnish all labor, equipment and material and do all work required to construct the coursed ashlar masonry facing required for the abutment of the Memorial Bridge, to the dimensions as shown on the drawings or as directed by the contracting officer.

b. Materials. - (1) Stone. - The stone to be used shall be obtained from materials salvaged under Item 9 c, (see Paragraph 3-09).

(2) Mortar. - Mortar for stone masonry shall be mixed in the proportions of 1 part Portland cement to 2 parts sand. Cement and sand shall conform to the provisions of Paragraph 8-05 for Portland cement and Paragraph 8-06 for fine aggregate (sand). The mortar may have just enough hydrated lime mixed in it to make it work evenly, but the quantity of lime shall not exceed 15 percent of the weight of the cement. Lime shall conform to Federal Specification SS-L-351 for Type "M" Hydrated Lime. Mortar shall be prepared in such quantities that it can be used entirely before it shall have obtained its initial set, and in no event shall any mortar be used after it has been mixed for a period longer than 30 minutes. Retempering of mortar will not be permitted.

c. Stone sizes. - The coursed ashlar masonry shall be laid in courses of the rise shown on the drawings. The thickness of stones, except headers, shall be equal to the rise. Stretchers shall have a length of not less than 2-1/2 times the rise of the course, and headers shall have a length of not less than 3 times the rise of the course, unless otherwise shown on the drawings. The width of headers shall be not less than the rise nor greater than 1-1/2 times the rise of the course. Back of the dressed joints, headers may taper to a width and thickness of not less than three-fourths of the rise of the course.

d. Joints. - So far as practicable in the opinion of the contracting officer, the width of all joints shall not exceed 3/4 inch; joints shall be dressed to surfaces which will permit the allowable width for a depth of not less than 6 inches back from the neat face. Joints shall also be dressed so that back of the allowable width required the joint is nowhere over 3 inches wide.

e. Face dressing. - The faces of the stones shall be rough-pointed so that the maximum projections shall not exceed 1 inch.

f. Setting. - (1) The setting of stone masonry shall be done by competent, experienced men and in strict accordance with the drawings and specifications. Each stone shall be brushed clean and thoroughly drenched with clean water immediately before laying and carefully bedded in a full bed of mortar. Stones shall be lowered carefully into their mortar beds so as not to injure their exposed faces nor jar adjacent stones. Stones shall be accurately set, with joints not exceeding the maximum width specified, and located as shown on the drawings for corners and other special locations. All joints shall be completely filled with mortar and shall be finished and pointed as the stones are laid and before the mortar shall have become hard. A sufficient number of suitable temporary wooden wedges shall be used in setting the stones to maintain alignment and a uniform width of joint and to prevent settlement in the joints. Faces shall be kept free of mortar at all times. No stone masonry shall be laid between the fifteenth of November and the first of April or at any time during freezing weather or at night, except that if specific permission is obtained from the contracting officer and if such work is done in all respects as he directs, stone masonry may be laid during these periods but the contractor shall receive no extra payment therefor. All unfinished masonry shall be suitably protected during the colder months to prevent damage from freezing. The contractor shall keep masonry wet by sprinkling with water until the mortar shall have become entirely set and hard enough to prevent its drying and cracking.

(2) The face bond between stretchers shall be not less than one-third of the length of the shorter stretcher, and between stretchers and headers shall be not less than two-fifths of the length of the face of the header. The exposed face of the stone shall not vary from the neat wall surface as shown on the drawings by more than 1 inch.

g. Anchorage. - The contractor shall provide sufficient and proper galvanized anchors, dowels, clamps, etc., for securing the stone

work in place and other structural features bearing thereon or attached, and shall do any drilling required to satisfactorily place such dowels and anchors. Approved metal ties shall be used and placed in accordance with the best practice. Galvanized anchors and dowels will be paid for under Item 30 (see Paragraph 11-05 b).

h. Protecting exposed surfaces. - The facing of all masonry which is permanently exposed to view shall be effectively protected from injury or disfigurement by the falling of stones, tools, mortar or other objects until the final acceptance of the work. The contractor shall build, at his own expense, timber or other acceptable coverings over the masonry if necessary for proper protection in the vicinity of derricks and in any other places where faces are particularly liable to injury. All face stones shall be carefully handled so as not to mar the exposed faces. The erection of derricks and other machinery, or of centering and forms, or the landing and storing of stones or other heavy objects upon the surfaces of masonry under construction, or walking or working over them, will not be permitted until an acceptable time has elapsed for the setting of the mortar. Care shall be taken to avoid disturbing stones in any way after they have been set. Whenever a stone that has been set has its bond broken, it shall be taken up and reset.

i. Measurement and payment. - The quantity to be paid for under Item 26 shall be the number of cubic yards of stone masonry facing satisfactorily placed in the work, measured by multiplying the exposed face area including all joints by 2 inches more than the required average depth of masonry back from the neat face, except that the masonry in corners shall not be included in the measurement more than once. Projections of the facing beyond the neat face shall not be included in the measurement. Payment will be made at the contract unit price for Item 26, "Stone Masonry", and shall include all costs of furnishing and placing the stone masonry, drilling holes for anchors and dowels and grouting same, and protecting the masonry and finishing the joints. Embedded metal will be paid for under Item 30 (see Paragraph 11-05 b).

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SECTION X. GATE HOUSE FOR MASSEEK STREET SEWER (Item 27).

