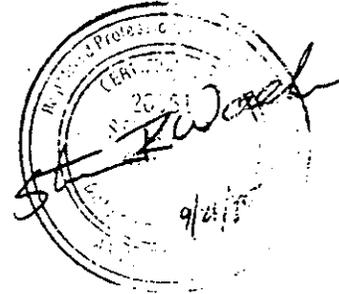


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CONSTRUCTION SPECIFICATIONS  
FOR

CONTRACT FCD 95-02  
Casandro Wash Dam in the Town of Wickenburg  
near the intersection of U.S. Highway 60 and Mariposa

CH2M Hill  
P. O. Box 28440  
Tempe, AZ 85285



(Engineer's Seal)

Prepared For  
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Recommended by: Edward A. Raleigh Date: 9/26/95  
Edward A. Raleigh, E.E., Chief  
Engineering Division

Issued for Public Bidding by: Stanley L. Smith, Jr. Date: 9-26-95  
Stanley L. Smith, Jr., P.E.  
Acting Chief Engineer and General Manager

SUPPLEMENTARY TO MARICOPA ASSOCIATION OF GOVERNMENTS UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION EDITION OF 1992 AND REVISIONS AND SUPPLEMENTS THERETO.

STATE OF ARIZONA  
DEPARTMENT OF WATER RESOURCES  
SAFETY OF DAMS SECTION  
THIS DRAWING IS APPROVED  
FOR CONSTRUCTION

APPLICATION NO. 07.65  
DATE 12-1-95 JB

**Flood Control District of Maricopa County**  
**Casandro Wash Dam, Town of Wickenburg**  
near the intersection of U. S. Highway 60 and Mariposa Drive

Contract FCD 95-02  
Addendum No. 1  
October 16, 1995



**FCD CONTRACT NO. 95-02**

**To Contract Documents:**

**TITLE:** Casandro Wash Dam

**OWNER:** Flood Control District Of Maricopa County

The above documents are herein modified. The provisions of said documents applicable to these modifications remain unchanged unless specifically indicated otherwise herein. This addendum forms a part of the contract documents and modifies them as follows:

**To the Bidding Schedule:**

**Page 6 of 31:** Item No. 405, Change the Approximate Quantity from 14 to 18.

**Page 7 of 31:** Delete Bid Items No. 650-1 & 650-2.

**To the Special Provisions:**

**Section 202.2 Water and Dust Control, Page 3 of 53**

Replace the last sentence of the first paragraph with the following sentences: The Town of Wickenburg will provide water and meter the water for the construction of the project, but there will be no charge for the water to the Contractor. The Contractor needs to contact the Public Works Department at 506-1622 for the Town to install a meter.

**Subsection 211.1--Description, page 10 of 53**

DEFINITIONS, Zone 1 material. Add "Material containing greater than 20 percent by weight passing the No. 200 sieve shall be mixed with cleaner material to produce a homogenous mixture with less than 20 percent passing the No. 200 sieve prior to placement in the dam." after the first full sentence in the first paragraph.

**Subsection 301.1--Description, page 18 of 53**

DEFINITIONS, Subgrade. Add "and excavation" after the word "grubbing."

**Subsection 430.3.2--Seeding, page 24 of 53**

Add "and Arizona Department of Water Resources. No deep rooted or extremely thorny species shall be planted" after the word "Engineer" in the last sentence of the last paragraph before the table entitled "Seed Mix A."

Add the following Section :

**Subsection 650.1 - Instrumentation Conduit**

This section covers the work necessary for construction of the instrumentation conduit within the dam embankment.

**Subsection 650.2 - Conduit**

Schedule 80 PVC in 2-inch-diameter as required. Pipe shall conform to ASTM D 1785. Use Schedule 80 fittings conforming to ASTM D 2467 with primer and adhesive solvent connections conforming to ASTM D 2564. Install conduit as shown on plans. Provide and install 200-lb minimum test pull string inside the conduit.

**Subsection 650.3 - Payment**

The instrumentation conduit shall be made at the bid price per lineal foot of pipe, which shall be full compensation for placement of the conduit system complete in place. No separate payment will be made for fittings or other materials required to complete the work.

**BID ITEM 650 - INSTRUMENTATION CONDUIT**

**To The Construction Drawings:**

To Sheet 2 of 34, General Notes, Abbreviations/Notes.  
Replace with revised Sheet 2 of 34; Changes made to project hydrographs.

**To Sheet 4 of 34, Site Improvements and Grading Plan.**

Replace with revised Sheet 4 of 34. Centerline locations of finger drains shown on plan.  
A marker has been added at the outlet of each finger drain.

FCD 95-02

Casandro Wash Dam

Addendum No. 1, October 16, 1995

Page 3

**To Sheet 5 of 34, Dam Centerline Profile.**

Replace with revised Sheet 5 of 34. Corrected boring logs BX-2 and BX-4.

**To Sheet 9 of 34, Structural Details--Spillway.**

Replace with revised Sheet 9 of 34. Changed elevation at first expansion joint downstream of crest from 2153 to 2152.94. Added clarifying dimensions to Detail 101.

**To Sheet 10 of 34, Structural Details--Stilling Basin.**

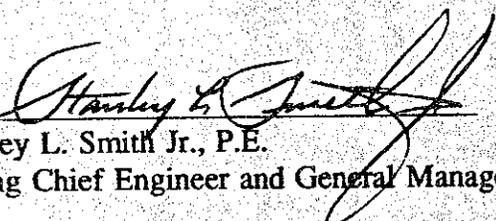
Replace with revised Sheet 10 of 34. Added line showing location of Zone 2 backfill behind spillway wall to Section FF. Corrected title of Section FF from Still Basin to Stilling Basin. Added 1'-6" dimension to spillway slab at elevation 2124. Spillway slab thickness varies evenly from 1'-0" thick at the first construction joint up from the stilling basin (Approximately 30'-6" up from the stilling basin floor) to 1'-6" thick at the stilling basin floor.

