

FINAL DESIGN SPECIFICATIONS

R.W.C.D FLOODWAY  
REACH ONE  
WILLIAMS-CHANDLER W.P.P., ARIZONA

AUGUST 1979

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BID SCHEDULE NO. 1  
 WILLIAMS-CHANDLER WPP, ARIZONA  
 RWCD FLOODWAY - Reach 1

Property of  
 Flood Control District of MC Library  
 Please Return to  
 2801 W. Durango  
 Phoenix, AZ 85009

Item	Work or Material	Spec. No.	Quantity	Unit	Unit Price	Amount
1.	Clearing and Grubbing	2	157	Acres	\$ _____	\$ _____
2.	Mobilization	8	1	L.S.	\$ _____	\$ _____
3.	Channel Excavation, Common	21	1,720,070	C.Y.	\$ _____	\$ _____
4.	Trench Excavation, Common	21	870	C.Y.	\$ _____	\$ _____
5.	Structure Excavation, Common	21	260	C.Y.	\$ _____	\$ _____
6.	Structure Backfill	23	115	C.Y.	\$ _____	\$ _____
7.	Earth Fill	23	438,050	C.Y.	\$ _____	\$ _____
8.	Pipe Backfill	23	655	C.Y.	\$ _____	\$ _____
9.	Reinforced Concrete, Class 4000X	31	13	C.Y.	\$ _____	\$ _____
10.	Cement	31	21	Bb1s.	\$ _____	\$ _____
11.	Steel Reinforcement	34	1,240	Lbs.	\$ _____	\$ _____
12.	48-Inch Diameter Reinforced Concrete Pipe, Class III	42	322	L.F.	\$ _____	\$ _____
13.	6-Inch Diameter Drain System	44	1	L.S.	\$ _____	\$ _____
14.	18-Inch Diameter Corrugated Metal Pipe	51	252	L.F.	\$ _____	\$ _____
15.	Special Fittings	51	1	L.S.	\$ _____	\$ _____
16.	Loose Rock Riprap (Type I)	61	42,720	C.Y.	\$ _____	\$ _____
17.	Loose Rock Riprap (Type II)	61	4,050	C.Y.	\$ _____	\$ _____
18.	Identification Sign	81	1	L.S.	\$ _____	\$ _____
19.	Metal Work	81	1	L.S.	\$ _____	\$ _____
20.	Grouted Rock Riprap	200	1,590	C.Y.	\$ _____	\$ _____
21.	Seed Mix No. One	400	108	Acres	\$ _____	\$ _____
22.	Seed Mix No. Two	400	430	Acres	\$ _____	\$ _____

BID SCHEDULE NO. 2  
 WILLIAMS-CHANDLER WPP, ARIZONA  
 DIP CROSSINGS

<u>Item No.</u>	<u>Work or Material</u>	<u>Spec. No.</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Amount</u>
1.	Channel Excavation, Common	21	1400	C.Y.	\$ _____	\$ _____
2.	Structure Excavation, Common	21	550	C.Y.	\$ _____	\$ _____
3.	Structure Backfill	23	434	C.Y.	\$ _____	\$ _____
4.	Reinforced Concrete, Class 4000X	31	116	C.Y.	\$ _____	\$ _____
5.	Cement	31	188	Bbls.	\$ _____	\$ _____
6.	Steel Reinforcement	34	14,694	Lbs.	\$ _____	\$ _____
7.	Loose Rock Riprap	61	1,016	C.Y.	\$ _____	\$ _____
8.	Asphalt Concrete Pavement	401	1,720	S.Y.	\$ _____	\$ _____
Total					\$ _____	\$ _____

## CONSTRUCTION SPECIFICATION

### 2. CLEARING AND GRUBBING

#### 1. SCOPE

The work shall consist of the clearing and grubbing of designated areas by removal and disposal of trees, snags, logs, stumps, shrubs and rubbish.

#### 2. MARKING

The limits of the areas to be cleared and grubbed will be marked by means of stakes, flags, tree markings or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunks at a height of about six feet above the ground surface.

#### 3. REMOVAL

All trees not marked for preservation and all snags, logs, brush, stumps, shrubs and rubbish shall be removed from within the limits of the marked areas. Unless otherwise specified, all stumps, roots and root clusters having a diameter of one inch or larger shall be grubbed out to a depth of at least two feet below subgrade elevation for concrete structures and one foot below the ground surface at embankment sites and other designated areas.

#### 4. DISPOSAL

Unless otherwise specified, all materials removed from the cleared and grubbed areas shall be burned or buried at locations approved by the Engineer or otherwise disposed of as approved by the Engineer.

#### 5. MEASUREMENT AND PAYMENT

(Method 1) For items of work for which specific unit prices are established in the contract, the cleared and grubbed area will be measured to the nearest 0.1 acre. Payment for clearing and grubbing will be made for the total area within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools and all other items necessary and incidental to the completion of the work.

(Method 2) For items of work for which specific unit prices are established in the contract, the length of the cleared and grubbed area will be measured to the nearest full station (100 feet) along the line designated on the drawings or in the specifications. Payment for clearing and grubbing will be made for the total length within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to completion of the work.

(Method 3) For items of work for which specific unit prices are established in the contract, each tree, stump and snag having a diameter of 4 inches or greater and each log having a diameter of 4 inches or greater and a length of 10 feet or greater will be measured prior to removal. The size of each tree and snag will be determined by measuring its trunk at breast height above the natural ground surface. The size of each log will be determined by measuring the butt and by measuring its length from butt to tip. The size of each stump will be measured at the top. Diameter shall be determined by dividing the measured circumference by 3.14.

Payment for clearing and disposal of each tree, stump and snag having a diameter of 4 inches or greater and each log having a diameter of 4 inches or greater and a length of 10 feet or greater will be made at the contract unit price for its size designation as determined by the following schedule:

<u>Measured Diameter</u>	<u>Size Designation</u>
.4 inches to 8 inches	6-inch size
Over 8 inches to 12 inches	10-inch size
Over 12 inches to 24 inches	18-inch size
Over 24 inches to 36 inches	30-inch size
Over 36 inches to 60 inches	48-inch size
Over 60 inches	60-inch size

The sum of such payments shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental to the work of completely clearing and grubbing the designated areas, including clearing, grubbing and disposal of smaller trees, stumps, snags and logs and brush, shrubs, roots and rubbish.

(Method 4) For items of work for which specific lump sum prices are established in the contract, payment for clearing and grubbing will be made at the contract lump sum price. Such payment shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental to completion of the work.

(Use with all Methods) Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 6 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 1, Clearing and Grubbing

- (1) This item shall consist of clearing and grubbing of all areas as shown on the drawings and staked in the field.
- (2) If waste materials are disposed of by burying, they shall be buried a minimum of 18 inches below the existing ground surface. After disposal, the waste areas shall be smoothed and graded to blend into the surrounding terrain.
- (3) If materials removed from the cleared and grubbed area are to be burned, burning must be carried out in accordance with Pinal County Health Department regulations.
- (4) Measurement and payment will be by Method 1.

## CONSTRUCTION SPECIFICATION

### 8. MOBILIZATION

#### 1. SCOPE

The work shall consist of the mobilization of the Contractor's forces and equipment necessary for performing the work required under the contract.

It shall include the purchase of contract bonds; transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary facilities at the site; and other preparatory work at the site.

It shall not include mobilization for any specific item of work for which payment for mobilization is provided elsewhere in the contract.

The specification covers mobilization for work required by the contract at the time of award. If additional mobilization costs are incurred during performance of the contract as a result of change or added items of work for which the Contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the items of work changed or added.

#### 2. PAYMENT

Payment will be made as the work proceeds, after presentation of invoices by the Contractor showing his own mobilization costs and evidence of the charges of suppliers, subcontractors, and others for mobilization work performed by them. If the total of such payments is less than the contract lump sum for mobilization, the unpaid balance will be included in the final contract payment. Total payment will be the lump sum contract price for mobilization, regardless of actual cost to the Contractor.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

Payment of the lump sum contract price for mobilization will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 3 of this specification.

3. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 2, Mobilization

- (1) This item shall consist of the mobilization of the contractor's equipment and forces for the Floodway, and Lateral 9-49.
- (2) There are no additional construction details.
- (3) Measurement and payment will be in accordance with Section 2.

## CONSTRUCTION SPECIFICATION

### 11. REMOVAL OF WATER

#### 1. SCOPE

The work shall consist of the removal of surface water and ground water as needed to perform the required construction in accordance with the specifications. It shall include (1) building and maintaining all necessary temporary impounding works, channels, and diversions, (2) furnishing, installing and operating all necessary pumps, piping and other facilities and equipment, and (3) removing all such temporary works and equipment after they have served their purposes.

#### 2. DIVERTING SURFACE WATER

The Contractor shall build, maintain, and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, a diversion must discharge into the same natural drainageway in which its headworks are located.

Unless otherwise specified, the Contractor shall furnish to the Engineer, in writing, his plan for diverting surface water before beginning the construction work for which the diversion is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

#### 3. DEWATERING THE CONSTRUCTION SITE

Foundations, cutoff trenches and other parts of the construction site shall be dewatered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all drains, sumps, pumps, casings, wellpoints, and other equipment needed to perform the dewatering as specified. Dewatering methods that cause a loss of fines from foundation areas will not be permitted.

Unless otherwise specified, the Contractor shall furnish to the Engineer, in writing, his plan for dewatering before beginning the construction work for which the dewatering is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

4. DEWATERING BORROW AREAS

Unless otherwise specified in Section 7, the Contractor shall maintain the borrow areas in drainable condition or otherwise provide for timely and effective removal of surface waters that accumulate, for any reason, within the borrow areas.

5. REMOVAL OF TEMPORARY WORKS

After the temporary works have served their purposes, the Contractor shall remove them or level and grade them to the extent required to present a slightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

Except as otherwise specified, pipes and casings shall be removed from temporary wells and the wells shall be filled to ground level with gravel or other material approved by the Engineer.

6. MEASUREMENT AND PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for diverting surface water, dewatering construction sites, and dewatering borrow areas will be made at the contract lump sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Removal of Water

- (1) This item shall consist of the removal of surface and ground water from the construction area as shown on the drawings.
- (2) No advance plan of dewatering will be required.
- (3) No separate payment will be made for the removal of water. Compensation for this work will be included in the payment for Bid Items 3,4,5,6,7 and 8 as appropriate.

## CONSTRUCTION SPECIFICATION

### 21. EXCAVATION

#### 1. SCOPE

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

#### 2. CLASSIFICATION

Excavation will be classified as common excavation or rock excavation in accordance with the following definitions or will be designated as unclassified.

Common excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrappers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline or clam shell) appropriate to the character of the materials and the site conditions.

Rock excavation shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.

Excavation will be classified according to the above definitions by the Engineer, based on his judgment of the character of the materials and the site conditions.

The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material.

For the purpose of this classification, the following definitions shall apply:

Heavy ripping equipment shall be defined as a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of 200-300 net horsepower (at the flywheel).

Wheel tractor-scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of 12-20 yards.

Pusher tractor shall be defined as a track type tractor having a power rating of 200-300 net horsepower (at the flywheel) equipped with appropriate attachments.

3. UNCLASSIFIED EXCAVATION

Items designated as "Unclassified Excavation" shall include all materials encountered regardless of their nature or the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in Section 2 of this specification shall apply.

4. BLASTING

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operations.

Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation and shall conform to any special requirements in Section 12 of this specification.

5. USE OF EXCAVATED MATERIALS

(Method 1) To the extent they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earth fill or rock fill. The suitability of materials for specific purposes will be determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

(Method 2) Suitable materials from the specified excavations may be used in the construction of required earth fill or rock fill. The suitability of materials for specific purposes will be determined by the Engineer.

6. DISPOSAL OF WASTE MATERIALS

(Method 1) All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at the locations shown on the drawings.

(Method 2) All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of by the Contractor at sites of his own choosing away from the site of the work.

7. BRACING AND SHORING

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The Contractor shall furnish, place and subsequently remove such supporting installations.

8. STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete or earth fill is placed or any piles are driven within the limits of the excavation.

9. BORROW EXCAVATION

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as directed by the Engineer.

Borrow pits shall be excavated and finally dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.

10. OVEREXCAVATION

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the Engineer. Concrete that will be exposed to the atmosphere when

construction is completed shall contain not less than 6 sacks of cement per cubic yard of concrete. Concrete that will be permanently covered shall contain not less than 4½ sacks of cement per cubic yard. The concrete shall be placed and cured as specified by the Engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved compacted earth fill, except that, if the earth is to become the subgrade for riprap, rock fill, sand or gravel bedding, or drain fill, the voids may be filled with material conforming to the specifications for the riprap, rock fill, bedding or drain fill.

11. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Regardless of quantities excavated, the measurement for payment will be made to the specified pay limits, except that excavation outside the specified lines and grades directed by the Engineer to remove unsuitable material will be included, but only to the extent that the unsuitable condition is not a result of the Contractor's operations.

(Method 1) The pay limits shall be as designated on the drawings.

(Method 2) The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be modified ground surface resulting from the specified previous excavation or fill.
- b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

(Method 3) The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated

for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.

- b. The lower and lateral limits shall be the true surface of the completed excavation as authorized by the Engineer.

(Method 4) The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.
- b. The lower limit shall be at the bottom surface of the proposed structure.
- c. The lateral limits shall be 18 inches outside of the outside surfaces of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d, below.
- d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the under side of the proposed lining or structure.
- e. For the purpose of the definitions in b, c, and d, above, any specified bedding or drain fill directly beneath or beside the structure will be considered to be a part of the structure.

(Use with all Methods) Payment for each type and class of excavation will be made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work, except that extra payment for backfilling required overexcavation will be made in accordance with the following provisions:

- a. Payment for backfilling overexcavation, as specified in Section 10 of this specification, will be made only if the excavation outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's operations.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 12 of this specification.

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12. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 3, Channel Excavation, Common

(1) This item shall consist of all excavation required to construct:

(a) The floodway between Stations 1215+60± and 1456+40± centerline floodway as shown on the drawings.

(b) The maintenance Ramps at Station 1228+60±, Station 1262+60±, Sta. 1288+60±, Sta. 1346+60±, Sta. 1372+60±, and Sta.1397+60±.

(2) In Section 5, Use of Excavated Material , Method 1 shall apply. Suitable materials resulting from this excavation and not required for Bid Item 6, Structure Backfill, Bid Item 7, Earth Fill and Bid Item 8, Pipe Backfill will be used to construct Lateral 9-49.

(3) In Section 6, Disposal of Waste Material, Method 1 shall apply.

(4) Measurement and payment will be by Method 1.

b. Bid Item 4, Trench Excavation, Common

(1) This item shall consist of all excavation between Station 1+12.50 and Station 4+33± required to construct the trench for the 48-inch diameter reinforced concrete pipe siphon to the lines and grades shown on the drawings.

(2) In Section 5, Use of Excavated Materials, Method 1 shall apply.

(3) In Section 6, Disposal of Waste Materials, Method 1 shall apply.

12. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 1, Channel Excavation, Common

- (1) This item shall consist of all excavation required to construct the Dip Crossings between Station 1314+97<sub>+</sub> and Station 1315+46<sub>+</sub>, and between Station 1430+66<sub>+</sub> and 1431+15<sub>+</sub>, Centerline Floodway, as shown on the drawings and staked in the field.
- (2) In Section 5, Use of Excavated Materials, Method 1 shall apply.
- (3) In Section 6, Disposal of Waste Materials, Method 1 shall apply.
- (4) Measurement and payment will be by Method 2.

b. Bid Item 2, Structure Excavation, Common

- (1) This item shall consist of all excavation outside the limits of the channel excavation, common, required to construct the Dip Crossings as shown on the drawings and staked in the field.
- (2) In Section 5, Use of Excavated Materials, Method 1 shall apply.
- (3) In Section 6, Disposal of Waste Materials, Method 1 shall apply.
- (4) Measurement and payment will be by Method 2.

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Williams-Chandler WPP, Arizona

6/79

RWCD Floodway - Reach 1

Dip Crossings

(4) Measurement and payment will be by Method 2.

c. Bid Item 5, Structure Excavation, Common

(1) This item shall consist of all excavation required for the installation of the following structures as shown on the drawings.

(a) Pipe Inlets

(b) Inlet and outlet to the 48-inch diameter reinforced concrete pipe siphon.

(2) In Section 5, Use of Excavated Material, Method 1 shall apply.

(3) In Section 6, Disposal of Waste Materials, Method 1 shall apply.

(4) Measurement and payment will be by Method 2.

## CONSTRUCTION SPECIFICATION

### 23. EARTH FILL

#### 1. SCOPE

The work shall consist of the construction of earth embankments and other earth fills required by the drawings and specifications.

#### 2. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing and disposition of materials in the various fills shall be subject to approval by the Engineer.

Fill materials shall contain no sod, brush, roots or other perishable materials. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The types of materials used in the various fills shall be as listed and described in the specifications and drawings.

#### 3. FOUNDATION PREPARATION

Foundations for earth fill shall be stripped to remove vegetation and other unsuitable materials or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earth fill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earth fill as specified for subsequent layers of earth fill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches in depth normal to the slope and shall be at such a moisture content that the earth fill can be compacted against them to effect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose materials by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earth fill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be not steeper than 1 horizontal to 1 vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earth fill conforming to the specifications for the earth fill to be placed upon the foundation.

4. PLACEMENT

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the Engineer. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of fill compacted by manually directed power tampers.

Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earth fill in dams, levees and other structures designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

- a. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks or layers of material differing substantially in texture or gradation from the surrounding material.

- b. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.
- c. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of not less than 2 percent shall be maintained to insure effective drainage, and except as otherwise specified for drain fill zones. If the drawings or specifications require or the Engineer directs that fill be placed at a higher level in one part of an embankment than another, the top surface of each part shall be maintained as specified above.
- d. Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of stream flow during construction are specifically authorized in the contract.
- e. Embankments built at different levels as described under c or d above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all loose material, and shall be scarified, moistened and recompacted when the new fill is placed against it as needed to insure a good bond with the new fill and to obtain the specified moisture content and density in the junction of the in place and new fill.

5. CONTROL OF MOISTURE CONTENT

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary. Uniform moisture distribution shall be obtained by discing, blading or other approved methods prior to compaction of the layer.

Material that is too wet when deposited on the fill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted fill or a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall be scarified and moistened by sprinkling to an acceptable moisture content prior to placement of the next layer of fill.

6. COMPACTION

Earth fill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified.

Class B compaction. Each layer of fill shall be compacted to a mass density not less than the minimum density specified.

Class C compaction. Each layer of fill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified, or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping if permitted by the Contracting Officer, or manually directed power tampers or plate vibrators. Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist will not be permitted.

The passage of heavy equipment will not be allowed: (1) over cast-in-place conduits prior to 14 days after placement of the concrete; (2) over cradled precast conduits prior to 7 days after placement of the concrete cradle; or (3) over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 2 feet, whichever is greater.

Compacting of fill adjacent to structures shall not be started until the concrete has attained the strength specified in Section 10 for this purpose. The strength will be determined by compression testing of test cylinders cast by the Engineer for this purpose and cured at the work site in the manner specified in ASTM Method C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of fill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

<u>Structure</u>	<u>Time Interval</u>
Retaining walls and counterforts	14 days
Walls backfilled on both sides simultaneously	7 days
Conduits and spillway risers, cast-in-place (with inside forms in place)	7 days
Conduits and spillway risers, cast-in-place (inside forms removed)	14 days
Conduits, precast, cradled	2 days
Conduits, precast, bedded	1 day
Antiseep collars and cantilever outlet bents	3 days

7. REMOVAL AND PLACEMENT OF DEFECTIVE FILL

Fill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

8. TESTING

During the course of the work, the Engineer will perform such tests as are required to identify materials, to determine compaction characteristics, to determine moisture content, and to determine density of fill in place. These tests performed by the Engineer will be used to verify that the fills conform to the requirements of the specifications. Such tests are not intended to provide the Contractor with the information required by him for the proper execution of the work and their performance shall not relieve the Contractor of the necessity to perform tests for that purpose.

Densities of fill requiring Class A compaction will be determined by the Engineer in accordance with ASTM Method D 1556 (or by equivalent methods), except that the volume and moist weight of included rock particles larger than those used in the compaction test method specified for the type of fill will be determined and deducted from the volume and moist weight of the total sample prior to computation of density. The density so computed will be used to determine the percent compaction of the fill matrix.

9. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earth fill within the specified zone boundaries and pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified, no deduction in volume will be made for embedded conduits and appurtenances.

The pay limits shall be as defined below, with the further provision that earth fill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only where such overexcavation is directed by the Engineer to remove unsuitable material and where the unsuitable condition is not a result of the Contractor's operations.

(Method 1) The pay limits shall be as designated on the drawings.

(Method 2) The pay limits shall be the measured surface of the foundation when approved for placement of the fill and the specified neat lines of the fill surface.

(Method 3) The pay limits shall be the measured surface of the foundation when approved for placement of the fill and the measured surface of the completed fill.

(Method 4) The pay limits shall be the specified pay limits for excavation and the specified neat lines of the fill surface.

(Method 5) The pay limits shall be the specified pay limits for excavation and the measured surface of the completed fill.

(Use method 6 or 7 with all method 1 through 5)

(Method 6) Payment for each type and compaction class of earth fill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

(Method 7) Payment for each type and compaction class of earth fill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work, except furnishing, transporting, and applying water to the foundation and fill materials.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 6, Structure Backfill

- (1) This item shall consist of placing and compacting backfill around the following structures as shown on the drawings.
  - (a) Pipe Inlets
  - (b) Inlet and outlet to the 48-inch diameter reinforced concrete siphon.
- (2) Backfill material shall consist of suitable silty sand, silts and clays obtained from the required excavations.
- (3) In Section 6, Compaction, Class A shall apply. The fill matrix shall be compacted to at least 95 percent of the fill materials performed by Method A, ASTM D 698 (Standard Proctor Test).
- (4) The maximum size of rock fragments incorporated in the fill shall be three (3) inches.
- (5) The maximum thickness of a layer before compaction shall be six (6) inches.
- (6) The moisture content of the material incorporated in the fill shall be maintained within the range of three (3) percentage points below to one (1) percentage point above the optimum moisture content.
- (7) Measurement and payment will be by Methods 1 and 6. Deduction in volume will be made for embedded conduit and appurtenances.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 3, Structure Backfill

- (1) This item shall consist of placing and compacting backfill around the concrete cutoff walls for the dip crossings, as shown on the drawings.
- (2) Backfill material shall consist of suitable silty sand, silts and clays obtained from the required excavations.
- (3) In Section 6, Compaction, Class A shall apply. The fill matrix shall be compacted to at least 95 percent of the maximum density obtained in compaction tests of the fill materials performed by Method A, ASTM D 698 (Standard Proctor Test).
- (4) The maximum size of rock fragments incorporated in the fill shall be three (3) inches.
- (5) The maximum thickness of a layer before compaction shall be six (6) inches.
- (6) The moisture content of the material incorporated in the fill shall be maintained within the range of three (3) percentage points below to one (1) percentage point above the optimum moisture content.
- (7) Measurement and payment will be by Methods 1 and 6.

b. Bid Item 7, Earth Fill

- (1) This item shall consist of placing and compacting all earth fill required to construct the floodway between Stations 1215+60± and 1456+40± as shown on the drawings.
- (2) Fill material shall consist of suitable CL's, ML's and SC's obtained from the required excavation located as follows:

From Station 1222+50± to Station 1232+50± lying generally between 0.5 foot and 8.0 feet below the existing ground line.

From Station 1232+50± to Station 1247+50± lying generally between 1.0 foot and 6.5 feet below the existing ground line.

From Station 1247+50± to Station 1255+00± lying generally between 0.5 foot and 6.5 feet below the existing ground line.

From Station 1262+50± to Station 1272+50± lying generally between 2.0 feet and 4.5 feet below the existing ground line.

From Station 1272+50± to Station 1290+00± lying generally between 3.0 feet and 6.0 feet below the existing ground line.

From Station 1290+00± to Station 1350+00± lying generally between 0.5 foot and 5.0 feet below the existing ground line.

From Station 1355+00± to Station 1400+00± lying generally between 0.5 foot and 5.5 feet below the existing ground line.

From Station 1400+00± to Station 1415+00± lying generally between 2.0 feet and 4.5 feet below the existing ground line.

From Station 1415+00± to Station 1427+50± lying generally between 4.0 feet and 5.0 feet below the existing ground line.

From Station 1435+00± to Station 1440+00± lying generally between 3.0 feet and 5.0 feet below the existing ground line ~~and obtained from the required excavations~~ <sup>as</sup> and approved by the Engineer. The material shall contain a minimum of 15 percent passing the #200 sieve when determined on a dry weight basis in accordance with ASTM D 1140.

- (3) In Section 6, Compaction, Class A shall apply. The fill matrix shall be compacted to at least 95 percent of the maximum density obtained in compaction tests of the fill materials performed by Method A, ASTM D 698 (Standard Proctor Test).
- (4) The maximum size of rock fragments incorporated in the fill shall be six (6) inches.
- (5) The maximum thickness of a layer before compaction shall be nine (9) inches.
- (6) The moisture content of the material incorporated in the fill shall be maintained within the range of three (3) percentage points below to one (1) percentage point above the optimum moisture content.
- (7) Measurement and payment will be by Methods 1 and 6.

c. Bid Item 8, Pipe Backfill

- (1) This item shall consist of placing and compacting all pipe backfill between Station 1+12.50 and Station 4+33± of the

48-inch diameter reinforced concrete pipe siphon  
as shown on the drawings.

- (2) Backfill material shall be suitable CL's, ML's, and SC's obtained from the required excavations.
- (3) In Section 6, Compaction, Class A shall apply. The fill matrix shall be compacted to at least 95 percent of the maximum density obtained in compaction tests of the fill materials performed by Method A, ASTM D 698 (Standard Proctor Test).
- (4) The maximum size of rock fragments incorporated in the fill shall be three (3) inches.
- (5) The maximum thickness of a layer before compaction shall be six (6) inches.
- (6) The moisture content of the material incorporated in the fill shall be maintained within the range of three (3) percentage points below to one (1) percentage points above the optimum moisture content.
- (7) Measurement and payment will be by Methods 1 and 6.

Deduction in volume will be made for the embedded conduit.

d. Subsidiary Item, Waste Fill

- (1) This shall consist of placing and smoothing all waste fill placed in the spoil disposal areas.
- (2) Waste fill material shall consist of all material resulting from the required excavations not needed to construct the floodway and lateral 9-49.
- (3) Section 6, Compaction, does not apply to this item.

(4) The maximum thickness of each layer before smoothing the surface shall not exceed two (2) feet.

(5) The finished surface shall not vary more than one-half (0.5) foot, plus or minus, from the average grade.

(6) Fill slopes resulting from the deposition of waste fill shall not be steeper than 4:1.

(7) No special moisture content of waste fill material will be required.

(8) No separate payment will be made for waste fill.

Compensation for this work will be included in the payment for Bid Items 3, Channel Excavation, Common.

## CONSTRUCTION SPECIFICATION

### 31. CONCRETE

#### 1. SCOPE

The work shall consist of furnishing, forming, placing, finishing and curing portland cement concrete as required to build the structures named in Section 26 of this specification.

#### 2. MATERIALS

Portland cement shall conform to the requirements of Material Specification 531 for the specified type. One brand only of any type of cement shall be used in any single structure as defined in Section 26.

Aggregates shall conform to the requirements of Material Specification 522 unless otherwise specified. The grading of coarse aggregates shall be as specified in Section 26.

Water used in mixing or curing concrete shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Air-entraining admixtures shall conform to the requirements of Material Specification 532. If air-entraining cement is used, any additional air-entraining admixture shall be of the same type as that in the cement.

Water-reducing, set-retarding admixtures shall conform to the requirements of Material Specification 533.

Shear plates shall conform to the requirements of Material Specification 581 for structural quality or commercial or merchant quality steel. Structural quality shall be used if specifically designated in the drawings or specifications.

Preformed expansion joint filler shall conform to the requirements of Material Specification 535.

Waterstops shall conform to the requirements of Material Specifications 537 and 538 for the specified kinds.

Curing compound shall conform to the requirements of Material Specification 534.

3. CLASSES OF CONCRETE

(Method 1)

Concrete shall be classified according to the required compressive strength. The strength of the concrete at 28 days shall equal or exceed the Minimum Compressive Strength tabulated below for the class of concrete specified.

<u>Class of Concrete</u>	<u>Minimum Compressive Strength at 28 days (psi)</u>
5000	5000
4000	4000
3000	3000
2500	2500

(Method 2)

Concrete shall be classified as follows:

<u>Class of Concrete</u>	<u>Maximum Net Water Content (gallons/bag)</u>	<u>Minimum Cement Content (bags/cu. yd.)</u>
5000X	5	7
4000X	6	6
3000X	7	5
2500X	8	4 1/2

4. AIR CONTENT AND CONSISTENCY

Unless otherwise specified the air content (by volume) of the concrete at the time of placement shall be:

<u>Maximum Size Agregate</u>	<u>Air Content (%)</u>
3/8 inch to 1/2 inch	6 to 9
Over 1/2 inch to 1 inch	5 to 8
Over 1 inch to 2 1/2 inches	4 to 7

The consistency of the concrete shall be such as to allow it to be worked into place without segregation or excessive laitance. Unless otherwise specified, the slump shall be:

<u>Type of Structure</u>	<u>Slump (inches)</u>
Massive sections, pavements, footings	2 ± 1/2
Heavy beams, thick slabs, thick walls (over 12 in.)	3 ± 1/2
Columns, light beams, thin slabs, thin walls (12 in. or less)	4 ± 1

5. DESIGN OF THE CONCRETE MIX

(Method 1) (For use with Method 1 in Section 3.)

The Contractor shall be responsible for the design of the concrete mixtures. At least 5 days prior to any placement of concrete he shall furnish the Contracting Officer a statement of the materials and mix proportions (including admixtures, if any) he intends to use for each specified class of concrete. The statement shall include evidence satisfactory to the Engineer that the materials and proportions selected will produce concrete of the quality, consistency and strength specified.

The materials and proportions so stated shall constitute the "job mix." After a job mix has been designated, neither the source, character or grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to the Engineer and establishment of a new job mix supported by evidence, as required for the initial job mix, that the proposed new materials and mix proportions will produce concrete of the quality, consistency, and strength specified.