10-01. Work included. - The contractor shall furnish all labor, equipment and materials and shall perform all work required to construct the gate house for the Masseek Street sewer in accordance with specifications and drawings. For the concrete and steel reinforcement required (see Section VIII and Paragraph 9-01). The work includes the furnishing and installing of the door and frame, louvres, steps, hatchways, miscellaneous metal details, builders' hardware and any other work, materials, or labor not specifically mentioned that are necessary to complete the gate house in accordance with the drawings.

10-02. Door and frame. - a. The door shall be of the type and design shown on the drawings. The door shall be of the vertical, swinging type and shall be supported at the jamb with butts as shown on the drawings. Stiles and rails shall be constructed of 5 by 1-3/4-inch 14-gauge pressed steel tube. All mitre joints and butt joints shall be welded and ground smooth. The metals in the panels shall be not less than 16-gauge in thickness. The door shall be provided with a structural steel door frame made of a 4-inch steel channel and the frame shall be supplied by the door manufacturer. The quality of the material, the type of door and the workmanship shall in all respects by similar and equal to the Tubular Steel Doors, manufactured by William Bayley Company, Springfield, Ohio. The door sill shall be cast iron with a fluted top and shall be similar and equal to products of American Abrasive Metals Company, Irvington, New Jersey.

b. The door shall be painted and finished at the shop in the color to be selected by the contracting officer (see Section XIII).

c. The payment for the door installed and the cast iron door sill will be included in the contract price for Item 27.

10-03. Louvres. - Where shown on the drawings, louvres of the size indicated, will be placed. The frame of these louvres shall be of structural steel as shown on the drawings. They shall be equipped on the exterior with 14-mesh copper screens of the size shown on the drawings.

10-04. Builders' hardware. - a. The contractor shall furnish and install bronze hardware for the door, including locksets, butts, wall bumpers, clamps, 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. The hardware shall be subject to the approval of the contracting officer, shall be of the 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 the following products of the William Bayley Company and the Stanley Company.

Butts 4-1/2 x 4-1/2 . . . Stanley BB 193

Lock . . . . . Bayley Y2

10-05. Miscellaneous details. - Existing covers and hatchways shall be modified in accordance with the drawings, or new metal covers provided. New hatch covers, pipe extensions, and fittings, hand grabs, and other miscellaneous metal items required, shall be furnished and installed as shown on the drawings. The materials and workmanship shall conform to the applicable provisions of Section XI. Payment will be included in the contract price for Item 27.

10-06. Payment. - For constructing and completing the gate house in accordance with the specifications and the drawings, payment will be made at the contract price for Item 27, "Gate House for Masseek Street Sewer", and shall include all costs of doing the work specified in Paragraphs 10-01 to 10-05 inclusive. Concrete and steel reinforcement will be paid for separately at the applicable contract unit prices.

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SECTION XI. VALVES, METALS AND EMBEDDED ITEMS (Items 28 to 32 incl.)

11-01. General. - a. 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. Wherever used in these specifications, the word "ton" shall mean two thousand pounds. 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.

b. The various articles shall be furnished and placed as indicated on the drawings. The more important articles required are listed below and are required at the gate structures or elsewhere, but other metal items, whether or not shown on the drawings, becoming necessary in the development of detailed plans and satisfactory construction, shall also be furnished at the applicable contract unit prices specified in this section; except materials and fittings specifically included for payment under other items of the work.

11-02. Materials and workmanship. - a. The articles included in Items 28 to 32, inclusive, other miscellaneous materials, and all metals 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. All reinforcement 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.

(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 Bureau of Welding.

(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 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.

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

(8) Iron castings, gray. - Federal Specification QQ-I-652 (dated April 4, 1939), class as indicated. Tensile tests and chemical analyses will not be required.

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

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

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

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

(13) Wrought-iron pipe. - Federal Specification WW-P-441, Class A.

(14) Black steel pipe. - Federal Specification WW-P-403, Type A, and WW-P-521.

(15) Sheet metal. - Federal Specification QQ-I-696, Type II, Class A.

(16) Bronze. - Appropriate Federal Specifications QQ-B-746, QQ-B-691, QQ-B-726, QQ-B-611 and QQ-C-591.

(17) Brass castings. - Federal Specification QQ-B-621, Composition "B".

(18) Commercial brass. - Federal Specification WW-B-611.

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

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

(21) Babbitt metal. - Federal Specification QQ-M-161.

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

(23) Solder. - Appropriate Federal Specifications QQ-S-571 and QQ-S-551.

(24) 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.

11-03. Galvanizing and painting. - a. Galvanized iron or steel articles as indicated on the drawings, shall be galvanized by the hot-dip process unless otherwise permitted. Injuries to the galvanizing shall be satisfactorily repaired at the contractor's expense. Provisions 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 four immersions in copper sulphate solution.

b. Except as otherwise specified all metal to be exposed in the finished work shall be thoroughly cleaned and then thoroughly and evenly painted in accordance with the provisions of Section XIII.

11-04. Valves. - (Items 28 and 29). - a. Work included. - The contractor shall furnish and install flap valves, gate valves and check valves of the size required as shown on the drawings or as directed by the contracting officer.

b. Materials. - The flap valves shall be Chapman Table 25 or equal. The gate valves shall be Crane #461 or equal. The check valve shall be Chapman Table 23 or equal. All valves shall be for flange connections and shall conform to the requirements of current American Water Works Association specifications applicable to the size and use intended.

c. Payment. - Payment will be made on the basis of the valve units complete under Items 28 and 29 as applicable (see Paragraph 1-05) and shall include all costs of furnishing and installing the valves.

11-05. Miscellaneous iron and steel (Item 30). - a. Ladder rungs, gratings, covers, metal conduits, and other miscellaneous iron and steel shall be furnished and installed. 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 11-06 b.