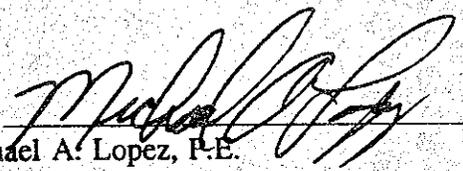
**To Sheet 12 of 34, Structural Details--Outlet Pipe (2 of 2).**

Replace with revised Sheet 12 of 34. Changed anchor bolts and epoxy anchor from galvanized to stainless steel on the outlet pipe access screen Detail 112.

**To Sheet 15 of 34, Drain Pipe Details.**  
Replace with revised Sheet 15 of 34. Added clarifying note about 8" animal guard to  
Drain Pipe Riser and Outlet Detail 5.

**Flood Control District of Maricopa  
County**

By:   
Stanley L. Smith Jr., P.E.  
Acting Chief Engineer and General Manager

By:   
Michael A. Lopez, P.E.  
Civil/Structures Branch Manager

# FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Casandro Wash Dam, Town of Wickenburg  
near the intersection of U. S. Highway 60 and Mariposa Drive

Contract FCD 95-02  
Addendum No. 2  
October 20, 1995

FCD CONTRACT NO. 95-02

To Contract Documents:

TITLE: Casandro Wash Dam

OWNER: Flood Control District of Maricopa County

To Addendum No. 1 dated October 18, 1995

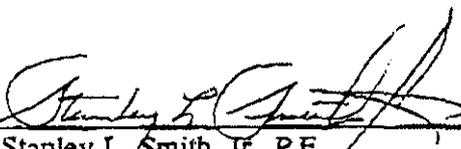
To the Bidding Schedule:

Corrects error:

Page 7 of 31: Should read:

Delete Bid Items No. 655-1 Precipitation/Pressure Transducer Package and No. 655-2 Vented Cable for the Pressure Transducer

FLOOD CONTROL DISTRICT  
OF MARICOPA COUNTY

By:   
Stanley L. Smith, Jr., P.E.  
Acting Chief Engineer and General Manager

By:   
Michael A. Lopez, P.E.  
Civil/Structures Branch Manager



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CONTRACT FCD

CONTRACT FCD 95-02  
CASANDRO WASH DAM

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(Area to left reserved for  
Engineer's Seal)

**FLOOD CONTROL DISTRICT OF MARICOPA COUNTY  
CONTRACT FCD 95-02  
CASANDRO WASH DAM**

**SPECIAL PROVISIONS**

**SECTION 201 - CLEARING AND GRUBBING**

Clearing and grubbing of the site shall conform to Section 201 of the MAG Uniform Standard Specifications, except as modified herein.

**Subsection 201.1 - Description**

Add the following:

All fill areas, waste disposal areas, borrow areas, and under structures shall be cleared and grubbed, as shown on the plans.

**DEFINITIONS**

**Interfering or Objectionable Material:** Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying.

**Clearing:** Removal of interfering or objectionable material lying on or protruding above ground surface.

**Grubbing:** Removal of vegetation and other organic matter including roots greater than 1/2-inch caliper to a depth of 18 inches.

**Project Limits:** Areas, as shown or specified, within which work is to be performed. All work is to occur within the right-of-way and easements shown on the plans.

**Subsection 201.3 - Construction Methods**

Add the following:

Clear and grub the detention basin and damsite foundation to a line 10 feet outside the excavation limit on the toe of the dam and spillway, 5 feet outside the cut or fill limits on the detention basin perimeter and all borrow areas. Remove all rubbish, debris, and other objectionable matter regardless of depth. Remove all trees, stumps, trash, and roots larger than 1/2-inch in diameter to a depth of 18 inches. Remove all rubbish, trash, and objectionable material from the project limits, including pavement building foundations and building debris.

Stake clearing and grubbing limits using the project benchmark and layout control lines, and obtain Engineer's approval prior to commencing clearing, grubbing, and stripping. Do not clear beyond approved limits. Provide stakes at 50-foot stations or closer as required to accurately define the limits of work.

Clear and grub only after adequate erosion and sediment controls are in place. Dispose of material removed by clearing and grubbing off site in waste disposal areas that are approved by federal, state, and local authorities.

**Subsection 201.5 - Payment**

Payment for the work in this section will be made at the lump sum amount stated in the bid.  
**BID ITEM 201 - CLEARING AND GRUBBING**

**SECTION 202 - MOBILIZATION**

**Subsection 202.1 - Description**

Add the following:

The work under this section shall consist of preparatory work and operations, including, but not limited to, the movement of personnel, equipment, supplies and incidentals to and from the project site; the establishment of all offices, buildings, and other facilities necessary for work on the project; providing water for dust control and compaction; and for all other work and operations that must be performed and costs incurred on various items on the project site.

**Engineer's Field Office:**

The Contractor shall provide a field office for the duration of the project for use by the Engineer. The field office shall be located on the project site on Parcel CWD-3 outside of the grading limits or otherwise with the approval of the Engineer. The office may be in the same building or trailer as office space of the Contractor, provided that such office is separated from the area used by the Contractor by a wall with a locking door. The office shall also have its own door to the outside.

The office shall have a minimum of 150 square feet. The office shall be fully equipped and shall be in place and acceptable to the Engineer not later than 10 days after the issuance of the Notice to Proceed (NTP). The office shall be provided and maintained by the Contractor until seven (7) days after the project acceptance by the District.

The Contractor shall provide hookups and continuous service for electricity, telephone, air conditioning, heating, and water service. All utility costs, except long distance calls made by the Engineer shall be the responsibility of the Contractor. Permits and hookup fees for the office are the responsibility of the Contractor.

The room for use by Engineer and Owner Personnel shall be equipped with the following:

1. Lights: Electric lighting, nonglare type to provide adequate illumination at desk height.
2. Heating and Cooling: Capable of maintaining an air temperature of 72 degrees F.
3. One office desk with locking drawers and padded swivel chair.
4. Four folding office chairs.
5. Two 3- by 5-foot tables.