When specified, a water-reducing, set-retarding admixture shall be used. When conditions are such that the temperature of the concrete at the time of placement is consistently above 75°F, a water-reducing, set-retarding admixture may be used, at the option of the Contractor. The cement content shall be same as that required in the mix without the admixture.

The use of calcium chloride or other accelerators or antifreeze compounds will not be allowed.

Before placing concrete containing a water-reducing, set-retarding admixture, the Contractor shall furnish test results to the Engineer showing that its performance in the job mix meets the requirements of Material Specification 533, Section 4.

(Method 2) (For use with Method 2 in Section 3.)

At least 35 days prior to any placement of concrete the Contractor shall inform the Contracting Officer in writing of the source and grading of aggregates and the brand and type of cement and the brand and type of admixture, if any, he proposes to use for each class of concrete, and shall furnish certifications or other

evidence satisfactory to the Engineer that the proposed materials meet the requirements of the specifications.

When acceptable sources, types and gradings of aggregates are designated in the contract, certifications for such aggregates will not be required.

Job mix proportions and batch weights will be determined by the Engineer. During the course of the work, the Engineer will adjust the job mix proportions and batch weights whenever necessary.

After the job mix has been designated, neither the source, character or grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to the Engineer.

If such changes are necessary, no concrete containing such new or altered materials shall be placed until the Engineer has designated a revised job mix.

When specified, a water reducing, set-retarding admixture shall be used. When conditions are such that the temperature of the concrete at the time of placement is consistently above 75°F, a water-reducing, set-retarding admixture may be used, at the option of the Contractor. The cement content shall be same as that required in the mix without the admixture.

The use of calcium chloride or other accelerators or antifreeze compounds will not be allowed.

When it is anticipated that a water-reducing, set-retarding admixture will be used, the Contractor shall furnish to the Engineer a sample of the admixture he proposes to use sufficient for the tests required by Material Specification 533, Section 4. Concrete containing the admixture shall not be placed until test results have been obtained showing that its performance in the job mix meets the requirements of Material Specification 533, Section 4.

6. INSPECTING AND TESTING

The following tests will be performed by the methods indicated:

<u>Test</u>	<u>Method</u> <u>(ASTM Designation)</u>
Sampling	C 172 <sup>1</sup>
Slump Test	C 143 <sup>1</sup>

<u>Test</u>	<u>Method (ASTM Designation)</u>
Air Content	C 231 <sup>1</sup> or C 173 <sup>1</sup>
Compression Test Specimens	C 31 <sup>1</sup> or C 42
Compressive Strength	C 39 <sup>2</sup> or C 42
Unit Weight	C 138

<sup>1</sup>Tests of a portion of a batch may be made on samples representative of that portion for any of the following purposes:

- (1) Determining uniformity of the batch.
- (2) Checking compliance with requirements for slump and air content when the batch is discharged over an extended period of time.
- (3) Checking compliance of the concrete with the specifications when the whole amount being placed in a small structure, or a distinct portion of a larger structure, is less than full batch.

<sup>2</sup>For each strength test of specimens made according to ASTM Designation C 31, 3 standard test specimens shall be made. The test result shall be the average of the strengths of the 3 specimens, except that if one specimen in the test shows manifest evidence of improper sampling, molding or testing, it shall be discarded and the strengths of the remaining 2 specimens shall be averaged. Should more than one specimen representing a test show such defects, the entire test shall be discarded.

The Engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the Engineer to inspect materials, equipment and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with the manufacture and delivery of the concrete.

#### 7. HANDLING AND MEASUREMENT OF MATERIALS

Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size will be avoided and that various sizes will not become intermixed before proportioning. Methods of handling and transporting aggregates shall be such as to avoid contamination, excessive breakage, segregation or degradation, or intermingling of various sizes.

Scales for weighing aggregates and cement shall be beam type or springless dial type. They shall be accurate within 1 percent under operating conditions. All exposed fulcrums, clevises and similar working parts of scales shall be kept clean.

The quantities of cement and aggregates in each batch of concrete, as indicated by the scales, shall be within the following percentages of the required batch weights:

Cement - plus or minus 1.0 percent

Aggregates - plus or minus 2.0 percent

Measuring tanks for mixing water shall be of adequate capacity to furnish the maximum amount of mixing water required per batch and shall be equipped with outside taps and valves to provide for checking their calibration unless other means are provided for readily and accurately determining the amount of water in the tank.

Except as otherwise provided in Section 8, cement and aggregates shall be measured as follows:

Cement shall be measured by weight or in bags of 94 lbs. each. When cement is measured by weight, it shall be weighed on a scale separate from that used for other materials, and in a hopper entirely free and independent of the hopper used for weighing the aggregates. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

Mixing water shall consist of water added to the batch, ice added to the batch, water occurring as surface moisture on the aggregates and water introduced in the form of admixtures. The added water shall be measured by weight or volume to an accuracy of 1 percent of the required total mixing water. Added ice shall be measured by weight. Wash water shall not be used as a portion of the mixing water for succeeding batches.

Dry admixtures shall be measured by weight, and paste or liquid admixtures by weight or volume, within a limit of accuracy of 3 percent.

#### 8. MIXERS AND MIXING

Concrete may be furnished by batch mixing at the site of the work or by ready-mix methods.

Mixers shall be capable of thoroughly mixing the concrete ingredients into a uniform mass within the specified mixing time and of discharging the mix without segregation. Each mixer or agitator shall bear a manufacturer's rating plate indicating the rated capacity and recommended speed of rotation, and shall be operated in accordance with these recommendations.

Concrete shall be uniform and thoroughly mixed when delivered to the work. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and shall be corrected by changing batching procedures, increasing mixing time, changing mixers or other means. Mixing time shall be within the limits specified below unless the Contractor demonstrates by mixer performance tests that adequate uniformity is obtained by different times of mixing. For this purpose the testing program and uniformity requirements shall be as set forth in ASTM Designation C 94.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery points.

Batch mixing at the site. For concrete mixed at the site of the work with paving mixers or stationary construction mixers, the time of mixing after all cement and aggregates are in the mixer drum shall be not less than 1-1/2 minutes.

The batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates and all mixing water shall be introduced into the drum before one-fourth of the mixing time has elapsed.

Controls shall be provided to insure that the batch cannot be discharged until the required mixing time has elapsed.

If truck mixers are used, the requirements below for truck mixers and truck-mixed concrete shall apply.

Volumetric batching and continuous mixing at the site. Unless otherwise specified, volumetric batching and continuous mixing at the construction site will be permitted if approved by the Contracting Officer. The batching and mixing equipment shall conform to the requirements of ASTM Specification C 685 and shall be demonstrated prior to placement of concrete, by tests with the job mix, to produce concrete meeting the specified proportioning and uniformity requirements. Concrete made by this method shall be produced, inspected, and certified in conformance with sections 6., 7., 8., 13., and 14. of ASTM Specification C 685.

Ready-mixed concrete. Ready-mixed concrete shall be mixed and delivered to the site of the work by one of the following methods:

- a. Truck-mixed concrete--Mixed completely in a truck mixer.
- b. Shrink-mixed concrete--Mixed partially in a stationary mixer, and the mixing completed in a truck mixer.
- c. Central-mixed concrete--Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in a truck agitator or in a truck mixer operating at agitating speed or in nonagitating equipment.

Truck mixers and agitators shall be equipped with revolution counters by which the number of revolutions of the drum or blades may be readily verified.

When ready-mixed concrete is furnished, the Contractor shall furnish the Engineer a statement-of-delivery ticket showing the time of loading, the revolution counter reading at the time of loading and quantities of materials used for each load of concrete.

Truck-mixed concrete. When concrete is mixed in a truck mixer loaded to its maximum capacity, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than 100. If the batch is at least 1/2 cubic yard less than maximum capacity, the number of revolutions at mixing speed may be reduced to not less than 50. Mixing in excess of 100 revolutions shall be at the speed designated by the manufacturer of the equipment as agitating speed. The mixing operation shall begin within 30 minutes after the cement has been added to the aggregates and the water shall be added to the aggregates and the water shall be added during mixing. When mixing is begun during or immediately after charging, a portion of the mixing water shall be added ahead of, or with, the other ingredients.

Shrink-mixed concrete. When concrete is partially mixed at a central plant and the mixing is completed in a truck mixer, the mixing time in the central plant mixer shall be the minimum required to intermingle the ingredients and shall be not less than 30 seconds. The mixing shall be completed in a truck mixer and the number of revolutions of the drum or blades at mixing speed shall be not less than 50 nor more than 100. Mixing in excess of 100 revolutions shall be at the speed designated by the manufacturer of the equipment as agitating speed.

Central-mixed concrete. For central-mixed concrete, mixing in the stationary mixer shall meet the same requirements as batching mixing at the site.

When an agitator, or truck mixer used as an agitator, transports concrete that has been completely mixed in a stationary mixer, mixing during transportation shall be at the speed designated by the manufacturer of the equipment as agitating speed.

The use of nonagitating equipment to transport concrete to the site of the work will be permitted only if the consistency and uniformity of the concrete as discharged at the point of delivery meet the requirements of this specification. Bodies of nonagitating hauling equipment shall be so constructed that leakage of the concrete mix, or any part thereof, will not occur. Concrete hauled in open-top vehicles shall be protected against access of rain, and against exposure to the sun of more than 20 minutes when the air temperature is above 75°F.

9. FORMS

Forms shall be of wood, plywood, steel or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags or other irregularities. Forms shall be coated with a nonstaining form oil before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed to view when the structure is completed shall be chamfered, unless finished with molding tools as specified in Section 20.

10. PREPARATION OF FORMS AND SUBGRADE

Prior to placement of concrete the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar or other harmful substances or coatings. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting or wire brush scrubbing, as necessary, and shall be wetted immediately prior to placement of concrete. Earth surfaces shall be firm and damp. Placement of concrete on mud, dried earth, uncompacted fill or frozen subgrade will not be permitted.

Unless otherwise specified, when concrete is to be placed over drain fill, the contact surface of the drain fill shall be covered with a layer of asphalt-impregnated building paper or polyvinyl sheeting prior to placement of the concrete. Forms for weepholes shall extend through this layer into the drain fill.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous materials.

11. CONVEYING

Concrete shall be delivered to the site and discharged into the forms within 1-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85°F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. The Engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the additional of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable, by methods that will prevent segregation of the aggregates or loss of mortar. Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation.

12. PLACING

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved.

The Contractor shall have all equipment and materials required for curing available at the site ready for use before placement of concrete begins.

No concrete shall be placed except in the presence of the Engineer. The Contractor shall give reasonable notice to the Engineer each time he intends to place concrete. Such notice shall be far enough in advance to give the Engineer adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with the specifications before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. The depositing of concrete shall be regulated so that the concrete may be consolidated with a minimum of lateral movement.

Internal stays and braces, serving temporarily to hold the forms in correct shape and alignment prior to placement of concrete at their locations, shall be removed when the concrete has been placed to an elevation such as to render their service unnecessary.

13. LAYERS

Unless otherwise specified, slab concrete shall be placed to design thickness in one continuous layer. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Hoppers and chutes, pipes or "elephant trunks" shall be used as necessary to prevent splashing of mortar on the forms and reinforcing steel above the layer being placed.

Successive layers shall be placed at a fast enough rate to prevent the formation of "cold joints." If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when vibrated, the Contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified in Section 15.

If placing is discontinued when an incomplete layer is in place, the unfinished end of the layer shall be formed by a vertical buldhead.

14. CONSOLIDATING

Unless otherwise specified, concrete shall be consolidated with internal type mechanical vibrators capable of transmitting vibration to the concrete at frequencies not less than 6000 impulses per minute.

The location, manner and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without causing segregation of the mortar and coarse aggregate, and without causing water or cement paste to flush to the surface.

The Contractor shall provide a sufficient number of vibrators to properly consolidate the concrete immediately after it is placed in the work. Vibration shall be applied to the freshly deposited concrete by slowly inserting and removing the vibrator at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibly effective. The vibrator shall extend into the previously placed layer of fresh concrete, at all points, to insure effective bond between layers.

Vibration shall not be applied directly to the reinforcement steel or the forms nor to concrete that has hardened to the degree that it does not become plastic when vibrated.

The use of virators to transport concrete in the forms on conveying equipment will not be permitted.

Vibration shall be supplemented by spading and hand tamping as necessary to insure smooth and dense concrete along form surfaces, in corners and around embedded items.

15. CONSTRUCTION JOINTS

Construction joints shall be made at the locations shown on the drawings. If construction joints are needed which are not shown on the drawings, they shall be placed in locations approved by the Engineer.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns as each lift is completed, the top surfaces shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

(Method 1)

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, stains or debris by either wet sandblasting after the concrete has gained sufficient strength to resist excessive cutting, or air-water cutting as soon as the concrete has hardened sufficiently to prevent the jet from displacing the coarse aggregates, or both. The surface of the concrete in place shall be cut to expose clean, sound aggregate but not so deep as to undercut the edges of larger particles of the aggregate. After cutting, the surface shall be thoroughly washed to remove all loose material. If the surface is congested by reinforcing steel, is relatively inaccessible, or it is considered undesirable to disturb the concrete before it is hardened, cleaning of the joint by air-water jets will not be permitted and the wet sandblasting method will be required after the concrete has hardened.

(Method 2)

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, stains, or debris by washing and scrubbing with a wire brush or wore broom or by other means approved by the Engineer.

(Use with Either Method)

The surfaces shall be kept moist for at least one hour prior to placement of new concrete. The new concrete shall be placed directly on the cleaned and washed surface.

16. EXPANSION AND CONTRACTION JOINTS

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

When open joints or weakened plane "dummy" joints are specified, the joints shall be constructed by the insertion and subsequent removal of a wood strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of the concrete at the joints shall be finished with an edging tool prior to removal of the joint strips.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

17. WATERSTOPS

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be brazed or welded. Joints in rubber or plastic waterstops shall be cemented, welded or vulcanized as recommended by the manufacturer.

18. REMOVAL OF FORMS

Forms shall be removed only when the Engineer is present and shall not be removed without his approval. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

(Method 1)

Forms shall not be removed sooner than the following minimum times after the concrete is placed. These periods represent cumulative number of days and fractions of days, not necessarily consecutive, during which the temperature of the air adjacent to the concrete is above 50°F.

<u>Element</u>	<u>Time</u>
Beams, arches - supporting forms and shoring	14 days
Conduits, deck slabs - supporting (inside) forms and shoring	7 days
Conduits (outside forms), sides of beams, small structures	24 hours

(31-13)

<u>Element</u>	<u>Time</u>
Columns, walls, spillway risers - with side or vertical load	7 days
Columns, walls, spillway risers - with no side or vertical load:	
Concrete supporting more than 30 feet of wall in place above it	7 days
Concrete supporting 20 to 30 feet of wall in place above it <sup>1</sup>	3 days
Concrete supporting not more than 20 feet of wall in place above it <sup>1</sup>	24 hours

<sup>1</sup>Age of stripped concrete shall be at least 7 days before any load is applied other than the weight of the column or wall itself and the forms and scaffolds for succeeding lifts.

(Method 2)

Forms, supports and housings shall not be removed until the concrete has attained the strength specified in Section 26 for this purpose. The strength will be determined by compression testing of test cylinders cast by the Engineer for this purpose and cured at the work site in the manner specified in ASTM Method C 31 for determining form removal time.