11-06. Copper water stops (Item 31). - a. Copper water stops required for the expansion joints of concrete work shall be furnished and installed. Copper water stops used in concrete expansion joints shall be continuous, and shall be crimped. Splicing of the water stops shall be done by overlapping, riveting and copper welding. Unless otherwise specified on the drawings the material shall be 20-ounce sheet copper of approved standard. The crimp shall be filled with a mastic filler of "elastite", as manufactured by Philip Carey Company, Cincinnati, Ohio, or equal. Copper water stops shall be placed in the expansion joints indicated on the drawings, as directed by the contracting officer.

b. Measurement and payment. - The quantities to be paid for under Items 30 and 31, will be the number of pounds respectively furnished and installed in accordance with the drawings and specifications except for the work required under Item 27 (see Paragraph 10-06). Wherever practicable, the quantities shall be determined by weighing the articles and materials on the most accurate scales available. 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 scale weights, railroad shipping weights, manufacturers' weights, catalog weights, and estimated 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.

11-07. Pipe hand railing (Item 32). - a. General. - Hand railing of wrought-iron pipe including sleeves or flanges for anchoring posts, shall be installed as indicated on the drawings, with malleable iron pipe fittings and connections, of ball pattern and pin connected, unless otherwise shown on the drawings. Post connections at the floor, and caps used on the bottoms of sleeves embedded in the concrete or on top of guard posts shall be standard screw type. All fittings shall be of Crane Co. type or equal. Floor or wall flanges of screw type shall be anchored into the concrete with stud type expansion bolts consisting of a primary and a secondary expansive unit similar and equal to that manufactured by Ackerman-Johnson Company.

b. Materials and workmanship. - The pipe rail, posts and sleeves for anchoring posts shall be of wrought iron and shall conform to Federal Specification WW-P-441, Class A, where applicable. The malleable-iron fittings and connections shall conform to Federal Specification QQ-I-666, Type A, for Castings, Iron, Malleable. The guard chain and attachments shall conform to Federal Specification RR-C-271, of Type "A" and Grade "2".

c. Measurement and payment. - The quantity to be paid for will be the number of linear feet of pipe hand-railing furnished and installed, measured overall. Payment will be made at the contract unit price for Item 32, "Pipe Hand Railing", and shall include all costs of furnishing and installing the railing, including all fittings, anchors and incidentals.

SECTION XII. SLUICE GATES, COMPLETE WITH HOISTS (Item 33).

12-01. Work included. - The contractor shall design, furnish and install two sluice gates for unseating pressure as shown on the drawings, complete with electric motor-operated hoists and accessories.

12-02. Description. - The gates shall be of cast iron with bronze seals, and shall be designed to operate satisfactorily under all heads up to and including the maximum hydrostatic head of 50 feet at the center of the gate. The dimensions of the gate opening with the gate fully raised shall be 6 feet in width and 6 feet in height for one gate, and 7 feet 6 inches in diameter for the other. Each gate shall be operated by means of a rising-stem hoist actuated by an electric motor. Each gate shall seat or unseat satisfactorily under the maximum hydrostatic head. When seated the gates shall be practically water-tight.

12-03. Gates. - a. The leaf of each gate shall consist of a rectangular cast iron plate not less than one inch thick and shall be suitably reinforced with horizontal and vertical ribs. Bronze seat facings shall be driven into dovetail grooves machined in the face of the gates. The leaf shall have a pocket cast in the center near the top, heavily reinforced by ribs into which shall be fitted a solid manganese bronze thrust nut threaded and keyed to the stem. This thrust nut provides the attachment between the stem and the leaf and shall be of ample size to take the thrust both ways. The leaf shall have tongues on each side extending the full length of the leaf and these tongues shall be accurately machined all over.

b. The leaf shall be fitted with four wedges on each side and with two top and two bottom wedges. The side wedges shall be of solid bronze and shall be of the adjustable type, and shall be provided with tongues on the back to slide in vertical keyways, machined in the leaf, and shall be secured to the leaf by shouldered steel studs and bronze nuts. They shall have solid bronze adjusting bolts. The side wedges shall be machined on all bearing surfaces and shall make accurate contact with the bronze wedge facings attached to the guides. The top and bottom wedges shall be of solid manganese bronze and shall be of the adjustable type. The wedges shall be attached to the leaf by shouldered steel studs and bronze nuts and shall have solid bronze adjusting bolts. The wedges shall be machined on all bearing surfaces and shall make accurate contact with the wedge seats attached to the frame.

12-04. Gate frames and guides. - a. The gate frame for the rectangular 6-foot by 6-foot gate opening shall be of the standard flat type, similar and equal to Chapman Table 8, having the rear face rough-machined and drilled to attach to concrete and the front face machined to take the sluice-gate guides. The gate frame for the 7-foot 6-inch diameter circular gate opening shall be of the standard spigot type having a flange rough-machined and drilled to attach to concrete and a short spigot extension to extend into the concrete. The frames shall be of cast iron of ample sec-

tion to prevent distortion and shall be cast in one piece. Bronze seat facings shall be driven into dovetail grooves machined in the front face of the frame.

b. The guide shall be of cast iron of sufficient length so that not less than one-half of the gate is within the guides when the gate is fully open. Slots shall be machined the full length of the guides, of such dimensions that there is not over 1/16-inch clearance with the tongues on the side of the leaf. The guides shall be machined to fit the frame and shall be bolted to the frame with steel studs and keyed to the frame to prevent lateral movement. Holes for studs shall be spot faced. The guides shall be reinforced with heavy ribs at points of contact with the side wedges of the leaf, capable of taking the whole thrust due to water pressure and wedge action. Heavy bronze wedge facings shall be attached to the guides at points of contact with the side wedges and these wedge facings shall be machined on all bearing surfaces and shall make accurate contact with the side wedges.