6. One dry erase board.
7. One office phone.
8. Maintenance: The Contractor shall maintain all the facilities and furnished equipment in good working condition.
9. Copy machine for sizes 8.5 x 11, 8.5 x 14, and 11 x 17 paper sheets, along with paper.
10. Plain paper FAX machine.
11. One 4-drawer legal size file cabinet with lock.

No separate payment shall be made for the Engineer's field office, the cost thereof being an incidental cost to the work.

#### **Subsection 202.2 - Water and Dust Control**

Contractor shall develop and pay all costs for obtaining and applying water at the construction site. This includes water for dust suppression, borrow areas, embankments, roads, and all uses on the project. Contractor shall develop a reliable water source that has sufficient capacity to deliver adequate supplies for all simultaneous uses.

Water shall be applied to all haul roads with sufficient frequency that no dust is created that would hinder safe driving or be offensive to users of the roads. Some roads are used by nearby residents, and Contractor shall maintain water on these roads as required to prevent dust. Alternatively, the Contractor may submit a dust palliative design to the Engineer for approval.

Haul roads shall be constructed as required to accomplish the work. Contractor shall keep all roads in safe driving condition and shall remove all evidence of where haul roads were at the end of construction. Loosen by plowing and discing all haul roads and provide seeding as specified.

#### **Subsection 202.3 - Payment**

Payment shall be made on the basis of the lump sum price bid and shall be full compensation for supplying, furnishing, and subsequent removals of all materials, facilities, and services including water and dust control and performing all work involved in as specified herein. The lump sum price bid shall not exceed three percent (3%) of the total project bid amount exclusive of mobilization. No additional payment will be made for occupancy and services during periods of contract extension of time.

#### **BID ITEM 202 - MOBILIZATION**

#### **SECTION 204 - EXCAVATION FOR DAM AND DETENTION BASIN PERIMETER SLOPES**

Add the following:

Section 204 - EXCAVATION FOR DAM AND DETENTION BASIN PERIMETER SLOPES to the MAG Uniform Standard Specifications.

### **Subsection 204.1 - Description**

The work under this section consists of all excavation for dam foundations, abutments, and detention basin perimeter slope embankments. For roadway excavation see Section 205. For structure excavation, see Section 206.

Submit excavation plan detailing methods and sequencing of excavation, proposed location of stockpiles of excavated materials, and proposed onsite spoil disposal areas.

Provide adequate survey control to avoid unauthorized overexcavation. Replace damaged or disturbed stakes as requested by the Engineer. Material wetted when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

Complete applicable clearing and grubbing work specified in Section 201 - CLEARING AND GRUBBING, prior to excavating. Conform to applicable requirements of Section 640, prior to initiating excavation.

Comply with local, state, and federal regulations for excavation support and safety. Install and maintain excavation support as necessary to support sides of excavations and prevent detrimental settlement and lateral movement of existing facilities, adjacent to property, and completed work. The Contractor shall be solely responsible for making all excavations in a safe manner. Provide appropriate measures to retain excavation sideslopes and ensure that persons in or near the excavation are protected.

### **Subsection 204.2 - General**

Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered. Excavate to lines, grades, and dimensions shown as necessary to accomplish work as shown or as directed. Excavate to within tolerance of plus or minus 0.1 foot except where thickness, dimensions, or grades are shown or specified or where maximum or minimum controls are shown. Allow for forms, working space, granular base, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against the earth. Do not overexcavate without authorization of Engineer. Remove or protect obstructions as shown and as specified.

The method of excavation used is optional; however, no equipment shall be operated within 5 feet of existing structures or newly completed construction where there is a potential for damage. Excavation that cannot be accomplished by machine without endangering the present or new structures or damaging the foundation material shall be done with hand tools.

### **Subsection 204.3 - Dam Foundation Excavation and Overexcavation**

Foundation excavation includes removal of loose soil debris and unsuitable material from beneath the dam, appurtenances, and from under the road embankments. The estimated depth of excavation is shown on the plans. The intent is to excavate to a dense, firm foundation over the full footprint of the dam by full removal of the recent alluvial stream channel deposits and any loose or otherwise unacceptable older alluvial deposits. The exact depths

will be field-determined by the Engineer during construction. Handwork and/or small equipment may be necessary to follow the surface of the dense low porosity foundation. All loose or unacceptable material shall be removed using motorized or hand-held tools to the satisfaction of the Engineer. The dam foundation must also be inspected and approved by a representative of the Arizona Department of Water Resources, Dam Safety and Flood Engineering Unit, prior to proceeding with the work described in Subsection 301.

Transitions in the finished foundation grade shall be smooth with uniform slopes. The Contractor shall conduct the excavation in a manner that does not disturb the intact materials below the excavation bottom. This may require the use of lightweight equipment, temporary construction haul roads, or other measures to protect the foundation. If the Contractor's operations disturb otherwise acceptable foundation materials not approved for removal by the Engineer, the Contractor shall overexcavate the disturbed material and backfill the overexcavation with the material shown for the overlying embankment, and compact to the satisfaction of the engineer, all at the Contractor's sole expense.

Excavate temporary cut slopes to be stable against failure, but no steeper than 1 horizontal to 1 vertical. Do not remove soil or flatten slope beyond limits required for safety unless approved by the Engineer.

Selected material excavated from the foundation area meeting Zone 1 specifications may be used to construct portions of the embankment. The stockpiling and rehandling of excavated material shall be accomplished in a manner approved by the Engineer. Excavated soil not suitable for use in the embankment shall be placed in the onsite disposal area designated by the Engineer. Foundation excavation for the entire damsite below existing grade shall be completed to the satisfaction of the Engineer prior to placing any fill material.

#### **Subsection 204.4 - Structure Excavation**

Remove overbuild in structure areas down to subgrade of structure or drainage layer. Use hand excavation methods where required. Remove all loose and uncompacted fill. Maintain moisture content and specified compaction until concrete or drainage material is placed. Obtain Engineer's approval prior to placing concrete or drain material.