19. FINISHING FORMED SURFACES

All concrete surfaces shall be true and even, and shall be free from open or rough spaces, depressions or projections.

Immediately after the removal of forms:

All bulges, fins, form marks or other irregularities which in the judgement of the Engineer will adversely affect the appearance or function of the structure shall be removed. All form bolts and ties shall be removed to a depth at least 1 inch below the surface of the concrete. The cavities produced by form ties and all other holes of similar size and depth shall be thoroughly cleaned and, after the interior surfaces have been kept continuously wet for at least 3 hours, shall be carefully packed with a dry patching mortar (preshrunk) mixed not richer than 1 part cement to 3 parts sand.

Holes left by form bolts or straps which pass through the wall shall be filled solid with mortar.

Patching mortar shall be thoroughly compacted into place to form a dense, well-bonded unit, and the in-place mortar shall be sound and free from shrinkage cracks.

All patched areas shall be cured as specified in Section 21.

20. FINISHING UNFORMED SURFACES

All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished, unless specified otherwise.

Excessive floating or troweling while the concrete is soft will not be permitted.

The addition of dry cement or water to the surface of the screeded concrete to expedite finishing will not be allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

21. CURING

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding or fog spraying, or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Wood forms (except plywood) left in place during the curing period shall be kept wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Water for curing shall be clean and free from any substances that will cause discoloration of the concrete.

Except as otherwise specified in Section 24, and except for construction joint surfaces, concrete may be coated with curing compound in lieu of the continued application of moisture.

The compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs and finishing of that surface are completed.

The curing compound shall be thoroughly mixed immediately before applying, and shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface. It shall form a uniform, continuous, adherent film that shall not check, crack or peel, and shall be free from pin holes or other imperfections.

Curing compound shall not be applied to surfaces requiring bond with subsequently placed concrete, such as construction joints, shear plates, reinforcing steel and other embedded items.

Surfaces subjected to heavy rainfall or running water within 3 hours after the compound has been applied, or surfaces damaged by subsequent construction operations during the curing period shall be resprayed in the same manner as for the original application.

11. REMOVAL OR REPAIR

When concrete is honeycombed, damaged or otherwise defective, the Contractor shall remove and replace the structure or structural member containing the defective concrete, or correct or repair the defective parts. The Engineer will determine the required extent of removal, replacement or repair.

Prior to starting repair work the Contractor shall obtain the Engineer's approval of his plan for making the repair. Such approval shall not be considered a waiver of the Contracting Officer's right to require complete removal of defective work if the completed repair does not produce concrete of the required quality and appearance.

Repair work shall be performed only when the Engineer is present.

Repair of formed surfaces shall be started within 24 hours after removal of the forms.

Except as otherwise approved by the Engineer, the appropriate methods described in Chapter VII of the Concrete Manual, Bureau of Reclamation, U. S. Department of the Interior, shall be used. If approved in writing by the Contracting Officer, proprietary compounds for adhesion or as patching ingredients may be used. Such compounds shall be used in accordance with the manufacturer's recommendations.

Curing as specified in Section 21 shall be applied to repaired areas immediately after the repairs are completed.

23. CONCRETING IN COLD WEATHER

When the atmospheric temperature may be expected to drop below 40°F at the time concrete is delivered to the work site, during placement, or at any time during the curing period, the following provisions also shall apply:

1. The temperature of the concrete at time of placing shall not be less than 50°F nor more than 90°F. The temperature of neither aggregates nor mixing water shall be more than 100°F just prior to mixing with the cement.

- b. When the daily minimum temperature is less than 40°F, concrete structures shall be insulated or housed and heated after placement. The temperature of the concrete and air adjacent to the concrete shall be maintained at not less than 50°F nor more than 90°F for the duration of the curing period.
- c. Methods of insulating, housing and heating the structure shall conform to "Recommended Practice for Cold Weather Concreting," ACI Standard 306.
- d. When dry heat is used to protect concrete, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the concrete has been coated with curing compound as specified in Section 21 or is covered tightly with an approved impervious material.

24. CONCRETING IN HOT WEATHER

When climatic or other conditions are such that the temperature of the concrete may reasonably be expected to exceed 90°F at the time of delivery at the work site, during placement, or during the first 24 hours after placement, the following provisions also shall apply;

1. The Contractor shall maintain the temperature of the concrete below 90°F during mixing, conveying, and placing. Methods used shall conform to "Recommended Practice for Hot Weather Concreting," ACI Standard 305.
- b. The concrete shall be placed in the work immediately after mixing. Truck mixing shall be delayed until only time enough remains to accomplish it before the concrete is placed.
- c. Exposed concrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected from drying during the time between placement and finishing, and after finishing.
- d. Finishing of slabs and other exposed surfaces shall be started as soon as the condition of the concrete allows and shall be completed without delay.

- e. Concrete surfaces exposed to the air shall be covered as soon as the concrete has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period, and for the entire curing period unless curing compound is applied as specified in subsection g, below.
- f. Formed surfaces shall be kept completely and continuously wet for the duration of curing period (prior to, during and after form removal) or until curing compound is applied as specified in subsection g, below.
- g. If moist curing is discontinued before the end of the curing period, white pigmented curing compound shall be applied immediately, following the procedures specified in Section 21.

25. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, concrete will be measured to the neat lines or pay limits shown on the drawings, and the volume of concrete will be computed to the nearest 0.1 cubic yard. No deduction in volume will be made for chamfers, rounded or beveled edges, or for any void or embedded item that is less than five cubic feet in volume. Where concrete is placed against the sides or bottom of an excavation without intervening forms, drain fill, or bedding, the volume of concrete required to fill voids resulting from overexcavation outside the neat lines or pay limits will be included in the measurement for payment where such overexcavation is directed by the Engineer to remove unsuitable foundation material; but only to the extent that the unsuitable condition is not a result of the Contractor's operations.

(Method 1)

Payment for each item of concrete will be made at the contract unit price for that item. The payment for concrete will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, falsework, bracing and all other items necessary and incidental to completion of the concrete work, such as joint fillers, waterstops, dowels or dowel assemblies and shear plates, but not including reinforcing steel or other items listed for payment elsewhere in the contract.

Measurement and payment for furnishing and placing reinforcing steel will be made as specified in Construction Specification 34.

(Method 2)

Payment for each item of concrete will be made at the contract unit price for that item. The payment for concrete will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, falsework, bracing and all other items necessary and incidental to completion of the concrete work, such as joint fillers, waterstops, dowels or dowel assemblies, and shear plates, but not including furnishing and placing reinforcing steel or furnishing and handling cement or other items listed for payment elsewhere in the contract.

Measurement and payment for furnishing and placing reinforcing steel will be made as specified in Construction Specification 34.

Cement will be measured by dividing the volume of concrete accepted for payment by the yield of the applicable job mix. The yield will be determined by the procedure specified in ASTM Designation C 138. If the amount of cement actually used per batch exceeds the amount in the job mix specified by the Engineer, the measurement will be based on the latter. One barrel of cement will be considered equal to 4 bags or 376 pounds. Payment for each type of cement will be made at the contract unit price for furnishing and handling that type of cement and such payment will constitute full compensation for all materials, labor, equipment, storage, transportation and all other items necessary and incidental to furnishing and handling the cement.

(Use with Either Method)

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 26 of this specification.

26. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 9, Concrete, Class 4000X

- (1) This item shall consist of furnishing, forming and placing all concrete required to construct the inlet and outlet structures for the 48-inch diameter reinforced concrete pipe siphon.
- (2) In Section 3, Classes of concrete, and Section 5, Design of the Concrete Mix, Method 2 shall apply. Concrete shall be Class 4000X.
- (3) Coarse aggregate shall be size No. 67 in accordance with ASTM C 33.
- (4) In Section 15, Construction Joints, Method 1 shall apply.
- (5) In Section 18, Removal of Forms, Method 1 shall apply.
- (6) All exposed surfaces shall be finished in the following manner:

Upon patching and pointing all holes as directed in Section 19, the surface shall be promptly covered with polyethylene film, wet burlap or wet cotton mats. If polyethylene film is used, the film shall be held securely to the surface by means of weights, adhesive or other suitable means. Only white polyethylene film for covering will be acceptable. When the mortar used in patching and pointing has set sufficiently, the surface shall be uncovered and thoroughly rubbed with either a float or a carborundum stone until

26. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 4, Concrete, Class 4000X

- (1) This item shall consist of furnishing, forming and placing all concrete required to construct the Dip Crossings.
- (2) In Section 3, Classes of Concrete, and Section 5, Design of the Concrete Mix, Method 2 shall apply. Concrete shall be Class 4000X.
- (3) Coarse aggregate shall be size No. 67, in accordance with ASTM C 33.
- (4) In Section 15, Construction Joints, Method 1 shall apply.
- (5) In Section 18, Removal of Forms, Method 1 shall apply.
- (6) All exposed surfaces shall be finished in the following manner:  
Upon patching and painting all holes as directed in Section 19, the surface shall be promptly covered with polyethylene film, wet burlap or wet cotton mats. If polyethylene film is used, the film shall be held securely to the surface by means of weights, adhesive or other suitable means. Only white polyethylene film for covering will be acceptable.

When the mortar used in patching and pointing has set sufficiently, the surface shall be uncovered and thoroughly rubbed with either a float or a carborundum stone until the surface is covered with a lather. Cork, wood or rubber floats shall be used only on

(31-20)

Williams-Chandler WPP, Arizona

6/79

RWCD Floodway - Reach 1

Dip Crossings

the surface is covered with a lather. Cork, wood or rubber floats shall be used only on surfaces sufficiently green to work up such lather, otherwise a carborundum stone shall be used. During the rubbing process, a thin grout composed of one (1) part cement and one (1) part of fine sand may be used to facilitate producing a satisfactory lather; however, this grout shall not be used in quantities sufficient to cause a plaster coating to be left on the finished surface. A portion of the required cement for grout shall be white as required to match the color of the surrounding concrete. Rubbing shall continue until irregularities are removed and there is no excess material. At the time a light dust appears, the surface shall be brushed or sacked. Brushing or sacking shall be carried in one direction so as to produce a uniform texture.

- (7) Curing compound shall be Type I-D conforming to Material Specification 534 and ASTM C 309.
- (8) Measurement and payment will be by Method 2.

b. Bid Item 10, Cement

- (1) This item shall consist of furnishing and handling all cement required to construct the concrete items in Bid Item 9.
- (2) Cement shall be Type II or IIA.
- (3) Measurement and payment will be by Method 2.

surfaces sufficiently green to work up such lather, otherwise a carborundum stone shall be used. During the rubbing process, a thin grout composed of one (1) part cement and one (1) part of fine sand may be used to facilitate producing a satisfactory lather; however, this grout shall not be used in quantities sufficient to cause a plaster coating to be left on the finished surface. A portion of the required cement for grout shall be white, as required to match the color of the surrounding concrete, Rubbing shall continue until irregularities are removed and there is no excess material. At the time a light dust appears, the surface shall be brushed or sacked. Brushing or sacking shall be carried in one direction so as to produce a uniform texture.

(10) Curing compound shall be Type I-D, conforming to Material Specification 534 and ASTM C 309.

(11) Measurement and payment will be by Method 2.

b. Bid Item 5, Cement

(1) This item shall consist of furnishing and handling all cement required to construct the concrete items in Bid Item 4.

(2) Cement shall be Type II or IIA.

(3) Measurement and payment will be by Method 2.

(31-21)

Williams-Chandler WPP, Arizona

6/79

RWCD Floodway - Reach 1

Dip Crossings

c. Subsidiary Item, Concrete, Class 3000

- (1) This item shall consist of furnishing, forming and placing all items required to construct the following:
  - (a) The identification sign post anchors
  - (b) The Pipe Inlets.
- (2) In Section 3, Classes of Concrete, and Section 5, Design of the Concrete Mix, Method 1 shall apply. Concrete shall be Class 3000.
- (3) Coarse aggregate shall be size No. 67 in accordance with ASTM C 33.
- (4) Cement shall be Type II or IIA.
- (5) In Section 15, Construction Joints, Method 2 shall apply.
- (6) In Section 18, Removal of Forms, Method 1 shall apply.
- (7) No separate payment will be made for Class 3000 concrete. Compensation for this work will be included in the payment for Bid Item 15 Special Fittings, and Bid Item 18, Identification Sign.

## CONSTRUCTION SPECIFICATION

### 34. STEEL REINFORCEMENT

#### 1. SCOPE

The work shall consist of furnishing and placing steel reinforcement for reinforced concrete or pneumatically applied mortar.

#### 2. MATERIALS

Steel reinforcement shall conform to the requirements of Material Specification 539. Before reinforcement is placed the surfaces of the bars and fabric and any metal supports shall be cleaned to remove any loose, flaky rust, mill scale, oil, grease or other coatings or foreign substances. After placement the reinforcement shall be maintained in a clean condition until it is completely embedded in the concrete.

#### 3. BAR SCHEDULE, LISTS AND DIAGRAMS

Any supplemental bar schedules, bar lists or bar-bending diagrams required to accomplish the fabrication and placement of reinforcement shall be provided by the Contractor. Prior to placement of reinforcement, the Contractor shall furnish three prints or copies of any such lists or diagrams to the Contracting Officer. Acceptance of the reinforcement will not be based on approval of these lists or diagrams but will be based on inspection of the reinforcement after it has been placed.

#### 4. BENDING

Reinforcement shall be cut and bent in compliance with the requirements of the American Concrete Institute Standard 315. Bars shall not be bent or straightened in a manner that will injure the material. Bars with kinks, cracks or improper bends will be rejected.

#### 5. SPLICING BAR REINFORCEMENT

Unless otherwise specified on the drawings, splices of reinforcing bars shall provide an overlap equal to at least 30 times the diameter of the smaller bar in the splice but not less than 12 inches.

6. SPLICING WELDED WIRE FABRIC

Welded wire fabric shall be spliced in the following manner:

- a. Adjacent sections shall be spliced end to end by either:
- (1) Overlapping the two pieces of fabric one full mesh (measured from the ends of the longitudinal wires in one piece to the ends of the longitudinal wires in the other piece) and securing the two pieces together with wire ties placed at intervals of 18 inches; or,
  - (2) Overlapping the two pieces of fabric so that the end crosswire of each piece comes in contact with the next-to-end crosswire of the other piece and securing the two pieces together only as required to keep the fabric in place and to prevent it from curling.
- b. Adjacent sections of fabric shall be spliced side to side by either:
- (1) Placing the two selvage wires (the longitudinal wires at the edges of the fabric) one along side and overlapping the other and securing the two pieces together with wire ties placed at intervals of 3 feet; or,
  - (2) Placing each selvage wire in the middle of the first mesh of the other section of fabric and securing it to the other section at intervals of 10 feet by means of wire ties placed on the selvage wires alternately at intervals of 5 feet.
  - (3) Placing each selvage wire in contact with the next-to-edge longitudinal wire and securing them together only as required to keep the fabric in place or to prevent it from curling.