12-05. Gate stems. - a. The gates shall have rising stems of sufficient size to withstand safely, without buckling, the whole thrust due to closing the gate under the maximum operating head. The gate stems shall be cold rolled steel in sections not exceeding 10 feet in length. The sections of each stem shall be joined together by solid manganese-bronze couplings threaded and keyed to the stems.

b. Each stem shall be furnished with stem guides located as shown on the drawings. All stem guides shall be bronze bushed and adjustable.

12-06. Hoists. - a. The gate hoists shall be electric motor-operated, pedestal type, one for each gate as shown on the drawings, complete with electric motor and controls, stems, stem guides, stem pipe covers and bracing, accessories and position indicator. Each hoist shall be of 30,000-pound capacity. Provisions shall be made for operating the hoists by remote control. The hoists shall have a stem rising and lowering speed of approximately one foot per minute.

b. The pedestal and gear case shall be made waterproof and shall be constructed of gray cast iron conforming to Federal Specification QQ-I-652 with provisions made for attaching stem cover to top cover plate. A suitable torque plate shall be provided at the base of the pedestal. Electric contactor cases and push button cases shall be cast as integral parts of the pedestal and shall have cast-iron covers with machined and gasketed water-tight and dust-tight joints.

c. All gears shall be of steel properly designed for the service intended. The gear shafts shall be provided with bronze bushings. Gearing shall be enclosed in water-tight and dust-tight casings and shall be so designed that it will not be necessary to run the gears in oil or grease. Spur gearing shall be used. The stands shall include automatic mechanical hammer-blow devices or other apparatus to allow the motor to come up to speed before unseating the gate.

d. A handwheel with disconnecting handle, and connected to the stem by suitable gearing, shall be provided for hand operation of each hoist, when desired. The handwheels shall not revolve when the hoists are electrically operated, and the motors shall be mechanically locked against starting when the hoists are being hand-operated, or when the "hand-motor" handles are in the "hand" position.

e. All hoists shall be equipped with stem covers of threaded wrought iron pipe with suitable caps.

12-07. Gate hoist electrical equipment. - a. The hoist motor shall be mounted on the pedestal and arranged so that the controls are built in, completely enclosed and waterproof. The motor shall be direct connected through a train of spur gears and shall be the single speed, high-torque, low-starting current type. The motor shall be designed for 220-volt, 3-phase, 60-cycle current to operate at a speed of not over 900 r.p.m. It shall be of the squirrel cage type, rated for 30-minute intermittent operation and shall be equipped with all necessary starting apparatus and protective devices. The starting torque of the motors at rated voltage and frequency shall be not less than 125 percent full-load torque, and the breakdown torque shall be not less than 200 percent full-load torque. The motor shall be equipped with grease-packed ball-bearings and splash-proof housing. Insulation shall be impregnated with special moisture and acid-resisting compound.

b. The controllers shall be of the full magnetic reversing type, designed for across-the-line starting; and controlled by a three-way push-button station, so that the gates may be raised, lowered, or stopped at any desired point in their travel. The controllers shall be provided with undervoltage, inverse-time-limit and instantaneous overload protection accomplished by suitable relays. Overload relays shall be of the automatic reset type. The limits of travel of the gate in both upward and downward directions shall be accurately determined by quick-break limit switches geared directly to the gate stems. The switches shall be designed to absolutely prevent "drift" or jamming of the gate. The switches shall be housed in waterproof and oil-tight cases and shall be equipped with quick-break contacts with micrometer adjustment.

c. Each hoist shall contain a motor contactor equipped with separate "open" and "close" contactor arms, mechanically interlocked, and provided with arc shields. The contactor shall be of ample size and rating to make and break the current required by the motor under all conditions. Push buttons in water-tight cases shall be provided. The push buttons shall be clearly labeled "open", "close" and "stop". A pilot light shall be installed, indicating that the motor is ready to be operated. All electrical apparatus shall be installed and internal connections shall be made by the hoist manufacturer.

d. A gate-position indicator shall be included on the hoists. The gate-position indicator shall be plainly visible from the push-button station. Unless otherwise specified, all electrical materials, workmanship,

and tests shall be in conformity with the current standard rules, regulations, and specifications of the American Institute of Electrical Engineers and of the National Electrical Manufacturers Association.

12-08. Furnishings and fittings. - a. The gate frames, guides and hoists shall be designed and constructed to provide a satisfactory method of fastening them securely to concrete or other supports during erection as shown on the drawings. All bolts, special tools, and other devices necessary to erect the gates, frames, guides, and hoists as shown on the drawings shall be furnished by the contractor.

b. All bolts, nuts, screws, studs, pins, etc., shall be securely locked by satisfactory devices that will prevent loosening due to vibration.

12-09. Design. - a. The detailed design for the sluice gates, hoists, and accessories shall be such that all working parts shall be readily accessible for inspection and repair, easily duplicated, and readily replaced. Each and every part of the equipment shall be 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-sixth of the ultimate strength of the material used.

12-10. Drawings. - The contractor shall submit for approval detail drawings for the sluice gates, hoists, and accessories he proposes to install in sufficient detail to check the design. These drawings shall be in accordance with Paragraph 1-04 c and 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. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details or 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 the same 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.

12-11. Materials and workmanship. - Each gate, with its hoist and accessories, 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 XI, where applicable. All metal workmanship shall be of approved standard quality.