#### **Subsection 204.5 - Detention Basin Perimeter Fill Areas**

After completing clearing and grubbing in areas to receive fill, remove loose soil to a depth of not less than one foot. Excavate additional areas requested by the Engineer if loose, soft, or unstable conditions are present. Make smooth transitions with adjoining areas. Expose native undisturbed soil and obtain approval of foundation surface from Engineer within 2 hours of placing fill. Temporary cut slopes shall be maintained in a stable condition until backfilled.

#### **Subsection 204.6 - Permanent Cut Slopes**

Excavate cut slopes to conform with lines, grades, and cross sections shown. Remove stones and rock that exceed 3 inches in diameter and that are loose and may roll downslope. Remove exposed roots from cut slopes. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend offsite or outside easements and right-

of-ways, or adversely impact existing facilities, adjacent property, or completed work. Compact any loose soil remaining on slopes by track-walking with D7 dozer using at least three passes. Any slopes overexcavated below the cut plane shall be backfilled with embankment material placed, moisture conditioned, and compacted as approved by the Engineer.

**Subsection 204.7 - Stockpiling Excavated Material**

Stockpile excavated material that is suitable for use as fill or backfill until material is needed. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads, streets, or drainage. Do not stockpile excavated material adjacent to trenches and other excavations unless excavation sideslopes and excavation support systems are designed, constructed, and maintained for stockpile loads. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed work.

**Subsection 204.8 - Waste Disposal Area**

Remove vegetation from designated waste disposal area. Place unsuitable or excess material in 1-foot loose lifts and compact by routing equipment through area. Make conscious effort to route equipment uniformly throughout area. Trim exterior slopes to a neat appearance and slope to drain. Seed area at completion of project as specified for detention basin slopes.

**Subsection 204.9 - Measurement**

Excavation volume for dam foundation and detention basin perimeter slopes shall be computed on the basis of field cross sections taken by the Contractor after all areas have been completely excavated and foundation preparation has been performed and approved by the Engineer. Cross sections will be taken at 50-foot spacing with a minimum of three sections per overexcavated area. The volume of overexcavation will be computed to the nearest 50 cubic yards.

Survey and computation for quantity measurements shall be made by the Contractor and checked and verified by the Engineer. Contractor shall resurvey as requested by the Engineer if there is disagreement on the accuracy or volume computations at no additional cost to the Owner.

**Subsection 204.10- Payment**

All work necessary to complete the excavations stated in this section and not specifically identified for payment shall be considered incidental to other pay items.

The cost of excavating the dam foundation and detention basin perimeter fill areas and cut slopes to the minimum pay limits shown on the plans and for authorized overexcavation approved by the Engineer shall be paid at the unit price stated in the bid. The unit price bid for this item will be paid for the final quantity measured as approved by the Engineer, unless such quantity varies from the bid quantity by more than 25 percent. In such case, the unit price may be subjected to adjustment as established in accordance with the contract modification procedures set forth in these contract documents.

**BID ITEM 204 - EXCAVATION FOR DAM AND DETENTION BASIN PERIMETER SLOPES**

**SECTION 210 - BORROW EXCAVATION**

Excavation of borrow material from the bottom of the detention basin shall conform to Section 210 of the MAG Uniform Standard Specifications except as modified herein.

**Subsection 210.1 - Local Borrow**

Add the following:

Borrow material shall be obtained from the required excavation of the dam and detention basin as indicated on the plans. Excavation of the detention basin shall be performed in a systematic manner, keeping the borrow area neat and orderly at all times.

Except as approved by Engineer, do not excavate from the borrow area when ground is frozen or when borrow is too wet to achieve required compaction. Review borrow area limits with Engineer prior to excavating. Obtain Engineer's approval of deviations from Construction Drawings prior to their implementation.

Keep borrow graded to drain and take all necessary precautions to minimize erosion and loss of silty and clayey soil. Dewater the borrow area as necessary to permit excavation and use of the borrow materials. The Contractor shall review his excavation plan with the Engineer prior to any excavation from the borrow. The Contractor shall operate the borrow area in a manner that will produce uniform material that meets the specifications for the embankment.

The intent is to construct the dam and all fills from material excavated from the detention basin area, resulting in a basin having final grades as shown on the plans. However, obtaining the correct quality and quantity of borrow material for the dam embankment and providing storage capacity in the detention basin are required. Therefore, if the borrow area has to be expanded to obtain the necessary material for the dam, or if additional material must be removed from the basin to obtain the storage capacity, the finish grading of the detention basin may be adjusted as necessary, with the excavated material placed within the disposal area approved by the Engineer. Changes to the basin grading plan shall be reviewed with the Engineer prior to making the necessary adjustments. The materials to be used as fill will be excavated from local borrow by routing equipment or other means, as approved by the Engineer, to meet the material requirements in Section 211 - Fill Construction.

Do not excavate more borrow material than required to provide embankment for dam, roads, and perimeter fills, and to provide required storage area. Limit excavation at borrow areas to a depth that will permit completed area to drain to basin outlet after completion of work. Grade borrow areas to drain without ponding surface water and blend graded surfaces neatly with surrounding terrain at completion of borrow operations. Maximum final slope shall be 2 horizontal to 1 vertical or as shown, and the minimum shall be 1 percent.

Do not use borrow areas for disposal of any materials, unless otherwise specified or shown.

#### **Subsection 210.4 - Measurement**

Add the following:

Quantities of borrow material from the detention basin will be computed on the basis of the cross sections shown on the Drawings and cross sections completed by the Contractor at the completion of the project. Cross sections shall be taken at the same locations as those on the Drawings, but not greater than 50-foot spacing. The volume of excavated material to the neat lines shown will be computed to the nearest 50 cubic yards. Survey and computation for quantity measurements shall be made by the Contractor and checked and verified by the Engineer. Contractor shall resurvey as requested by the Engineer if there is disagreement on the accuracy or volume computations at no additional cost to the Owner.