7. PLACING

Reinforcement shall be accurately placed and secured in position in a manner that will prevent its displacement during the placement of concrete. Tack welding of bars will not be permitted. Metal chairs, metal hangers, metal spacers and concrete chairs

may be used to support the reinforcement. Metal hangers, spacers and ties shall be placed in such a manner that they will not be exposed in the finished concrete surface. The legs of metal chairs that may be exposed at the lower face of slabs or beams shall be galvanized as specified for iron and steel hardware in Material Specification 582. Precast concrete chairs shall be manufactured of the same class of concrete as that specified for the structure and shall have tie wires securely anchored in the chair or a V-shaped groove at least 3/4 inch in depth molded into the upper surface to receive the steel bar at the point of support. Precast concrete chairs shall be moist at the time concrete is placed.

Reinforcement shall not be placed until the prepared site has been inspected and approved by the Engineer. After placement of the reinforcement, concrete shall not be placed until the reinforcement has been inspected and approved by the Engineer.

8. MEASUREMENT AND PAYMENT

(Method 1) For items of work for which specific unit prices are established in the contract, the weight of reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends will be based on the requirements of ACI Standard 315. Computation of weights of reinforcement will be based on the unit weights established in Tables 34-1, 34-2, and 34-3. The area of welded wire fabric reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest square foot by computation from the placing drawings with no allowance for laps. The weight of steel reinforcing in extra splices or extra-length splices approved for the convenience of the Contractor or the weight of supports and ties will not be included in the measurement for payment.

Payment for furnishing and placing reinforcing steel will be made at the contract unit price. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, cutting, bending, cleaning and securing all reinforcement.

(Method 2) For items of work for which specific unit prices are established in the contract, the weight of bar reinforcement placed in the concrete in accordance with the drawings will be determined

to the nearest pound by computation from the placing drawings. Measurement of hooks and bends will be based on the requirements of ACI Standard 315. Computation of weights of bar reinforcement will be based on the unit weights established in Table 34-1. The weight of steel reinforcing in extra splices or extra-length splices approved for the convenience of the Contractor or the weight of supports and ties will not be included in the measurement for payment.

The area of welded wire fabric reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest square foot by computation from the placing drawings with no allowance for laps.

Payment for furnishing and placing bar reinforcing steel will be made at the contract unit price for bar reinforcement. Payment for furnishing and placing welded wire fabric reinforcing steel will be made at the contract unit price for welded wire fabric reinforcement. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, cutting, bending, cleaning and securing all reinforcement.

(Use with Either Method) Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Section 9 of this specification.

TABLE 34-1. STANDARD REINFORCING BARS

Bar Size No.	2	3	4	5	6	7	8	9	10	11
Wt. (lb./ft.)	0.167	0.376	0.668	1.043	1.502	2.044	2.670	3.400	4.303	5.313

TABLE 34-2. RECTANGULAR WELDED WIRE FABRIC <sup>1</sup>

Style Designation	Wt. in Lb. Per 100 Sq. Ft.	Style Designation	Wt. in Lb. Per 100 Sq. Ft.	Style Designation	Wt. in Lb. Per 100 Sq. Ft.
24-1414	16	312- 711	39	43- 912	23
212- 04	169	312- 812	32	48-1012	20
212- 15	144	412- 26	69	48-1112	17
212- 26	124	412- 37	59	48-1212	14
212- 37	107	412- 48	51	48-1214	12
212- 48	91	412- 59	43	612-3/04	91
212- 59	77	412- 610	36	612-2/04	78
212- 610	66	412- 711	31	612- 00	81
212- 711	56	412- 810	27	612- 03	72
312- 04	119	412- 812	25	612- 11	69
312- 15	102	412- 912	22	612- 14	61
312- 26	87	412-1012	19	612- 22	59
312- 37	75	412-1112	16	612- 25	52
312- 48	64	412-1212	13	612- 33	51
312- 59	54	48- 711	33	612- 44	44
312- 610	46	48- 812	27	612- 66	32
				612- 77	27

<sup>1</sup>Style designation is defined in ACI Standard 315 of the American Concrete Institute.

TABLE 34-3. SQUARE WELDED WIRE FABRIC<sup>1</sup>

Style Designation	Wt. in Lb. Per 100 Sq. Ft.	Style Designation	Wt. in Lb. Per 100 Sq. Ft.
2 x 2 - 10/10	60	4 x 4 - 14/14	11
2 x 2 - 12/12	37	6 x 6 - 0/0	107
2 x 2 - 14/14	21	6 x 6 - 1/1	91
2 x 2 - 16/16	13	6 x 6 - 2/2	78
3 x 3 - 8/8	58	6 x 6 - 3/3	68
3 x 3 - 10/10	41	6 x 6 - 4/4	58
3 x 3 - 12/12	25	6 x 6 - 4/6	50
3 x 3 - 14/14	14	6 x 6 - 5/5	49
4 x 4 - 4/4	85	6 x 6 - 6/6	42
4 x 4 - 6/6	62	6 x 6 - 7/7	36
4 x 4 - 8/8	44	6 x 6 - 8/8	30
4 x 4 - 10/10	31	6 x 6 - 9/9	25
4 x 4 - 12/12	19	6 x 6 - 10/10	21
4 x 4 - 13/13	14		

<sup>1</sup>Style designation is defined in ACI Standard 315 of the American Concrete Institute.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 11, Steel Reinforcement

- (1) This item shall consist of furnishing and installing all steel reinforcement required in the construction of reinforced concrete inlet and outlet structures for the 48-inch diameter reinforced concrete pipe siphon.
- (2) Measurement and payment will be by Method 1.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 6, Steel Reinforcement

- (1) This item shall consist of furnishing and installing all steel reinforcement required in the construction of reinforced concrete for the dip crossings.
- (2) Measurement and payment will be by Method 1.

(34-7)

Williams-Chandler WPP, Arizona

6/79

RWCD Floodway - Reach 1

Dip Crossings

## CONSTRUCTION SPECIFICATION

### 42. CONCRETE PIPE CONDUITS AND DRAINS

#### 1. SCOPE

The work shall consist of furnishing and installing concrete pipe or concrete drain tile and the necessary fittings as shown on the drawings.

#### 2. MATERIALS

Reinforced concrete pressure pipe shall conform to the requirements of Material Specification 541 for the type and strength specified.

Concrete culvert pipe shall conform to the requirements of Material Specification 542 for the kind of pipe specified.

Concrete irrigation pipe, drainage pipe and drain tile shall conform to the requirements of Material Specification 543 for the kind of pipe or tile specified.

Pipe fittings shall conform to the requirements of the applicable pipe specifications.

Sealing compound for filling rubber gasket joints shall conform to the requirements of Material Specification 536.

Hot-pour joint sealer shall conform to the requirements of Federal Specification SS-S-169.

Cold-applied sealing compound shall conform to the requirements of Federal Specification SS-S-168.

Preformed sealing compound shall conform to the requirements of Interim Federal Specification SS-S-00210.

Joint packing shall conform to the requirements of Federal Specification HH-P-119 for mastic sealed joints and Federal Specification HH-P-117 for cement mortar sealed joints.

Preformed expansion joint filler shall conform to the requirements of Material Specification 535.

## LAYING AND BEDDING

Pipe and tile shall be laid to the line and grade shown on the drawings. Pipe shall be laid with the bell or groove at the upstream end of each section.

- a. Concrete Cradles or Bedding. Pipe to be cradled or bedded on concrete shall be set to the specified line and grade and temporarily supported on precast concrete blocks or wedges until the cradle or bedding concrete is placed. Concrete blocks or wedges used to temporarily support the pipe during placement of bedding or cradle shall be of a class of concrete equal to or better than that used in the bedding or cradle.
- b. Earth, Sand, or Gravel Bedding. The pipe shall be firmly and uniformly bedded throughout its entire length to the depth and in the manner specified on the drawings. The pipe shall be loaded sufficiently during backfilling around the sides to prevent its being lifted from the bedding.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about a vertical centerline. Perforations shall be clear of any obstructions when the pipe is laid.

Elliptical pipe and pipe with elliptical or quadrant reinforcement shall be laid so that the vertical axis, as indicated by markings on the pipe, is in a vertical position.

## 4. JOINTS

Pipe joints shall conform to the details shown on the drawings and to the requirements of Section 5 and 6 of this specification applicable to the type of joint specified. Except where unsealed joints are indicated, pipe joints shall be sound and watertight at the pressure specified.

## 5. JOINING BELL AND SPIGOT PIPE

- a. Rubber Gasket Joint, Pressure Pipe. Just before the joint is connected the connecting surfaces of the spigot and the bell or coupling band, sleeve or collar shall be thoroughly cleaned and dried, and the rubber gasket and the inside surface of the bell or coupling band, sleeve or collar shall be lubricated with a light film of soft vegetable soap compound (flax soap). The rubber gasket shall be stretched uniformly as it is placed in the spigot groove to insure a uniform volume of rubber around the circumference of the pipe.

(Method 1) The joint shall be connected by means of a pulling or jacking force so applied to the pipe that the spigot enters squarely into the bell.

(Method 2) The joint shall be connected in accordance with the manufacturer's recommendations.

(Use with Either Method) When the spigot has been seated to within 1/2 inch of its final position, the position of the gasket in the joint shall be checked around the entire circumference of the pipe by means of metal feeler gage. In any case where the gasket is found to be displaced, the joint shall be disengaged and properly reconnected. After the position of the gasket has been checked, the spigot shall be completely pulled into the bell and the section of the pipe shall be adjusted to line and grade.

- b. Rubber Gasket Joints, Sewer and Culvert Pipe or Irrigation Pipe. The pipe shall be joined in accordance with the gasket manufacturer's recommendations except as otherwise specified.
- c. Mastic Sealed Joints. At the time of assembly the inside surfaces of the bell and the outside surfaces of the spigot shall be clean, dry and primed as recommended by the manufacturer of the sealing compound. A closely twisted gasket of joint packing of the diameter required to support the spigot at the proper grade and to make the joint concentric shall be made in one piece of sufficient length to pass around the pipe and lap at the top. The gasket shall be laid in the bell throughout the lower third of the circumference. The end of the spigot shall be laid on the gasket and the spigot shall be fully inserted into the bell so that the pipe sections are closely fitted and aligned. The gasket then shall be lapped at the top of the pipe and thoroughly packed into the annular space between the bell and the spigot.

- (1) Hot-Pour Joint Sealer. The sealing compound shall be heated to within the temperature range recommended by the manufacturer and shall not be overheated or subjected to prolonged heating. After the joint is assembled, with the pipe in its final location, a suitable joint runner shall be placed around the joint with an opening left at the top. Molten sealing compound shall be poured into the joint as rapidly as possible without entrapping air until the annular space between bell and spigot is completely filled. After the compound has set, the runner may be removed. Alternate joints may be poured before the pipe is lowered into the trench. In this case, the joint shall be poured with the pipe in a vertical position without the use of the runner. The compound shall have thoroughly set before the pipe is placed in the trench, and the pipe shall be handled so as to cause no deformation of the joint during placement.
  - (2) Cold-Applied Sealing Compound. The annular space between bell and spigot shall be completely filled with the sealing compound. The compound shall be mixed on the job in accordance with the manufacturer's recommendations and in relatively small quantities so that setting will not be appreciable before application.
  - (3) Preformed Sealing Compound. Joint packing will not be required, except as recommended by the manufacturer of the sealing compound. Preformed strips or bands of the sealing compound shall be applied to the bell and spigot prior to assembly of the joint in accordance with the manufacturer's recommendations. Any compound extruded from the interior side of the joint during assembly shall be trimmed even with the interior surface of the pipe.
- d. Cement Mortar Sealed Joints. Cement mortar for joints shall consist of one part by weight of portland cement and two parts by weight of fine sand with enough water added to produce a workable consistency. At the time of assembly the inside surface of the bell and the outside surface of the spigot shall be clean and moist.

(1) With Packing. A closely twisted gasket of joint packing of the diameter required to support the spigot at the proper grade and to make the joint concentric shall be made in one piece of sufficient length to pass around the pipe and lap at the top. The gasket shall be saturated with neat cement grout, laid in the bell throughout the lower third of the circumference and covered with mortar. The end of the spigot shall be fully inserted into the bell so that the pipe sections are closely fitted and aligned. A small amount of mortar shall be placed in the annular space throughout the upper two-thirds of the circumference. The gasket then shall be lapped at the top of the pipe and thoroughly packed into the annular space between the bell and the spigot. The remainder of the annular space then shall be filled completely with mortar and beveled off at an angle of approximately forty-five (45) degrees with the outside of the bell. If the mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. After the mortar has set slightly, the joint shall be wiped inside the pipe. In pipe too small for a man to work inside, wiping may be done by dragging an approved swab through the pipe as the work progresses.

(2) Without Packing. The lower portion of the bell shall be filled with stiff mortar of sufficient thickness to make the inner surface of the abutting sections flush. The spigot end of the pipe to be joined shall be fully inserted into the bell so that the sections are closely fitted and aligned. The remaining annular space between the bell and spigot shall then be filled with mortar and the mortar neatly beveled off at an angle of approximately forty-five (45) degrees with the outside of the bell. After the mortar has set slightly, the joint shall be wiped inside the pipe. In pipe too small for a man to work inside, wiping may be done by dragging an approved swab through the pipe as the work progresses.

e. Unsealed Joints. When unsealed joints are specified, they shall conform to the details shown on the drawings.

6. JOINING TONGUE AND GROOVE PIPE

- a. Cement Mortar Sealed Joint. Mortar shall be as specified for bell and spigot joints. The tongue end of the section being placed shall be covered with mortar and firmly pressed into the groove of the laid section in such a manner that the tongue fits snugly and truly in the groove and that mortar is squeezed out both on the interior and exterior of the joint. Care shall be taken that no mortar falls from the groove end during the abutting operation. Immediately after the pipe sections have been abutted, exposed external surface mortar shall be pressed into the joint and any excess mortar removed, after which the interior surface of the joint shall be carefully pointed and brushed smooth, and all surplus mortar removed.
- b. Mastic Sealed Joints. Strips or bands of preformed sealing compound shall be applied to the tongue and groove prior to assembly of the joint in accordance with the manufacturer's recommendations. Any compound extruded from the interior side of the joint during assembly shall be trimmed even with the interior surface of the pipe.
- c. Rubber Gasket Joints. The pipe shall be joined in accordance with the gasket manufacturer's recommendations except as otherwise specified.
- d. Unsealed Joints. When unsealed joints are specified, they shall conform to the details shown on the drawings.

7. BANDING

When external mortar bands are specified, they shall conform to the details shown on the drawings.

8. CURING MORTAR JOINTS AND BANDS

The external surfaces of mortar joints shall be covered with moist earth, sand, canvas, burlap or other approved materials and shall be kept moist for 10 days or until the pipe is backfilled.

Water shall not be turned into the conduit within 24 hours after the joints are finished. Hydrostatic pressure shall not be applied to the conduit prior to 14 days after the joints are finished.

9. PRESSURE TESTING

(Method 1) Pressure testing of the completed conduit will not be required.

(Method 2) Prior to the placement of concrete or earth fill around the conduit, the conduit shall be tested for leaks in the following manner: The ends of the conduit shall be plugged and a standpipe with a minimum diameter of two (2) inches shall be attached to the upstream plug. The conduit shall be braced at each end to prevent slippage. The conduit and the standpipe shall be filled with water. The water level in the standpipe shall be maintained, by continuous pumping, a minimum of 10 feet above the invert of the upstream end of the conduit for a period of not less than two hours. Any leaks shall be repaired and the conduit shall be retested as described above. The procedure shall be repeated until the conduit is watertight.