12-12. Installation. - The gates shall be completely assembled

during installation and the leaf shall be screwed lightly into its seat and shall be held in place by jack screws. Care shall be exercised when drawing the frame up to the concrete to insure its being pulled against a true surface. All bolts shall be tightened carefully so as not to strain or warp the parts and to preserve proper alignment. Grout shall be poured between the face of the flange and the concrete to prevent any tendency to spring the frame. After installation, the jack screws shall be removed.

12-13. Inspection and tests. - a. The gates, hoists and accessories to be furnished shall be assembled in the shop as directed by the contracting officer for inspection and to insure that all parts fit accurately and are in proper alignment. Each gate shall be opened and closed to insure proper operation.

b. After completion of the gate house and the installation of all machinery, each gate shall be tested for satisfactory operation by being raised and lowered electrically and manually several times for its full length of travel. Any adjustments in the setting or installation required to secure satisfactory operation and tight closure of the gates shall be made by the contractor. The gate hoists shall be tested as directed and any adjustments or changes that may be required in the opinion of the contracting officer shall be done by the contractor.

c. The cost of all testing shall be borne by the contractor, except for the Government's representatives, and shall be included in the contract price for Item 33.

12-14. Painting. - a. Painting shall conform to the applicable provisions of Section XIII.

b. For gates and gate guides there shall be one coat of metal filler, one shop coat of red lead and one field coat of red lead paint, of a color approved by the contracting officer, and two finish coats of graphite paint. Painting shall be similar or equal to Detroit Graphite Company's Iron-Gard System for underwater steel structures.

c. For gate hoists there shall be applied one coat of metal filler, one shop coat of red lead, one field touch-up coat of red lead, and two coats of selected engine enamel.

d. The touch-up coat shall be applied as may appear necessary to the contracting officer and shall be done with the same shade as the shop coat.

12-15. Payment. - a. Payment for designing, furnishing, painting and installing the work included in Paragraph 12-01 will be made at the contract price for Item 33, "Sluice Gates, Complete with Hoists."

b. Partial payments up to 50 percent of the contract price will be made when the sluice gates, complete, are delivered to the site of the work provided the quality of such 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 equipment 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.

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SECTION XIII. PAINTING

13-01. Work included. - The contractor shall do all shop and field painting of equipment, and all other painting required at gate and stop-log structures. All exposed iron and steel work not galvanized, all unfinished iron or steel parts of the equipment, all doors, door frames, and louvres shall be painted.

13-02. 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 shall be done with pure lead and oil paint of a composition and color 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.

13-03. 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 shall be given one finish coat of approved paint (see Paragraph 13-02 c).

13-04. Painting equipment. - 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 13-02 c). The sluice gates and hoists shall be painted in accordance with the requirements of Paragraph 12-14.

13-05. 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.

13-06. 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.

13-07. 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.

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SECTION XIV. MISCELLANEOUS (Items 34 to 42 incl.)

14-01. Timber stop-logs (Item 34). - a. Work included. - Creosoted timber stop-logs shall be furnished and installed for the stop-log structures at the locations shown on the drawings or as directed by the contracting officer.

b. Materials. - Creosoted timber shall be No. 1 Common plain white oak conforming with the Standard Grading and Dressing Rules of The National Hardwood Lumber Association and to Federal Specification MM-L-736, "Lumber and Timber; Hardwood". Timber shall be treated with a creosote-tar-solution conforming to Federal Specification TT-W-566, "Wood-Preservative; Creosote-Coal-Tar-Solution (for) Ties and Structural-Timbers". (See Specification No. 5-b of the American Wood Preservers' Association). Timber shall be treated by the pressure process in accordance with Federal Specification TT-W-571a, "Wood-Preservative; Preservative-Treatment". The minimum absorption of preservative shall be 6 pounds per cubic foot by the empty cell treatment (see specification for treatment, American Wood Preservers' Association Specification No. 34-b).

c. Description. - Stop-logs with their necessary bracing shall be carefully framed to fit the stop-log structures, and shall be installed as shown on the drawings or stored as directed by the contracting officer. Creosoting shall be done after stop-logs have been cut to length and surfaced.

d. Measurement and payment. - Measurement for payment will be based on the number of thousand feet board measure furnished and installed computed on the basis of the nominal dimensions of the timber stop-logs. Payment shall include all costs of furnishing, installing, and removing and storing timber stop-logs in a designated place. Payment will be made at the contract unit price for Item 34, "Timber Stop-Logs."

14-02. Placing topsoil and sodding embankment slope (Items 35 and 36). - a. Work included. - The contractor shall furnish and place topsoil on the slopes of the earth dike as shown on the drawings, and on other areas as required by the contracting officer. Under Item 35, acceptable topsoil shall be placed to the required depth over the required areas. Under Item 36, the prepared topsoil surface shall be sodded and seeded when and as directed by the contracting officer.

b. Placing topsoil. - After the earth dike has been completed to the required height and dimensions, the contractor shall apply the stored topsoil (see Paragraph 3-03 a(2)) or additional acceptable topsoil if required, to the required depth when compacted, over the slopes of the embankment 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. Sodding. - (1) The slopes of the earth dike shall be spot sodded with living sods of Bermuda or some other acceptable grass which will best meet the climatic conditions as approved by the contracting officer. Sods obtained by stripping operations (see Paragraph 3-03a(2)) may be used if approved by the contracting officer. Each sod shall have an area of not less than 16 square inches. Sods shall be placed not more than 18 inches center to center for the minimum-sized sods; larger sods may be spaced proportionately, depending on their size. Sods shall be covered with 1/2 to one inch of earth, in such manner as to protect the roots from drying out. Sods shall be placed as soon as practicable after cutting, and newly placed sods shall be kept moistened by sprinkling when and as required by the contracting officer for the entire period of the contract until the work is completed and accepted by the contracting officer.