#### **Subsection 210.5 - Payment**

Payment for borrow excavation from the detention basin will be made at the lump sum price bid, and shall be full compensation for all labor equipment and materials necessary for excavating the detention basin as shown on the plans and described herein.

#### **BID ITEM 210 - BORROW EXCAVATION**

### **SECTION 211 - FILL CONSTRUCTION**

Fill construction shall conform to Section 211 of the MAG Uniform Standard Specifications except as modified herein.

#### **Subsection 211.1 - Description**

Add the following:

#### **DEFINITIONS**

**Relative Compaction:** Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D698-78. Use 6-inch mold. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by Engineer.

**Optimum Moisture Content:** Determined in accordance with ASTM standard specified to determine maximum dry density for relative compaction. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, excavation to grade, and subgrade preparation.

Completed Course: A course or layer that is ready for next layer or next phase of work.

Lift: Loose (uncompacted) layer of material.

Well-Graded: A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

Influence Area: Area within planes sloped downward and outward at 60 degree angle from horizontal measured from:

- 1 foot outside outermost edge at base of foundations or slabs.
- 1 foot outside outermost edge at surface of roadways or shoulder.
- 0.5 foot outside exterior at spring line of pipes or culverts.

Borrow Material: Material from required excavations or from designated borrow areas in basin area.

Selected Backfill Material: Materials available onsite that Engineer determines to be suitable for specific use.

Segregation: Nesting of larger particles in a soil mass so that finer particles do not completely fill the voids. Segregation also refers to lenses or layers of finer material that are not intermixed with coarser particles in accordance with the specified gradation.

Imported Material: Materials obtained from sources offsite, suitable for specified use.

Structural Backfill: Fill materials required around structures, walls, and other facilities shall be Zone 1 embankment material or concrete as shown on the plans.

Embankment Material: Fill materials required to raise existing grade.

Basin Perimeter Fills: Use onsite soil free from organic and deleterious materials approved by the Engineer.

#### Zone 1

Material for the dam embankment and road fills shall consist of 3-inch minus silty sand obtained from onsite borrow area, free from deleterious and organic material, well-graded from coarse to fine, and containing sufficient fines to bind material when compacted, and

with at least 5 percent by weight passing No. 200 sieve. No clean sand or granular material shall be placed in the dam. The material in the detention basin bottom is suitable provided it is well mixed as it is excavated, it meets the above gradation, and it contains no layers, zones, or lenses of clean sand.

### Zone 2

Material for the chimney drain and pervious filter zones shall consist of well-graded processed imported sand and crushed gravel free from clay, organic matter, or other deleterious material. Gradation as determined in accordance with ASTM C117-90 and C136-84a:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
1-1/2 inch	100
1 inch	75 - 100
3/4-inch	60 - 100
1/2-inch	50 - 90
1/4-inch	30 - 65
No. 4	20 - 55
No. 8	10 - 35
No. 16	0 - 15
No. 30	0 - 5
No. 200	<1

All points on individual grading curves obtained from representative samples of Zone 2 material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated grading limits plotted on a mechanical analysis diagram. The individual grading curves within these limits shall not exhibit abrupt changes in slope denoting gap grading, scalping of certain sizes, or other irregularities that would be detrimental to the proper functioning of the filter material. Uniformity coefficient shall be between 3.3 and 7.0 as determined by the ratio of the D60 size to the D10 size.

In addition to the above gradation requirements, the Zone 2 material shall have a loss not to exceed 12 percent after being subjected to 12 cycles of the sodium sulfate soundness test in accordance with ASTM C88. The Zone 2 material shall have a percentage of wear not to exceed 40 percent when tested for resistance to abrasion in conformance with ASTM C131, Grading D. The permeability of Zone 2 material shall exceed 1 foot/minute. Contractor shall have independent laboratory perform 6-inch diameter permeability test. Provide test procedures to Engineer at least 7 days prior to performing the test. Provide test results to Engineer prior to bringing material to project site.

### **Subsection 211.2 - Placing**

Add the following:

Backfill against concrete structures only after concrete has attained compressive strength specified in Sections 725. Obtain Engineer's acceptance of concrete work and attained strength prior to placing backfill. Remove all soil and debris from behind concrete walls that does not meet the subgrade preparation specification or the specified dam or backfill material requirements prior to placing specified material. During filling and backfilling around structures, keep surface of fill and backfill around each structure horizontal and level. Bring existing embankment surfaces up to specified moisture content and relative compaction of surrounding embankment prior to placing backfill. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

Do not place fill or backfill if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen or excessively wet.

Place Zone 1 fill in maximum 8-inch thick loose lifts over the full width and length of the embankment and compact to specified relative compaction. Maintain the embankment horizontal with a cross slope not to exceed 1.5 percent. No vertical joints or steps will be allowed. Overbuild embankment horizontally 2-foot minimum and trim back to neat line so that specified compaction is achieved at the neat lines shown. In the spillway and stilling basin area, overbuild the embankment at least 5 feet horizontally beyond the required base of the structures. In the detention basin fills, the overbuilt embankments shall be trimmed smooth to the neat lines indicated, unless approved by the Engineer. After trimming of slopes provide ridges on slopes parallel to crest of the embankment to provide seed bed and prevent erosion.

Where fill is to be placed against native soil, key new fill into existing slope at least 1 foot horizontally. If fill is too narrow to drive equipment on and is less than 10 feet wide, then excavate native soil, moisture condition, and compact to specified relative compaction.

Place Zone 2 material in specified location in 8-inch maximum loose lifts. Contractor may use whatever bins, boxes, forms, or placement methods are required, except that the Zone 2 material will be placed in the embankment chimney drain using bins, boxes, or forms to maintain the minimum width required of 4 feet and to minimize contamination of the Zone 2 material with other materials. Zone 2 materials in the chimney drain will be maintained a minimum of 3 inches above the adjacent Zone 1 material prior to compaction. The Contractor shall pull up or remove placement bins, boxes, or forms prior to compacting the next lift of Zone 2 materials in the chimney drain. Deviation from the specified width of the chimney drain shall not exceed plus 2 feet or minus 0 inch from the width shown on the plans. During construction, the location of the centerline of the chimney drain shall be established and maintained by the Contractor for location and drain width reference. Where Zone 2 material is shown for trench or wall backfill or for drainage beneath the spillway floor, the thickness shown on the plans is the minimum. The maximum thickness shall be approved by the Engineer.