The pipe joints shall show no leakage. Damp spots developing on the surface of the pipe will not be considered as leaks.

(Method 3) Prior to the placement of concrete or earth fill around the conduit, the conduit shall be tested at the specified test pressure for a period of at least 2 hours. Any leaks shall be repaired and the conduit shall be retested. The procedure shall be repeated until the conduit is watertight.

The pipe joints shall show no leakage. Damp spots developing on the surface of the pipe will not be considered as leaks.

10. MEASUREMENT AND PAYMENT

(Method 1) For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe or tile will be determined to the nearest foot by measurement of the laid length along the invert centerline of the conduit. Payment for each kind, size, and class of pipe or tile will be made at the contract unit price for that kind, size, and class. Such payment will constitute full compensation for furnishing, transporting and installing the pipe or tile complete in place.

(Method 2) For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe or tile will be determined as the sum of the nominal laying lengths of the sections used. Payment for each kind, size, and class of pipe or tile will be made at the contract unit price for that kind, size, and class. Such payment will constitute full compensation for furnishing, transporting and installing the pipe or tile complete in place.

(Use with Either Method). Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 11 of this specification.

SCS-WEST

(42-8)

3-1-74

11. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 12, 48-inch Diameter Reinforced Concrete Pipe, Class III.

- (1) This item shall consist of furnishing and installing all pipe for the siphon between Station 1283+91 and Station 1285+60.28 centerline floodway, as shown on the drawings.
- (2) Pipe shall conform to the requirements of Material Specification 542 and ASTM C-76. The pipe shall be Class III.
- (3) Pipe shall be furnished with bell and spigot joints equipped with endless "O" ring type gaskets of circular cross section.
- (4) Cement shall be Type II.
- (5) In Section 5, Joining Bell and Spigot Pipe, Method 1 shall apply.
- (6) In Section 9, Pressure Testing, Method 1 shall apply.
- (7) Measurement and payment will be by Method 1.

## CONSTRUCTION SPECIFICATION

### 44. ASBESTOS-CEMENT PIPE CONDUITS AND DRAINS

#### 1. SCOPE

The work shall consist of furnishing and installing asbestos-cement pipe and the necessary fittings as shown on the drawings.

#### 2. MATERIALS

Pipe, fittings, and gaskets shall conform to the requirements of Material Specification 545 for the kind of pipe specified.

#### 3. LAYING AND BEDDING

Pipe shall be laid to the line and grade shown on the drawings.

- a. Concrete Cradle or Bedding. Pipe to be cradled or bedded on concrete shall be set to the specified line and grade and temporarily supported on concrete blocks or wedges until the cradle or bedding concrete is placed.
- b. Earth, Sand, or Gravel Bedding. The pipe shall be firmly and uniformly bedded throughout its entire length to the depth and in the manner specified on the drawings. The pipe shall be loaded sufficiently during backfilling around the sides to prevent its being lifted from the bedding.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about the vertical centerline. Perforations shall be clear of any obstructions when the pipe is laid.

#### 4. JOINTS

Pipe joints shall conform to the details shown on the drawings and, except where unsealed joints are indicated, shall be sound and watertight at the pressures specified.

Pipe shall be installed and joined in accordance with the manufacturer's recommendations except as otherwise specified.

#### 5. PRESSURE TESTING

(Method 1) Pressure testing of the completed conduit will not be required.

(Method 2) Prior to the placement of concrete or earth fill around the conduit, the conduit shall be tested for leaks in the following manner: The ends of the conduit shall be plugged and a standpipe with a minimum diameter of two (2) inches shall be attached to the upstream plug. The conduit shall be braced at each end to prevent slippage. The conduit and the standpipe shall be filled with water. The water level in the standpipe shall be maintained by continuous pumping, a minimum of 10 feet above the invert of the upstream end of the conduit for a period of not less than two hours. Any leaks shall be repaired and the conduit shall be retested as described above. The procedure shall be repeated until the conduit is watertight.

The pipe joints shall show no leakage. Damp spots developing on the surface of the pipe will not be considered as leaks.

(Method 3) Prior to the placement of concrete or earth fill around the conduit, the conduit shall be tested at the specified test pressure for a period of at least 2 hours. Any leaks shall be repaired and the conduit shall be retested. The procedure shall be repeated until the conduit is watertight.

The pipe joints shall show no leakage. Damp spots developing on the surface of the pipe will not be considered as leaks.

6. MEASUREMENT AND PAYMENT

(Method 1) For items of work for which specific unit prices are established in the contract, the quantity of each kind, size and class of pipe will be determined to the nearest foot by measurement of the laid length of pipe along the invert centerline of the conduit. Payment for each kind, size, and class of pipe will be made at the contract unit price for that kind, size, and class of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe complete in place.

(Method 2) For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe will be determined as the sum of the nominal laying lengths of the pipe sections used. Payment for each kind, size, and class of pipe will be made at the contract unit price for that kind, size, and class of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe complete in place.

(Use with Either Method) Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

SCS-WEST

(44-3)

3-7-69

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in accordance with this specification and the construction details are:

a. Bid Item 13, 6-Inch Diameter Drain Systems

- (1) These items shall consist of furnishing and installing all the 6-inch diameter perforated and non-perforated asbestos-cement pipe, including fittings for the grouted rock riprap drain system as shown on the drawings.
- (2) All pipe shall be asbestos cement pressure pipe conforming to Material Specification 545 and ASTM C 296; Type I or II, Class 200.
- (3) In Section 5, Pressure Testing, Method 1 shall apply.
- (4) Measurement and payment will be by Method 2.

CONSTRUCTION SPECIFICATION51. CORRUGATED METAL PIPE CONDUITS1. SCOPE

The work shall consist of furnishing and placing circular, arched or elliptical corrugated metal pipe and the necessary fittings.

2. MATERIALS

Pipe and fittings shall conform to the requirements of Material Specification 551 or Material Specification 552, whichever is specified.

3. LAYING AND BEDDING THE PIPE

Unless otherwise specified, the pipe shall be installed in accordance with the manufacturer's recommendations. The pipe shall be laid with the outside laps of circumferential joints pointing upstream and with longitudinal laps at the sides at about the vertical midheight of the pipe. Field welding of corrugated galvanized iron or steel pipe will not be permitted. Unless otherwise specified, the pipe sections shall be jointed with standard coupling bands. The pipe shall be firmly and uniformly bedded throughout its entire length to the depth and in the manner specified on the drawings.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about a vertical center line. Perforations shall be clear of any obstructions at the time the pipe is laid.

The pipe shall be loaded sufficiently during backfilling around the sides to prevent its being lifted from the bedding.

4. STRUTTING

When required, struts or horizontal ties shall be installed in the manner specified on the drawings. Struts and ties shall remain in place until the backfill has been placed to a height of 5 feet above the top of the pipe, or has been completed if the finished height is less than 5 feet above the top of the pipe, at which time they shall be removed by the Contractor.

(51-1)

5. HANDLING THE PIPE

The Contractor shall furnish such equipment as is necessary to place the pipe without damaging the pipe or coatings. The pipe shall be transported and handled in such a manner as to prevent bruising, scaling, or breaking of the spelter coating or bituminous coating.

6. REPAIR OF DAMAGED COATINGS

Any damage to the zinc coating shall be repaired by thoroughly wire brushing the damaged area, removing all loose and cracked coating, removing all dirt and greasy material with solvent, and painting with two coats of zinc dust-zinc oxide primer conforming to the requirements of Federal Specification TT-P-641, Type III, or zinc dust paint conforming to the requirements of Military Specification MIL-P-21035. If the coating is damaged in any individual area larger than 12 square inches, or if more than 0.2 percent of a total surface area of a length of pipe is damaged, the length will be rejected.

Breaks or scuffs in bituminous coatings that are less than 36 square inches in area shall be repaired by the application of two coats of hot asphaltic paint or a coating of cold-applied bituminous mastic. The repair coating shall be at least 0.05 inches thick after hardening and shall bond securely and permanently to the pipe. The material shall meet the physical requirements for bituminous coatings contained in the references cited in Material Specifications 551 and 552. Whenever individual breaks exceed 36 square inches in area or when the total area of breaks exceeds 0.5 percent of the total surface area of the pipe, the pipe will be rejected.

Bituminous coating damaged by welding of coated pipe or pipe fittings shall be repaired as specified in this section for breaks and scuffs in bituminous coatings.

7. MEASUREMENT AND PAYMENT

(Method 1) For items of work for which specific unit prices are established in the contract the quantity of each type, class, size and gage of pipe will be determined to the nearest 0.1 foot by measurement of the laid length of pipe along the centerline of the pipe. Payment for each type, class, size and gage of pipe will be made at the contract unit price for that type, class, size and gage of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe and fittings and all other items necessary and incidental to the completion of the work.

(Method 2) For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size and gage of pipe will be determined as the sum of the nominal laying lengths of the pipe sections and fittings used. Payment for each type, class, size and gage of pipe will be made at the contract unit price for that type, class, size and gage of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe and fittings and all other items necessary and incidental to the completion of the work.

(Method 3) For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size and gage of pipe will be determined to the nearest 0.1 foot by measurement of the laid length of pipe along the centerline of the pipe. Payment for each type, class, size and gage of pipe will be made at the contract unit price for that type, class, size and gage of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe and fittings and all other items necessary and incidental to the completion of the work except items designated as "special fittings." Payment for special fittings will be made at the contract lump sum price for special fittings (CMP).

(Method 4) For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size and gage of pipe will be determined as the sum of the nominal laying lengths of the pipe sections and fittings used. Payment for each type, class, size and gage of pipe will be made at the contract unit price for that type, class, size and gage of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe and fittings and all other items necessary and incidental to the completion of the work except items designated as "special fittings." Payment for special fittings will be made at the contract lump sum price for special fittings (CMP).

(Method 5) For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size and gage of pipe will be determined to the nearest 0.1 foot by measurement of the laid length of pipe along the centerline of the pipe. Payment for each type, class, size and gage of pipe will be made at the contract unit price for that type, class, size and gage of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe, including the necessary fittings and all other items necessary and incidental to the completion of the work except the special

fittings and appurtenances listed separately in the bid schedule. Payment for each special fitting and appurtenance will be made at the contract unit price for that type and size of fitting or appurtenance.

(Method 6) For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size and gage of pipe will be determined as the sum of the nominal laying lengths of the pipe sections used. Payment for each type, class, size and gage of pipe will be made at the contract price for that type, class, size and gage of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe, including the necessary fittings and all other items necessary and incidental to the completion of the work except the special fittings and appurtenances listed separately in the bid schedule. Payment for each special fitting and appurtenance will be made at the contract unit price for that type and size of fitting or appurtenance.

(Method 7) For items of work for which specific lump sum prices are established in the contract, payment for corrugated metal pipe structures will be made at the contract lump sum prices. Such payment will constitute full compensation for furnishing, fabricating, transporting, and installing the pipe, fittings, and appurtenances, and all other items necessary and incidental to completion of the work, including, except as otherwise specified, required excavation, dewatering, and backfilling.

(Use with All Methods) Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 14. 18-Inch Diameter Corrugated Metal Pipe

- (1) This item shall consist of the furnishing and installing of the 18-inch diameter corrugated metal pipe for the pipe inlets as shown on the drawings and staked in the field.
- (2) In Section 2, Materials, Materials Specification 551 shall apply.
- (3) The pipe shall be 16 gage, Class I or II, Shape 1, Series A and have Coating A in accordance with Federal Specification WW-P-405.
- (4) Measurement and payment will be by Method 3.

b. Bid Item 15. Special Fittings

- (1) This item shall consist of furnishing and installing the 24-inch diameter corrugated metal pipe risers, including the Class 3000 concrete for the 9-inch and 3-inch slabs for the pipe inlets as shown on the drawings.
- (2) In Section 2, Materials, Materials Specification 551 shall apply.
- (3) The pipe shall be 16 gage, Class I or II, Shape 1, Series A and have Coating A in accordance with Federal Specification WW-P-405.
- (4) Measurement and payment will be by Method 3.

CONSTRUCTION SPECIFICATION61. LOOSE ROCK RIPRAP1. SCOPE

The work shall consist of the construction of loose rock riprap revetments and blankets, including filter layers or bedding where specified.

2. MATERIALS

Rock for loose rock riprap shall conform to the requirements of Material Specification 523 or, if so specified, shall be obtained from designated sources.

Rock from designated sources shall be excavated, selected and handled as necessary to meet the quality and grading requirements in Section 9 of this specification. The rock shall conform to the specified grading limits when installed in the riprap.

Filter material shall conform to the requirements of Material Specification 521 unless otherwise specified.

Bedding shall be obtained from the designated sources and shall be selected to meet the quality and grading requirements in Section 9 of this specification.

At least 30 days prior to delivery of material from other than designated sources, the Contractor shall notify the Contracting Officer in writing of the sources from which he intends to obtain the material. The Contractor shall provide the Engineer free access to the sources for the purpose of obtaining samples for testing.

3. SUBGRADE PREPARATION

The subgrade surfaces on which the riprap or bedding course is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved materials and shall conform to the requirements of the specified class of fill.

Riprap shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the Engineer.

(61-1)

4. EQUIPMENT-PLACED ROCK RIPRAP

The rock shall be placed by equipment on the surfaces and to the depths specified. The riprap shall be constructed to the full course thickness of one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks.

Riprap shall be placed in a manner to prevent damage to structures. Hand placing will be required to the extent necessary to prevent damage to the permanent works.

5. HAND-PLACED RIPRAP

The rock shall be placed by hand on the surfaces and to the depths specified. It shall be securely bedded with the larger rocks firmly in contact one to another. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute for larger rock. Flat slab rock shall be laid on edge.

6. FILTER LAYERS OR BEDDING

When the drawings specify filter layers or bedding beneath riprap, the filter or bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth specified. Compaction of filter layers or bedding will not be required, but the surface of such layers shall be finished reasonably free of mounds, dips or windrows.

7. TESTING

The Engineer will perform such tests as are required to verify that the riprap, filter, and bedding materials and the completed work meet the requirements of the specifications. These tests are not intended to provide the Contractor with the information he needs to assure that the materials and workmanship meet the requirements of the specifications, and their performance will not relieve the Contractor of the responsibility of performing his own tests for that purpose.

8. MEASUREMENT AND PAYMENT

(Method 1) For items of work for which specific unit prices are established in the contract, the volume of each type of riprap, including filter layers and bedding, will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for each type of riprap, including filter layers and bedding, will be made at the contract unit price for that type of riprap. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

(Method 2) For items of work for which specific unit prices are established in the contract, the volume of each type of riprap and the volume of each type of filter layer or bedding will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

(Method 3) For items of work for which specific units prices are established in the contract, the quantity of each type of riprap placed within the specified limits will be measured to the nearest ton by actual weight, and the volume of each type of filter layer or bedding will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. For each load of rock placed as specified, the Contractor shall furnish to the Engineer a statement-of-delivery ticket showing the weight, to the nearest 0.1 ton, of rock in the load.

Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

(Method 4) For items of work for which specific unit prices are established in the contract, the quantity of each type of riprap placed within the specified limits will be measured to the nearest ton by actual weight, and the volume of each type of filter

(61-3)

material or bedding delivered and placed within the specified limits will be measured to the nearest cubic yard by measurement of the hauling equipment. For each load of material placed as specified, the Contractor shall furnish to the Engineer a statement-of-delivery ticket showing the weight, to the nearest 0.1 ton, or rock in the load; or the volume, to the nearest 0.1 cubic yard, of filter material or bedding in the load.

Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to completion of the riprap, filter layers and bedding.

(Use with All Methods) Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

(61-4)

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 16, Loose Rock Riprap (Type I)

- (1) This item shall consist of furnishing and placing all loose rock riprap between Station 1234+89 and Station 1249+80, between Station 1367+40 and Station 1368+40, between Station 1381+02 and Station 1395+40, between Station 1401+40.85 and Station 1414+95, between Station 1450+50 and Station 1453+43.09 and the pipe inlets at Station 1283+25+, Station 1367+07 and Station 1368+60.
- (2) The rock shall be graded as follows:

<u>Particle Size (inch)</u>	<u>Percent Passing (by Dry Wt.)</u>
12	100
8	55 - 100
4	30 - 50
2	5 - 30

- (3) Rock shall be either hand or equipment placed.
- (4) Measurement and payment will be by Method 1.

b. Bid Item 17, Loose Rock Riprap (Type II)

- (1) This item shall consist of the furnishing and placing of loose rock riprap between Station 1453+43.09 and Station 1456+40+ as shown on the drawings and as stated in the field.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 7, Loose Rock Riprap

- (1) This item shall consist of furnishing and placing of loose rock riprap between Station 1314+21<sub>+</sub> and Station 1315+46<sub>+</sub>, and between Station 1430+90<sub>+</sub> and Station 1431+15<sub>+</sub> (Centerline Floodway), as shown on the drawings and staked in the field.
- (2) The rock shall be graded as follows:

<u>Particle Size (inch)</u>	<u>Percent Passing (by Dry Wt.)</u>
30	100
20	60 - 100
12	30 - 60
6	5 - 30
4	0 - 5

- (3) Rock shall be either hand or equipment placed.
- (4) Measurement and payment will be by Method 1.

(61-5)

Williams-Chandler WPP, Arizona

6/79

RWCD Floodway - Reach 1

➤ Crossing

(2) The rock shall be graded as follows:

<u>Particle Size (inch)</u>	<u>Percent Passing (by Dry Wt.)</u>
30	100
20	60 - 100
12	30 - 60
6	5 - 30
4	0 - 5

(3) Rock shall be either hand or equipment placed.

(4) Measurement and payment will be by Method 1.

## CONSTRUCTION SPECIFICATION

### 81. METAL FABRICATION AND INSTALLATION

#### 1. SCOPE

The work shall consist of furnishing, fabricating and erecting metalwork, including the metal parts of composite structures.

#### 2. MATERIALS

Unless otherwise specified, materials shall conform to the requirements of Material Specification 581. Steel shall be structural quality unless otherwise specified. Castings shall be thoroughly cleaned and subjected to careful inspection before installation. Finished surfaces shall be smooth and true to assure proper fit. Galvanizing shall conform to the requirements of Material Specification 582.

#### 3. FABRICATION

Fabrication of structural steel shall conform to the requirements of Section 1.23 of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings (Riveted, Bolted and Arc-Welded Construction)," American Institute of Steel Construction.

Fabrication of structural aluminum shall conform to the requirements in the Aluminum Construction Manual, "Specifications for Aluminum Structures," Section 6 and Section 7, The Aluminum Association, November 1967.

#### 4. ERECTION

The frame of metal structures shall be carried up true and plumb. Temporary bracing shall be placed wherever necessary to resist all loads to which the structure may be subjected, including those applied by the installation and operation of equipment. Such bracing shall be left in place as long as may be necessary for safety.

As erection progresses the work shall be securely bolted up, or welded, to resist all dead load, wind and erection stresses. The Contractor shall furnish such fitting up bolts, nuts and washers as may be required.

No riveting or welding shall be done until as much of the structure as will be stiffened thereby has been properly aligned.

Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.

All field welding shall be done in conformance to the requirements for shop fabrication, except those that expressly apply to shop conditions only.

Galvanized items shall not be cut, welded or drilled after the zinc coating is applied.

5. PROTECTIVE COATINGS

Items specified to be galvanized shall be completely fabricated for field assembly before the application of the zinc coatings.

Items specified to be painted shall be painted in conformance to the requirements of Construction Specification 82 for the specified paint systems.

6. MEASUREMENT AND PAYMENT

(Method 1) The work will not be measured. Payment for metal fabrication and installation will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work, including connectors and appurtenances such as rivets, bolts, nuts, pins, studs, washers, hangers and weld metal.

(Method 2) The weight of metal installed complete in place shall be determined to the nearest pound. Unless otherwise provided, the weight of metal shall be computed by the method specified in Section 3 of the "Code of Standard Practice for Steel Buildings and Bridges," American Institute of Steel Construction, except that the following unit weights shall also be used, as appropriate, as the basis of computation:

<u>Material</u>	<u>Unit Weight</u> <u>Pounds per Cubic Foot</u>
Aluminum alloy	173.0
Bronze or copper alloy	536.0
Iron, malleable	470.0
Iron, wrought	487.0

(81-2)

Payment for furnishing, fabricating and installing metalwork will be made at the contract unit price for the specified types of metals. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work.

(Method 3) The work will not be measured. Payment for furnishing, fabricating and installing each item of metalwork will be made at the contract price for that item. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work, including connectors and appurtenances such as rivets, bolts, nuts, pins, studs, washers, hangers and weld metal.

(Use with all Methods) Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 18, Identification Signs

- (1) This item shall consist of the fabrication and installation of the identification sign as shown on the drawings and as directed by the Engineer.
- (2) Painting shall be in accordance with Construction Specification 82.
- (3) Measurement and payment will be by Method 3.

b. Bid Item 19, Metal Work

- (1) This item shall consist of fabricating and installing the trash rack for the inlet structure to the 48-inch diameter reinforced concrete pipe siphon and the pipe inlet handrails.
- (2) The trash rack shall be fabricated of structural steel conforming to the requirements of ASTM Specification A-36 to the sizes and dimensions shown on the drawings.
- (3) Pipe inlet handrails shall be fabricated of standard weight steel pipe conforming to the requirements ASA B 36.10.
- (4) The trash rack and handrails shall be painted in the manner specified in Construction Specification 82.
- (5) All anchor bolts, nuts and washers shall be galvanized.
- (6) Measurement and Payment will be by Method 1.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Metal Work

- (1) This item shall consist of the fabrication and installation of depth gauges as shown on the drawings and as directed by the Engineer.
- (2) Painting shall be in accordance with Construction Specification 82.
- (3) All anchor bolts, nuts and washers shall be galvanized.
- (4) No separate payment will be made for metal work.

Compensation for this work will be included in the payment for Bid Item 4, Reinforced Concrete Class 4000X.

CONSTRUCTION SPECIFICATION

82. CLEANING AND PAINTING METALWORK

1. SCOPE

The work shall consist of cleaning metal surfaces and applying paints and protective coatings.

2. PAINTS

For the purposes of this specification paints shall be designated by types as defined below:

Type 1 paint shall conform to the requirements of Federal Specification TT-P-86, Type IV, Red Lead Base Paint.

Type 2 paint shall conform to the requirements of Federal Specification TT-P-86, Type II or Type III, Red Lead Base Paint.

Type 3 paint shall conform to the requirements of Federal Specification TT-P-86, Type I, Red Lead Base Paint.

Type 4 paint shall conform to the requirements of Federal Specification TT-P-636, Synthetic Primer.

Type 5 paint shall be prepared by mixing aluminum paste conforming to the requirements of Federal Specification TT-P-320, Type II, Class 2 with phenolic resin spar varnish conforming to the requirements of Federal Specification TT-V-119 at the rate of two pounds of aluminum paste per gallon of varnish. The paint shall be mixed at the time of use.

Type 6 paint shall be prepared by mixing aluminum paste conforming to Federal Specification TT-P-320, Type II, Class 2 with mixing varnish conforming to the requirements of Federal Specification TT-V-81, Type II, Class B (Class 2) at the rate of two pounds of aluminum paste per gallon of varnish. The paint shall be mixed at the time of use.

Type 7 paint shall conform to the requirements of Federal Specification TT-E-489, Class A, Alkyd Gloss Enamel.

Type 8 paint shall conform to the requirements of Federal Specification TT-E-529, Alkyd Semi-Gloss Enamel.

Type 9 paint shall conform to the requirements of Federal Specification TT-P-641, Type I or Type II, Zinc Dust-Zinc Oxide Primer.

Type 10 paint shall conform to the requirements of Federal Specification TT-P-641, Type III, Zinc Dust-Zinc Oxide Primer.

Type 11 paint shall conform to the requirements of Material Specification 583. The paint shall be mixed at the time of use.

Paints of Types 1, 2, 3, 5 and 6 may be thinned with mineral spirits as necessary for proper application but the amount of thinner used shall not exceed one pint per gallon of paint. Other paints may be thinned in accordance with the manufacturer's instructions only if such thinning is approved by the Engineer.

When tinting is required, it shall be accomplished by the addition of pigment-in-oil tinting colors conforming to the requirements of Federal Specification TT-P-381.

Mineral spirits shall conform to the requirements of Federal Specification TT-T-291, Grade 1, Light Thinner.

### 3. SURFACE PERPARATION

Surfaces to be painted shall be thoroughly cleaned prior to the application of the paint. For the purposes of this specification methods of surface preparation shall be designated as defined below:

Method 1 surface preparation shall consist of the removal of all grease and oil by means of steam cleaning or solvent cleaning methods and removal of all dirt, rust, mill scale and other coatings by means of sandblasting, grit blasting or pickling. The finished surface shall uniformly expose the base metal and shall present an etched, but not polished or peened, appearance. Not more than 5 percent of the surface may exhibit very light shadows, light streaks, or slight discolorations caused by rust stain, mill scale oxides, or slight, tight residues of paint or coating.

Method 2 surface preparation shall consist of the removal of all grease and oil by means of steam cleaning or solvent cleaning and the removal of all dirt, surface rust and loose scale by means of wire brushing, flame cleaning, use of rotary abrading tools or light sandblasting.

Method 3 surface preparation shall consist of the treatment of the surface with a dilute acid solution. The surface shall be thoroughly wetted with a dilute (about 5 percent strength) phosphoric acid solution. After the acid has dried, the surface shall be thoroughly rinsed with clear water and allowed to dry. Dirt, grease and oil shall be removed from the surface by solvent cleaning prior to the acid treatment.

Cleaning solvent shall be mineral spirits. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface being cleaned. The final cleaning and wiping shall be done with clean solvent and clean cloths. Grit blasting shall be accomplished using compressed air blast nozzles and grit made of steel, malleable iron or cast iron crushed shot. Abrasives used shall have a maximum particle size that will pass the No. 16 sieve (U. S. Standard) and a minimum size that will be retained on the No. 50 sieve (U. S. Standard). The equipment used for sandblasting shall be equipped with adequate separators and traps to insure that the compressed air shall be free of detrimental amounts of water and oil. Blast cleaned surfaces shall be brushed, blown or vacuum cleaned to remove any trace of blast products or abrasives prior to painting.

Surfaces that are not to be painted immediately after cleaning shall be treated with one brush coat of metal conditioner conforming to the requirements of Military Specification MIL-M-10578, except that surfaces cleaned by pickling in phosphoric acid solution shall not require such treatment.

Surfaces shall be thoroughly dry when paint is applied.

No field coats of paint shall be applied until the prepared surfaces have been inspected and approved by the Engineer.

#### 4. PAIN T SYSTEMS

For the purposes of this specification, systems of preparing and painting metalwork will be designated as defined below:

Paint System A shall consist of the preparation of the surfaces to be painted by Method 1 and the application of two priming coats of Type 1 paint and two or more top coats of Type 5 paint as necessary to provide a total dry paint film thickness of 6 mils.

Paint System B shall consist of the preparation of the surfaces to be painted by Method 1 and the application of one priming coat of Type 1 paint and two top coats of Type 5 paint.

Paint System C shall consist of the preparation of the surfaces to be painted by Method 2 and the application of one priming coat of Type 2, Type 3 or Type 4 paint and two top coats of Type 6 paint.

Paint System D shall consist of the preparation of the surfaces to be painted by Method 2 and the application of one priming coat of Type 2 paint and two top coats of Type 7 paint.

Paint System E shall consist of the preparation of the surfaces to be painted by Method 2 and the application of one priming coat of Type 2 paint and two top coats of Type 8 paint.

Paint System F shall consist of the preparation of the surfaces to be painted by Method 3 and the application of two coats of Type 9 paint.

Paint System G shall consist of the preparation of the surfaces to be painted by Method 3 and the application of two coats of Type 10 paint.

Paint System H shall consist of the preparation of the surfaces to be painted by Method 1 and the application of four or more coats of Type 1 paint as necessary to provide a total dry paint film thickness of 6 mils.

Paint System I shall consist of the preparation of the surfaces to be painted by Method 1 and the application of two or more coats of Type 11 paint as necessary to provide a total dry paint film thickness of at least 16 mils.

## 5. APPLICATION OF PAINT

Surfaces shall be painted immediately after preparation (or within two days after preparation and treatment with metal conditioner) with at least one coat of the type of priming paint required by the specified paint system. Surfaces not required to be painted shall be protected against contamination and damage during the cleaning and painting operation.

Paints shall be thoroughly mixed at the time of application.

After erection or installation of the metalwork, all damage to shop applied coats shall be repaired and all bolts, nuts, welds and field rivet heads shall be cleaned and painted with one coat of the specified priming paint.

Except on surfaces accessible only to spray equipment, initial priming coats shall be applied by brush. All other coats may be applied by brush or spray. Each coat shall be applied in such a manner as to produce a paint film of uniform thickness with a rate of coverage within the limits recommended by the paint manufacturer.

The drying time between coats shall be as prescribed by the manufacturer of the paint but not less than that required for the paint film to dry through. The elapsed time between the application of the first and second prime coats of Paint System A shall not exceed 60 hours. In the application of Paint System I, if, for any reason, the first coat dries hard before the second coat is applied or the elapsed time between coats exceeds 48 hours, the method of application must be modified in any of the following ways: (1) the first coat must be wiped down with MIBK with the application of the second coat following the wipedown by not more than 6 feet; or (2) the first coat must be lightly brush blasted or given a fog coat of the paint before application of the full second coat; or (3) a special bonding additive supplied by the paint manufacturer must be mixed with the paint applied in the second coat.

The finished surface of each coat shall be free from runs, drops, ridges, laps or excessive brushmarks and shall present no variation in color, texture and finish.

The surface of each dried coat shall be cleaned as necessary before application of the next coat.

Except for Paint System I, the first coat of each two-coat system shall be tinted for contrast. The first coat of red-lead paint shall be tinted by the addition of 3 ounces per gallon of 1B

black pigment. The first coat of machinery paint shall be tinted off color with 3 ounces per gallon of a pigment suitable to the color of the paint.

6. ATMOSPHERIC CONDITIONS

Paint shall not be applied when the temperature of the item to be painted or of the surrounding air is less than 50°F. For Paint System I, the temperature of the coated surface must be maintained at not less than 50°F for 6 hours after the application of each coat. Painting shall be done only when the humidity and temperature of the surrounding air and the temperature of the metal surfaces are such that evaporation rather than condensation will result during the period of time required for application and drying. Surfaces protected from adverse atmospheric conditions by special cover, heating or ventilation shall remain so protected until the paint is dry.