(2) Sodding shall be commenced immediately upon completion of the dike to final grade and cross section and shall be prosecuted at a rate satisfactory to the contracting officer. Seeding shall be done to supplement the sodding operations.

d. 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 of the slopes 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, weeds 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 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 the 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.

e. Measurement and payment. - (1) The quantity of topsoil to be paid for under Item 35 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 35, "Topsoil".

(2) The quantity to be paid for under Item 36 will be the number of acres sodded and seeded as directed. The measurement will be the actual superficial areas sodded and seeded. Payment shall include all costs for sodding as specified in subparagraphs c and d above, and for all materials and expenses incidental thereto. Payment will be made at the contract unit price for Item 36, "Sodding and Seeding".

14-03. Surfacing for top of dike (Item 37). - a. Work included. - The contractor shall furnish and place gravel of the sizes and quality specified or directed for the surfacing of the top of the dike, as shown on the drawings or as directed by the contracting officer.

b. Material. - The gravel shall be composed of hard, durable stones, free from thin or elongated pieces, and mixed with sand or other approved binding material. The gravel shall be of such sizes that all will pass through a screen with 3/4-inch square openings, and not less than 35 percent will be retained on a screen with 1/4-inch square openings, and shall be uniformly graded. The finer material shall consist of sand or other binding material 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 manipulated in such a manner as to furnish a material to meet the above requirements.

c. Placing. - (1) The surfacing shall be placed in one layer, and shall be 6 inches thick after compaction. After the subgrade or foundation shall have been properly prepared and compacted and proper drainage provided, the 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 graded and compacted to the required thickness, by rolling with a self-propelled three-wheel roller weighing not less than 10 tons, until a firm even surface is obtained. If at any time the material does not contain a sufficient amount of moisture to insure proper binding of the material, water shall be added by means of a sprinkling wagon or any approved method in a sufficient amount to obtain the desired results.

(2) Compacting of the material shall start longitudinally at the side and gradually proceed toward the center of the roadway so far as practicable, overlapping on successive trips. During the process of compacting the material shall be dragged; the dragging and compacting shall continue until the material does not creep or wave under the roller.

d. Shoulders. - Shoulders shall be constructed as shown on the drawings and carefully maintained. Before the final completion of the work the shoulders shall be reformed, trimmed, and dressed as required by the contracting officer.

e. Measurement and payment. - Measurement will be made by the cubic yard for the amount of surfacing furnished and 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 compacting. Payment for all work in connection with surfacing for top of dike, including furnishing, placing, and compacting the material will be made by the cubic yard under Item 37, "Surfacing for Top of Dike".

14-04. Bituminous surface treatment (Item 38). - a. Work included. - The contractor shall furnish and place the bituminous road surface shown on the drawings, in the locations shown on the drawings or otherwise designated by the contracting officer, after the gravel base shall have been placed in accordance with the drawings and the provisions of Paragraph 14-03. Care shall be taken not to spatter bituminous material on surfaces adjacent to the work.

b. Materials. - The bituminous material to be used in this work shall be an approved product for the purpose, either oil asphalt or refined tar.

c. Placing. - (1) The bituminous material shall be applied to the prepared surface of gravel (see Paragraph 14-03) at the rate of not

less than one-half gallon per square yard, at as low temperature (80 degrees to 150 degrees Fahrenheit) as will permit uniform distribution. No bituminous material shall be applied in wet or cold weather (below 50 degrees Fahrenheit).

(2) After the prime coat has been applied the road shall be closed to traffic until the bituminous material shall have penetrated completely into the gravel, after which a thin layer of sand shall be spread over the prime coat and a second coat of bituminous material shall be applied at a rate of not less than one-half gallon per square yard.

(3) Over the second coat of bituminous material there shall be spread sufficient sand (not less than 25 pounds per square yard) conforming to the requirements of Paragraph 8-06, to absorb the excess bituminous material.

(4) The surface shall be broomed to break up all clumps and produce a uniform covering after which the surface shall be rolled. The rolling shall be done by a suitable roller, the roller to lap at least one-half the width of the rear wheel on each trip. Any damage to the road surface caused by the working equipment or otherwise through the life of the contract, shall be satisfactorily repaired.

d. Measurement and payment. - The quantity to be paid for under Item 38 will be the number of square yards of bituminous surface of the required quantity and thickness satisfactorily placed in the work, measured after placing. Payment will be made at the contract unit price, Item 38, "Bituminous Surface Treatment". The contract unit price shall include all costs of furnishing materials, equipment, tools, labor and all work incidental to satisfactory construction.

14-05. Concrete cribbing (Item 39). - a. Work included. - The contractor shall construct reinforced concrete cribbing at the landside toe of the dike and elsewhere as shown on the drawings. The contractor shall furnish and place the specified fill inside and around the cribs as shown on the drawings.

b. Concrete crib members. - (1) The crib members shall be cast in conformity with the requirements for Class "A" concrete (see Section VIII). The steel reinforcement shall conform to the provisions of Paragraph 8-18. The crib members shall be free from depressions and spalls, patched or plastered surfaces or edges, or any other defects which may impair their strength or durability. Cracked or otherwise defective members will be rejected. The cribbing shall be the standard commercial interlocking type requiring no metal dowels.