Maintain Zone 2 material free from dirt, Zone 1 material, and other contamination throughout the construction. Avoid segregation during handling and placement. Protect compacted materials until the overlying layer is placed or the project is accepted by the Owner. If traffic crosses the Zone 2 material, take whatever precautions are necessary to protect and repair all damage prior to placing new fill material.

If pipe is to be laid within fill or backfill, first, fill or backfill to an elevation 2 feet above top of item to be laid, then excavate the trench, install bedding as specified in Section 601, if applicable, and then place the pipe. Finally, backfill envelope zone and remaining trench as specified in Section 601, before resuming filling or backfilling specified in this section. No embankment shall be placed on the dam when pipes are being installed or backfilled.

Final lines and grades shall be constructed to within a tolerance of the least significant number shown, but in no case greater than a tolerance of 0.1 foot. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted. Construct all earthwork on the dam up to Elevation 2163.5 prior to starting construction of the spillway or stilling basin, unless approved by the Engineer.

Replace excavation carried below gradelines shown or established by Engineer as follows. For overexcavations beneath footings and slabs on grade use concrete of strength equal to that of respective footing or slab. Where overexcavation occurs beneath fill or backfill, use same material as specified for overlying fill or backfill. Trenches with unauthorized overexcavation shall have either concrete slurry backfill or granular pipe base material, as specified in Section 601 and directed by the Engineer. Authorized overexcavation of trench stabilization material shall be as specified in Section 601. At permanent cut slopes (where overlying area is not to receive fill or backfill) that are flat to moderate steep (3:1, horizontal run: vertical rise or flatter), use earthfill. If the slopes are steep, (steeper than 3:1), correct overexcavation by transitioning between overcut areas and designed slope adjoining areas, provided such cutting does not extend offsite or outside easements and right-of-ways, or adversely impact existing facilities, adjacent property, or completed work. Backfilling overexcavated steep-sloped areas is prohibited unless, in Engineer's opinion, backfill will remain stable, and overexcavated material is replaced as compacted earth fill.

Excavate handle and place material from required excavations so as to produce fill free from rocks larger than 3 inches, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials. Material containing more than 10 percent gravel particles is unacceptable. Mix/blend material for the embankment so there are no lenses, pockets, layers, or accumulations of sand and that fill is uniform across the dam or perimeter embankment.

#### **Subsection 211.2.1 - Finish Grading**

The dam and detention basin areas shall be graded as required to leave a smooth appearance conforming to the general shape and cross sections indicated on the plans. Limits of graded areas shall transition to natural ground resulting in gradual slope transitions and positive drainage as indicated by the contours shown on the plans.

### **Subsection 211.3 - Compacting**

Add the following:

#### **Compaction Equipment**

Compaction equipment for the miscellaneous fills and structure backfill or trench backfill not in the dam embankment shall be of suitable type and adequate to obtain the relative compaction specified, and shall provide satisfactory breakdown of materials to form a dense fill. Selection of proper compaction equipment is the Contractor's responsibility. Compaction equipment shall be operated in strict accordance with the manufacturer's instructions and recommendations. Equipment shall be maintained in such condition that it will deliver the manufacturer's rated compactive effort. If inadequate compaction is obtained, larger and/or different types of additional equipment shall be provided by the Contractor. Hand-operated equipment shall be capable of achieving the specified compaction. Compaction of all materials shall be by mechanical means. Traditional methods of "jetting" or flooding" will not be permitted.

Compaction equipment used for compacting Zone 1 material and perimeter fills shall be a heavy-duty self-propelled vibratory tamping sheeps foot roller, adequate to break down, mix, and knead borrow material into a dense, uniform embankment. Roller travel speed shall not exceed 5 miles per hour.

Compaction equipment for compacting the Zone 2 material shall be a vibratory drum roller. The static weight of the roller shall be at least 8,000 pounds. The dynamic force shall be at least 16,000 pounds and an applied force of not less than 5,000 pounds per foot of drum width. Roller shall be operated between 1,100 and 1,500 vibrations per minute. The roller may be either towed or self-propelled; roller shall travel at speeds not to exceed 2.0 miles per hour. Alternative equipment may be used provided the Contractor demonstrates that densities equal to those obtained with the specified equipment can be obtained. If the Zone 2 material is placed in trenches or against slopes, equivalent equipment to that given above shall be used. Obtain Engineer's approval of alternative equipment at least 1 week prior to using alternative equipment at site.

#### **Moisture Control**

Equipment for applying water shall be of a type and quality adequate for the work and shall not leak. Irrigation equipment for prewetting shall have adequate control to adjust the application as necessary for obtaining the specified moisture content. Trucks or other vehicles for water spreading shall be equipped with a pressurized distributor bar or other devices with adequate control of pressure to ensure uniform application. Equipment for mixing and drying out material shall consist of blades, discs, or other equipment as necessary. Water used for moisture conditioning shall be free of hazardous or toxic contaminants, or contaminants deleterious to proper compaction.

When the materials in the borrow areas or the dam foundation area are below optimum moisture content, they shall be conditioned to the proper moisture content in the borrow areas

and required excavation area before excavation. Moisture shall be introduced into the borrow areas by irrigation sufficiently in advance of excavation and embankment operations so the moisture has time to penetrate and uniformly condition the soil. Prewetting of the borrow area is recommended to provide uniform moisture in the Zone 1 material.