7. TESTS

Acceptance of dry paint film thickness for Paint Systems A, H, and I will be based on the measurement of paint film thickness by means of an Elcometer or other suitable dry film thickness gage.

8. PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for painting metalwork will be at the contract lump sum price. Such payment will constitute full compensation for furnishing, preparing and applying all materials and for the cleaning, painting and coating of metalwork including labor, tools, equipment and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Cleaning and Painting

- (1) This item shall consist of cleaning and painting the designated metal items in Bid Item 19 and the Identification sign, Bid Item 18.
- (2) In Section 3, Surface Preparation, Method 2 shall apply.
- (3) In Section 4, Painting Systems, Paint System C shall apply for the trash rack and handrails in Bid Item 19 and Paint System E (except that Type 4 paint shall be used in place of Type 2 paint except for the priming coat) shall apply for the Identification Sign, Bid Item 18. The two (2) top coats of paint on the identification sign shall be white and the letters painted with a dark green enamel.
- (4) No separate payment will be made for cleaning and painting. Compensation for this work will be included in the payment for Bid Item 18, Identification Sign and Bid Item 19, Metal Work.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Cleaning and Painting

- (1) This item shall consist of cleaning and painting the depth gauges.
- (2) In Section 3, Surface Preparation, Method 2 shall apply.
- (3) In Section 4, Paint Systems, Paint System E (except that type 4 paint shall be used in place of type 2 paint for the priming coat) shall apply. The two top coats of enamel paint on the depth gauges shall alternate white background with green numbers, and green background with white numbers.
- (4) No separate payment will be made for cleaning and painting. Compensation for this work will be included in the payment for Bid Item 4, Reinforced Concrete, Class 4000X.

Williams-Chandler WPP, Arizona

(82-7)

6/79

RWCD Floodway - Reach 1

Dip Crossings

## CONSTRUCTION SPECIFICATION

### 200. GROUTED ROCK RIPRAP

#### 1. SCOPE

The work shall consist of furnishing, transporting and placing rock and concrete grout in the construction of grouted rock riprap sections.

#### 2. MATERIALS

Rock used in grouted rock riprap construction shall conform to the requirements of Material Specification 523. At least 30 days prior to delivery of rock, the Contractor shall designate in writing the source from which he intends to obtain the rock. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in the construction details.

Drain materials, when specified, shall conform to the requirements of Material Specification 521.

Portland cement shall conform to the requirements of Material Specification 531 for the specified type. The temperature of the cement at the time it is introduced into the mixture shall not exceed 170° F.

Aggregates shall conform to the requirements of Material Specification 522.

Water shall be clean and free from injurious amounts of oils, acid, alkali, organic matter or other deleterious substances.

Air-entraining admixtures shall conform to the requirements of Material Specification 532.

Curing compound shall conform to the requirements of Material Specification 534.

Other admixtures, when required, shall be as specified in the construction details.

#### 3. SUBGRADE PREPARATION

Riprap or filter shall not be placed until the subgrade surfaces have been inspected and approved by the Engineer.

#### 4. FILTER LAYERS OR BEDDING

When filter layers or bedding beneath the riprap is specified, the drain material shall be spread uniformly on the prepared subgrade

surfaces to the depth shown on the drawings. Compaction of drain material will not be required but the surface of such layers shall be finished reasonably free of mounds, dips or windrows.

5. PLACING ROCK

The rock shall be placed on the surfaces and to the depths specified in such a manner as to avoid displacement of the underlying materials. The rock may be equipment or hand placed as necessary to produce a surface in which the tops of the individual rocks do not vary more than the specified deviation from the neat lines shown on the drawings. Double decking of thin, flat rocks to bring the surface up to the required grade will not be permitted.

6. AIR CONTENT AND CONSISTENCY

The air content (by volume) of the grout mixture at the time of placement shall be 5 to 7 percent.

The consistency of the grout mixture shall be so maintained that the grout may be readily placed without segregation of materials or excessive laitance. Unless otherwise specified, the slump shall be within the range of six (6) to ten (10) inches.

7. DESIGN OF THE GROUT MIX

The Contractor shall be responsible for proportioning the mix.

The grout shall consist of Portland cement, fine and coarse aggregate, water and an air-entraining agent. The cement content shall be 5 1/2 bags per cubic yard unless otherwise specified. The maximum nominal size of coarse aggregate shall be 3/4 inch.

Prior to placement of grout, the Contractor shall furnish the Engineer a statement of the mix proportions. After the job mix has been so stated, neither the source or character of the aggregates nor the type or brand of cement will be changed without prior approval by the Engineer.

8. INSPECTING AND TESTING FRESH GROUT

The Engineer will inspect and test grout during the course of the work. Sampling of fresh grout will be done by the methods prescribed in ASTM Designation C 172. The volume of each batch will be determined by the methods prescribed in ASTM Designation C 138.

The Engineer shall have free entry to all parts of the Contractor's plant and equipment which concern mixing and placing the grout while work on the contract is being performed. Proper facilities shall be provided for the Engineer to inspect materials and processes used in

mixing and placing the grout as well as for securing samples of the grout mix. All tests and inspections shall be so conducted as not to interfere unnecessarily with the mixing and placing of the grout.

When ready-mixed grout is furnished, the Contractor shall furnish to the Engineer a statement of delivery ticket for each batch delivered to the job site. The ticket shall show the total weights in pounds of cement, water and fine and coarse aggregates, amount of air-entraining agent, time of loading and the revolution counter reading at the time of batching.

9. PLACING GROUT

The rock riprap shall be flushed with water to remove the fines from the rock prior to placing the grout. The rock shall be kept moist just ahead of the actual placing but the grout shall not be placed in standing or flowing water. Grout placed on inverts or other nearly level areas may be placed in one course. On slopes, the grout shall be placed in two (2) courses in successive lateral strips approximately ten (10) feet in width starting at the toe of the slope and progressing to the top. The grout shall be delivered to the place of final deposit by approved means and discharged directly on the surface of the rock, using a splash plate of metal or wood to prevent displacement of the rock directly under the discharge. The flow of grout shall be directed with brooms, spades or baffles to prevent it from flowing excessively along the same path and to assure that all intermittent spaces are filled. Sufficient barring shall be done to loosen tight pockets of rock and otherwise aid the penetration of grout so that all voids shall be filled and the grout fully penetrates the rock blanket. All brooming on slopes shall be uphill and after the grout has stiffened, the entire surface shall be rebroomed to eliminate runs and to fill voids caused by sloughing.

After completion of any strip or panel, no workman or other load shall be permitted on the grouted surface for a period of twenty-four (24) hours. The grouted surface shall be protected from injurious action by the sun; shall be protected from rain, flowing water and mechanical injury; and shall be cured in the manner specified for concrete in Construction Specification 31.

10. MEASUREMENT AND PAYMENT

(Method 1) For items of work for which specific unit prices are established in the contract, the volume of grouted rock riprap, including filter layers or bedding, will be determined from the specified thickness shown on the drawings and the area on which acceptable placement has been made. Payment for grouted rock riprap will be made at the contract unit price. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the grouted rock riprap and filter layers or bedding.

(Method 2) For items of work for which specific unit prices are established in the contract, the volume of riprap and the volume of filter layers or bedding will be determined from the specified thickness shown on the drawings and the area on which acceptable placement has been made. The volume of grout will be determined from the calculated batch volume and the number of mixed batches delivered to the site and acceptably placed in the work. Payment for riprap; filter or bedding material; and concrete grout will be made at the contract unit price for each item. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 11 of this specification.

11. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 20, Grouted Rock Riprap

(1) This item shall consist of the furnishing and placing of grouted rock riprap including filter material at the following locations as shown on the drawings and staked in the field:

(a) Between Station 1454+43.09 and Station 1455+12.09  
centerline floodway

(b) The pipe inlet at Station 1283+25±, Station 1367+07±  
and Station 1368+60±.

(2) The rock shall be graded as follows:

<u>Particle Size (inch)</u>	<u>Percent Passing (by Dry Wt.)</u>
18	100
12	75 - 95
9	40 - 80
6	5 - 20
3	0 - 5

(3) Filter beneath riprap shall be graded as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing (by Dry Wt.)</u>
1"	100
3/4"	85 - 100
#4	60 - 80
#16	40 - 60
#40	22 - 44
#200	0 - 3

Size No. 67 blended with fine aggregates in accordance with ASTM C 33 meets these requirements.

- (4) Rock shall be either hand or equipment placed
- (5) Cement shall be Type II or IIA.
- (6) The maximum thickness of riprap before grout is applied shall be twelve (12) inches.
- (7) Measurement and payment will be by Method 1.

CONSTRUCTION SPECIFICATION

400. SEEDING

1. SCOPE

The work shall consist of furnishing and installing seed including planting as shown on the drawings and staked in the field.

2. MATERIALS

Seed - The seed mixtures shall be as follows:

Mix Number One:

<u>Botanical Name</u>	<u>Common Name</u>	<u>Percentage</u>
Festucs megalura	'zorro' fescue	20.0
Bromus mollis	'blando' brome	20.0
Plantago insularis	desert indian wheat	60.0

Mix Number Two:

<u>Botanical Name</u>	<u>Common Name</u>	<u>Percentage</u>
Atriplex canescens	fourwing saltbush	36.0
Atriplex nummularia	oldman saltbush	36.0
Atriplex brewerii	quail bush	10.0
Plantago insularis	desert indian wheat	18.0

The percentage given are by weight of the mix. Weights of mix shall be on an adjusted basis to one-hundred (100) percent pure, live seed (PLS) at the specified proportion. Noxious weed seed content shall be prohibited as listed on page ten (10), Arizona State Seed Law.

Atriplex canescens (fourwing saltbush) seed shall be from a southern source having an elevation that is within one-thousand (1,000) feet of the area to be planted and it shall be dewinged.

Seed shall be premixed by the supplier and furnished in containers with the project name, seed mix number, and area of application clearly labeled on the container.

3. SHIPMENT

Seed shall be furnished in sealed containers, labeled by the supplier and delivered to the job site prior to use for approval by the Engineer. Containers shall not be damaged and seed shall not show evidence of water damage, mildew, or rot.

Chemical fertilizer shall be delivered in undamaged, moistureproof containers and shall be free from any evidence that fertilizer contains lumps or has caked.

4. SITE PREPARATION

(Method 1) No site preparation is required.

(Method 2) The area to be seeded shall be ripped to a minimum depth of five (5) inches, disked and harrowed to form a smooth, firm surface. Large soil clods, stones or foreign material brought to the surface by discing and which would interfere with the operation of the seeding equipment shall be removed and disposed of at areas designated by the Engineer.

5. SEED APPLICATION

(Method 1) The seed shall be broadcasted with equipment as approved by the Engineer and performed as follows:

1. One-half of the seed shall be sown with the sower moving in one direction.
2. The other half of the seed shall be sown with the sower moving parallel to the first sowing in the opposite direction, and over the same area.

The broadcast method shall provide an even distribution of seed and shall not be applied during wind of speeds greater than five (5) miles per hour.

(Method 2) The areas shall be seeded by the drill method to a minimum depth of one-quarter ( $\frac{1}{4}$ ) inch and a maximum depth of one-half inch.

6. MEASUREMENT AND PAYMENT

The surface areas seeded will be measured to the nearest tenth ( $\frac{1}{10}$ ) acre of the average slope. Payment for seeding will be made at the unit price established in the bid schedule and shall constitute full compensation for all labor, materials, equipment, and incidentals necessary to the completion of the work, including seed.

Compensation for any item of work described in the contract, but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 21, Seed Mix No. One

- (1) This item shall consist of furnishing and installing seed between 124.0 feet right and 124.0 feet left of the Floodway Centerline as shown on the drawings and staked in the field.
- (2) Seed shall conform to the requirements of seed Mix Number One.
- (3) In Section 4, Site Preparation, Method 1 shall apply.
- (4) In Section 5, Seed Application, Method 2 shall apply.
- (5) Seed application rate shall be ten (10) pounds PLS per acre.
- (6) Measurement and payment shall be in accordance with Section 6.

b. Bid Item 22, Seed Mix Number Two

- (1) This item shall consist of furnishing and installing seed within the following limits as shown on the drawings and staked in the field.
  - (a) Between 137.0 feet and 330 feet right and left of the Floodway Centerline.
  - (b) All spoil disposal areas.
- (2) Seed shall conform to the requirements of seed Mix Number Two.
- (3) In Section 4, Site Preparation, Method 2 shall apply.
- (4) In Section 5, Seed Application, Method 2 shall apply.
- (5) Seed application rate shall be eleven (11) pounds PLS per acre.
- (6) Measurement and payment shall be in accordance with Section 6.

CONSTRUCTION SPECIFICATION

<sup>401</sup>  
~~406~~. ASPHALT CONCRETE PAVEMENT

1. SCOPE

The work shall consist of furnishing and installing the asphalt concrete pavement including the untreated base, as shown on the drawings.

2. APPLICABLE STANDARD SPECIFICATIONS

All the work specified herein shall comply with the requirements of the following referenced specifications, including revisions, except as modified herein.

UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

Maricopa Association of Government

July 1, 1974

Arizona

3. EARTHWORK

Base material shall be compacted to the grading plane of the road base as shown on the drawings.

4. UNTREATED BASE

The untreated base shall be installed in accordance with Section 310 of the referenced specifications. The base material shall be crushed aggregate in accordance with Section 702, and shall be placed in the following manner:  
First Lift; A three-(3) inch layer of aggregate base  
Second Lift; A six-(6) inch layer of select material

Williams-Chandler WPP, Arizona

<sup>401</sup>  
(~~406~~-1)

6/79

RWCD Floodway - Reach 1

Dip Crossings

5. ASPHALT CONCRETE PAVEMENT

The asphalt concrete pavement shall be installed in accordance with Section 321. Materials shall conform with the requirements of Section 710, except no mineral filler or blending sand will be required. Asphalt shall be AR 4000 and conform to the requirements of Section 711. The mineral aggregate shall meet the grading requirements within the range of specified tolerances for mix designation C-3/4.

6. PRESERVATIVE SEAL FOR ASPHALT CONCRETE

The preservative seal shall be installed in accordance with Section 334. The material shall conform to Section 718 and shall be applied at the rate of 0.07 of a gallon of diluted mixture per square yard.

7. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the dimensions of the surface of the asphaltic concrete will be measured to the neat lines shown on the drawing and the surface area will be computed to the nearest square yard. Payment will be made at the contract unit price for asphalt concrete pavement. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule, will be included in the payment for the item of work to which it is made subsidiary.

Williams-Chandler WPP, Arizona

401  
(406-2)

6/79

RWCD Floodway - Reach 1

Dip Crossings

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 8, Asphalt Concrete Pavement

- (1) This item shall consist of furnishing and installing the asphalt concrete pavement, including the untreated base and preservative seal, within the following limits, as shown on the drawings and staked in the field.

Between Station 1314+98<sub>+</sub> and Station 1315+20<sub>+</sub> centerline floodway.

Between Station 1430+67<sub>+</sub> and Station 1430+89<sub>+</sub> centerline floodway.

- (2) Payment will be made in accordance with Section 7.

Williams-Chandler WPP, Arizona

401  
(406-3)

6/79

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Dip Crossings