(2) If reinforcement details are not fully shown on the drawings, the contractor shall submit detailed drawings and specifications for the approval of the contracting officer, and such drawings and specifications must be approved before delivery of the material is begun (see Paragraph 1-04 c).

c. Construction methods. - The foundation or bed for the cribbing shall be firm and true to foundation grade and shall be approved by the contracting officer before any of the crib members are placed. Transverse concrete sill members (mud sills) shall be used to support the lower cribbing course. Crib members shall be carefully handled and erected in a manner so as to avoid any injury due to shock or impact. Any interlocking system shall be as approved by the contracting officer. Any member which becomes cracked, or otherwise injured, during hauling or erection, shall be removed from the work and replaced with satisfactory members.

d. Filling. - (1) Filling inside and around cribbing, as shown on the drawings, shall be dumped rock and pervious material (see Paragraph 3-08), placed in a careful manner without distorting the cribbing. The pervious material required to complete the crib filling refers to pervious fill placed under Item 8 (see Paragraph 1-05), and compacted as directed by the contracting officer (see Paragraph 5-05 a).

(2) Any earth that slides in or around the crib members before the filling is placed shall be removed. Filling shall be placed in even, horizontal layers and arranged to reduce the voids to a minimum, and shall be placed as fast as the crib members are added.

e. Measurement and payment. - (1) The quantity to be paid for under Item 39 will be the number of cubic feet in the concrete crib members placed in the completed work. Payment will be made at the contract unit price for Item 39, "Concrete Cribbing", and shall include all costs of furnishing materials, equipment and labor required to construct the concrete cribbing complete in place, except the cost of filling and any excavation required.

(2) Payment for excavation will be made under Item 3, "Common Excavation-General" (see Paragraph 3-06 d).

(3) Payment for dumped rock fill will be made under Item 18, "Dumped Rock Fill" (see Paragraph 6-05 c). Payment for pervious material will be made under Item 8 in accordance with the provisions of Paragraph 3-08 c.

14-06. Backwater gate, complete with hoist (Item 40). - a. Work included. - The contractor shall design, furnish and install one timber or metal backwater gate and frame, complete with hoist and accessories, for the Massesk Street sewer as shown on the drawings and specified herein.

b. Gate. - The gate shall be designed to close tightly a 5'-0" wide by 5'-9" high rectangular opening in the sewer line against a pressure head of 40 feet of water. The gate shall be properly balanced so as to cause a drop in head, with the sewer flowing full through the gate opening, of not more than one foot, and so that the gate will close and seat itself properly if it is entirely submerged when outflow stops and before backflow starts. The gate shall be provided with a metal eye bolt for hoisting or holding the gate.

c. Hoist. - The gate hoist shall be a hand-operated geared winch sufficient in capacity to operate the gate against the maximum head.

d. Furnishings and fittings. - The applicable provisions of Paragraph 12-08 shall apply.

e. Design and drawings. - The applicable provisions of Paragraphs 12-09 and 12-10 shall apply. The backwater gate, hoist and accessories shall be built and furnished by a manufacturer regularly engaged in this class of work who has an established reputation for the excellence of his product.

f. Materials and workmanship. - (1) The provisions of Paragraph 12-11 shall apply.

(2) If of timber construction, the gate and frame shall be made of sound, dense, long-leaf southern pine of the best quality structural grade, creosoted to retain not less than 12 pounds of creosote per cubic foot of lumber. Metal fastenings, eye bolts, hinges, bearings and anchor bolts shall meet first-class requirements for timber backwater gates in sewers as to strength, durability, wear and non-corrosion.

g. Installation. - The applicable provisions of Paragraph 12-13 shall apply. The gate and hoist shall be installed under the supervision of a competent representative of the manufacturer.

h. Inspection and tests. - The applicable provisions of Paragraph 12-12 shall apply.

i. Painting. - Painting shall conform to the applicable provisions of Paragraph 12-14, except for wood work (see subparagraph f (2) above).

j. Payment. - (1) Payment for designing, furnishing, painting and installing the work included in Paragraph 14-06 a will be made at the contract price for Item 40, "Backwater Gate, Complete with Hoist."

(2) The provisions of Paragraph 12-15 b shall apply.

14-07. Foundation drain wells (Item 41). - a. Work included. - The contractor shall sink drain wells into the foundation of the earth dike at the locations and to the elevations as shown on the drawings or as directed by the contracting officer, and shall backfill the drain wells with sand. Any casing used in sinking the drain wells shall be removed. When completed each drain well shall consist of a sand filled hole of 12-inch minimum diameter, providing a free and continuous drainage path for the water expelled from the clay.

b. Construction methods. - (1) Methods and equipment for advancing the holes and completing the drain wells in the time specified

in Paragraph 1-07 shall be subject to the approval of the contracting officer. The contractor shall furnish detailed drawings in accordance with the provisions of Paragraph 1-04 c, showing his proposed method of construction. Borings will be taken and tests will be made by the Government of several of the completed drain wells. The contracting officer may require such changes in the contractor's methods and equipment as may be deemed necessary to produce the specified results.

(2) Each drain well shall be backfilled to the extent shown on the drawings with clean pervious sand selected from river dredged material. The sand shall be free of organic material and debris and shall be uniform in size with at least seventy-five percent by weight passing a sieve having 10 meshes to the inch and not over eight percent passing a sieve having 100 meshes to the inch. The sand backfill shall be compacted by tamping with hand or power tampers to the satisfaction of the contracting officer.

c. Measurement and payment. - Measurement for payment will be based on the linear feet of drain wells completed. Payment will be made at the contract unit price for Item 41, "Foundation Drain Wells", and shall include the costs of all labor, materials, equipment and incidentals required to complete the drain wells as specified or directed.