When moisture is introduced into the borrow areas, required excavation area, and embankment foundation area, care shall be exercised to moisten the material uniformly to produce the required moisture content, avoiding both excessive runoff and accumulation of water. The Contractor is cautioned to carefully control the application of water and check on the depth and amount of water penetration during application so as to avoid applying too little or too much water. Contractor shall make allowances for water loss during excavation, transportation, and placing operations. Supplementary water shall be added to the material by sprinkling the surface of the borrow area prior to excavation to the extent possible or on the embankment surface if material has dried. Each layer of embankment shall be conditioned by discing and application of additional water to prepare the surface to receive the next layer of fill. If borrow area or required excavation becomes dry, re-irrigate to the proper moisture content. Surface of embankment shall be maintained in a moist condition until the next lift is completed.

If there is excessive moisture in the borrow area or required excavation, reduce the moisture by selective excavation to secure the drier materials; by excavating and placing in temporary stockpiles material containing excessive moisture; by excavating drainage ditches; by allowing adequate additional time for curing or drying by aeration discing; or by other means.

The Contractor shall excavate sufficient suitable material from the borrow area to complete the work under these specifications regardless of whether overly wet conditions encountered are caused by groundwater, precipitation, overirrigation, difficulty of draining, or for any other reason.

During placement of embankment, the moisture content of the underlying layer shall be maintained within the range for embankment as specified.

Previously placed materials not meeting the specified water content and dry density requirements, as determined by the Engineer's tests, shall be reworked and retested until the specified moisture content and density are obtained. If previously compacted and accepted material falls outside of the range of placement moisture contents, the Contractor shall rework the fill and recompact to the specified densities. Reworking may include discing, removal, rehandling, moisturizing, drying, reconditioning, or combinations of these or other mechanical procedures. The use of admixture is prohibited.

The moisture contained in the embankment materials during compacting shall be distributed uniformly throughout the layer of material being compacted. The allowable ranges of placement water content are based on design considerations and shall be within the following limits:

<u>Material</u>	<u>Range of Placement Moisture Content</u>	
	<u>% Dry of Optimum</u>	<u>% Wet of Optimum</u>
Zone 1, Embankment	2	2
Zone 2, Drain and Chimney Drain	3	3

When the moisture falls outside the moisture content limits specified above, the Contractor shall immediately make adjustments in procedures as necessary to maintain the water content within the specified limits.

#### Compaction of Zone 1

The initial 3 feet of Zone 1 embankment shall be placed on prepared ground surface, blended, and leveled to the specified lift thickness. When the specified moisture content is distributed uniformly through the layer, it shall be compacted to a minimum of 98 percent relative compaction. Scarify the top surface prior to placing each lift with a disc.

Above the initial 3 feet of embankment, after each layer has been placed, scarified, and leveled to a 10-inch thick loose layer before compaction including thickness of previously placed layer loosened by discing, and the specified moisture content distributed uniformly throughout the layer, it shall be compacted with the specified tamping foot roller operated in accordance with the manufacturer's recommendation; however, speed shall not be more than 5 miles per hour. When compacted, the dry density of the Zone 1 material shall be uniform throughout the depth of the layer. Passes of the roller shall be carried out so that the compactive effort is uniformly distributed in a systematic manner over the entire layer. The specified minimum relative compaction is 95 percent with the average of the most recent five tests at least 98 percent relative compaction.

#### Compaction of Zone 2

After each layer of material has been placed and leveled to a uniform thickness of 12 inches, moisten as specified, and compact with the vibratory roller hereinbefore specified. Roller shall be operated in accordance with the manufacturer's recommendation; however, the speed shall not exceed 1-1/2 miles per hour. Passes shall be carried out so that the compaction effort is uniformly distributed in a systematic manner over the entire layer. The Zone 2 material shall be compacted to at least 95 percent relative compaction.

#### Detention Basin Perimeter Embankments

Miscellaneous fill material in the detention basin area shall be compacted to at least 95 percent relative compaction. No minimum running average above 95 percent is required. When the density is less than that specified, the Contractor shall immediately make adjustments in procedures as necessary to maintain the dry density within the specific limits.

## Road A and Road D

Fills not designed to retain water as part of the dam shall be compacted to at least 95 percent relative compaction. Use specified Zone 1 material for fill. Compact 8-inch maximum loose lifts with moisture content as specified.

## Foundation Stabilization Material

Foundation stabilization material shall be crushed rock or pit run rock, uniformly graded from course to fine, free from excessive dirt and other organic material, and maximum 2-1/2-inch particle size. This material will be used outside the dam footprint in the new sewerline if unsuitable material is found below the pipe base zone.

### Subsection 211.4 - Tests

Add the following:

All tests necessary for the Contractor to locate acceptable processed material shall be made by the Contractor. Certification that the material conforms to the specification requirements along with copies of the test results from a qualified commercial testing laboratory and representative samples of material shall be submitted to the Engineer for review at least 30 days before the material is required for use. All material samples shall be furnished by the Contractor at the Contractor's sole expense. Samples shall be representative and be clearly marked to show the location of the source of the material and the intended use on the project. Sampling of the processed material shall be done by the Contractor in accordance with ASTM D75 including appendixes. Notify the Engineer at least 48 hours prior to sampling. The Engineer may, at the Engineer's option, observe the sampling procedures. Tentative acceptance of the processed material shall be based on an inspection of the source and processing method by the Engineer and/or the certified test results submitted by the Contractor to the Engineer, at the Engineer's discretion. No processed materials shall be delivered to the site until the proposed source and processing methods and materials tests have been tentatively accepted in writing by the Engineer. Final acceptance will be based on tests made on samples of material taken from the completed and compacted course. Contractor shall make tests as necessary to control the quality of the compacted embankment according to these specifications. Engineer will make independent tests for acceptance of the completed portions of the work. All testing for final acceptance shall be performed by the Engineer.

Submit the following to the Engineer for approval:

#### Samples:

Imported materials for new sewer pipeline—20 pounds of each material.  
Zone 2 drainage material—20 pounds.

#### Quality Control Submittals:

1. Catalog and manufacturer's data sheets for all compaction equipment.
2. Certified test results from independent testing agency demonstrating that imported materials meet these specifications.