14-08. Reconstruction of existing access walkway (Item 42). - a. Work included. - The contractor shall remove, replace, and paint the existing access walkway as shown on the drawings or as directed by the contracting officer.

b. Materials. - New materials furnished shall be similar and equal to materials being replaced or shall conform to materials as shown on the drawings. Painting and paint materials shall conform to the applicable provisions of Section XIII.

c. Payment. - Payment will be made at the contract price for Item 42, "Reconstruction of Existing Access Walkway", and shall include all costs of removing and replacing existing access walkway and furnishing and placing new material required.

14-09. 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 42, inclusive.

U. S. Engineer Office
Providence, Rhode Island
June 20, 1940

Invitation No. 699-40-385

STANDARD GOVERNMENT FORM OF BID
(Construction Contract)

To the District Engineer
U. S. Engineer Office
Room 819, Industrial Trust Bldg.
Providence, Rhode Island

(Place) _____

(Date) _____

In compliance with your invitation for bids dated June 20, 1940, and subject to all the conditions thereof, 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, and perform all work required for the construction of concrete Flood Walls, Earth Dikes and Appurtenant Structures on the Connecticut River below the Highway Bridge at 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:

Item No.	Designation	Unit	Quantity	Unit Price	Amount
1	Preparation of Site	acre	36		
2	Stripping				
	a. Common	cu.yd.	30,000		
	b. Roadway	" "	1,600		
3	Common Excavation, General	" "	70,000		
4	Common Excavation, Impervious Borrow	" "	135,000		
5	D E L E T E D				
6	Common Excavation, Cut-off Trench		7,200		
7	Common Excavation, Special Work at Power Stations	" "	10,400		
8	Free Draining River Sand				
	a. Dredging not Exceeding 4,000 feet to Point of Disposal	" "	635,000		
	b. Dredging for Each Additional 2,000 Feet to Point of Disposal	" "	50,000		
9	Removal of Existing Structures				
	a. Brick	" "	-		
	b. Concrete	" "	2,000		
	c. Stone Masonry	" "	600		
	d. Masseek Street Sewer	lin.ft.	70		
10	Steel Sheet Piling				
	a. Permanent Cut-off	sq.ft.	293,700		
	b. Temporary Sheeting	" "	6,000		
	c. Permanent Bulkhead	" "	5,200		
11	Timber Piling				
	a. Sheet Piling	" "	6,600		
	b. Bearing Piles	lin.ft.	4,200		

Item No.	Designation	Unit	Quantity	Unit Price	Amount
12	Reinforced Concrete Piling				
	a. 14" Size	lin.ft.	4,700		
	b. 16" Size	" "	12,500		
	c. 18" Size	" "	4,400		
13	Impervious Fill, Placing and Rolling	cu.yd.	116,000		
14	Random Fill, Placing and Rolling	" "	20,000		
15	Screened Gravel	" "	14,000		
16	Compacted Backfill	" "	22,600		
17	Semi-Compacted Backfill	" "	37,000		
18	Dumped Rock Fill	" "	48,700		
19	Riprap, Hand Placed	" "	21,500		
20	Grouted Riprap	" "	260		
21	Tile Drains				
	a. 12" V.C. Pipe	lin.ft.	1,700		
	b. 15" V.C. Pipe	" "	900		
	c. 18" V.C. Pipe	" "	800		
22	Cast Iron Pipe				
	a. 16-Inch	" "	70		
	b. 18-Inch	" "	170		
23	Cement	bbl.	30,000		
24	Class "A" Concrete	cu.yd.	21,900		
25	Steel Reinforcement	lb.	2,563,000		
26	Stone Masonry	cu.yd.	10		
27	Gate House for Masseek Street Sewer	job	-		

Item No.	Designation	Unit	Quantity	Unit Price	Amount
28	Flap Valves				
	a. 4-Inch	each	1		
	b. 6-Inch	"	3		
	c. 8-Inch	"	3		
29	Gate and Check Valves				
	a. 4-Inch Gate Valve	each	1		
	b. 6-Inch Gate Valve	"	2		
	c. 8-Inch Gate Valve	"	1		
	d. 8-Inch Check Valve	"	1		
30	Miscellaneous Iron and Steel	lb.	13,500		
31	Copper Water Stops	"	5,700		
32	Pipe Hand Railing	lin.ft.	64		
33	Sluice Gates, Complete with Hoists	job	-		
34	Timber Stop-Logs	M.F.B.M.	3		
35	Topsoil	cu.yd.	23,000		
36	Sodding and Seeding	acre	19		
37	Surfacing for Top of Dike	cu.yd.	1,500		
38	Bituminous Surface Treatment	sq.yd.	2,000		
39	Concrete Cribbing	cu.ft.	2,300		
40	Backwater Gate, Complete with Hoist	job	-		
41	Foundation Drain Wells	lin.ft.	8,400		
42	Reconstruction of Existing Access Walkway	job	-		
	TOTAL.....				

NOTE:- All amounts and total given above 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 ON THE WORK

(See Invitation for Bids and Paragraph 1-09 of the specifications.)

Note:- Use separate lines 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 the contract shall not be construed as a guaranty by the Government that the equipment listed on the sheet is approved.

DATA SHEET

SLUICE GATES

1. Gates:

Manufacturer _____

2. Hoists:

a. Manufacturer's name _____

b. Model or type _____

c. Hoisting speed _____

3. Electric Motors:

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 performance and payment 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 455 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.