During production of imported material, test as follows:

1. Zone 2 Drain Material: 1 gradation per 75 cubic yards with minimum 1 per day and 1 sodium sulfate soundness test and 1 abrasion test per 100 cubic yards.
2. Aggregate Base Course: 1 gradation per 75 cubic yards with minimum 1 per day.
3. Foundation Stabilization Rock: 1 gradation per 50 cubic yards.
4. Granular Bedding, Class B: 1 gradation per production site.

If variation in gradation is occurring or if material appears to depart from specifications as it is being produced, the out-of-specification material shall be reprocessed until all stockpiled material complies with these specifications. If test results during placement indicate material does not meet specification requirements, terminate material placement until corrective measures are taken. Remove material placed in work that does not meet specification requirements. Provide Engineer with all test results prior to transporting material to jobsite.

In-Place Density Tests: The Engineer will perform in-place density tests in accordance with ASTM D1556-90 and D2922-81. Moisture content will be determined by using either the nuclear gage or by oven dry methods. Alternative methods of density and moisture content determination may be used at the discretion of the Engineer if approved by the Arizona Department of Water Resources. Testing locations and frequency shall be at the discretion of the Engineer based on the Construction Quality Assurance Plan. Contractor shall make test excavation and compact areas disturbed as requested by the Engineer.

#### **Subsection 211.6 - Payment**

Payment for constructing the earth dam embankment to the dimensions shown on the Drawings will be made under the prices bid for each of the respective items. Such payment shall be full compensation for all labor, equipment, and materials required for the complete construction of the dam's embankment.

**BID ITEM 211-1 - FILL CONSTRUCTION (ZONE 1 MATERIAL)**

**BID ITEM 211-2 - FILL CONSTRUCTION (ZONE 2 MATERIAL)**

**BID ITEM 211-3 - FINISH GRADING**

#### **SECTION 220 - RIPRAP CONSTRUCTION**

Riprap shall conform to the requirements of Section 220 of the MAG Uniform Standard Specifications except as modified herein.

#### **Subsection 220.41 - Plain Riprap**

Riprap downstream of the stilling basin shall be hand placed within 5 feet of the concrete stilling basin wall, and at the gated entrance area where voids are to be filled with Zone 1 material as shown. Riprap may be dumped in other areas where required.

Hand placed riprap shall consist of stone using material specified in Section 703 of these special provisions and using equipment to manipulate and densify the rock. Avoid segregation by mixing rocks as required to minimize voids. For the gated entrance area, hand place riprap and Zone 1 material together in lifts. Tamp and/or rod to ensure voids are properly filled. Place Zone 1 material over the top 12 inches of the area for a driving surface.

#### **Subsection 220.8 - Payment**

Payment for riprap construction complete shall be paid to the neat lines shown on the Drawings at the price bid per cubic yard in place. No payment will be made for placing the soil into or over the riprap.

#### **BID ITEM 220 - RIPRAP**

### **SECTION 301 - SUBGRADE PREPARATION**

Preparation of excavated areas and subgrade shall conform to Section 301 of the MAG Uniform Standard Specifications except as modified herein.

#### **Subsection 301.1 - Description**

Add the following:

This section includes subgrade preparation of the dam foundation, basin perimeter fills, and road fills that could retain water up to Elevation 2163.5 and all other road fills.

#### **DEFINITIONS**

Optimum Moisture Content: As defined in Section 211.

Prepared Ground Surface: Ground surface after completion of clearing and grubbing, excavation to grade, and scarification and compaction of subgrade.

Relative Compaction: As defined in Section 211.

Subgrade: Layer of existing soil after completion of clearing, grubbing, prior to placement of fill or roadway aggregate base course.

Proof-Rolling: Testing of subgrade by compactive effort to identify areas that will not support the future loading without excessive settlement. Proof-rolling shall be accomplished in road areas with a loaded 10-cubic yard dump truck or equal approved by the Engineer.

### **Subsection 301.2 - Preparation of Subgrade**

Add the following:

Notify the Engineer when road subgrade is ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity. Prepare subgrade when unfrozen and free of excessive water. When adding water to moisten dry subgrade, mix to make moisture content uniform throughout. For drying out wet subgrade, aerate material by blading, disking, harrowing, or other methods, to hasten drying process.

After completion of foundation excavation for dam, structures, and detention basin perimeter fills to the satisfaction of the Engineer and the representative of the Arizona Department of Water Resources, Dam Safety and Flood Engineering Unit, and prior to fill construction of the dam, scarify, moisture condition, and compact the 12 inches of native ground beneath the excavation surface to at least 95 percent relative compaction in accordance with ASTM D698. All compaction of foundation must be witnessed and approved by the Engineer. Any disturbance to the compacted surface shall be repaired immediately prior to placing overlying fill.

If foundation becomes disturbed or loosened prior to placement of overlying fill material, remove all unsuitable material until the foundation is approved by the Engineer and recompact to at least 95 percent relative compaction.

### **Subsection 301.3 - Relative Compaction**

Add the following:

Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling. Bring subgrade to proper grade and cross section and uniformly compact surface.

Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic. Maintain prepared ground surface in finished condition until aggregate base course is placed.

For compacting areas under roadways, compact the upper 12 inches of the subgrade to a minimum of 95 percent relative compaction as determined in accordance with ASTM D698.

Proof-roll subgrade to detect soft or loose subgrade or unsuitable material, as determined by Engineer. If soft or loose subgrade is found, adjust moisture content and recompact or overexcavate as specified in Sections 204 and 210, and replace with suitable material, as specified in Section 211. If unsuitable material is found, overexcavate as specified in Sections 204 and 210, and replace with suitable material from the excavation, as specified in Section 211.

**Subsection 301.8 - Payment**

Preparation of subgrade under the dam, earthfills, and roadway subgrade shall be paid for at the lump sum price bid.

**BID ITEM 301 - SUBGRADE PREPARATION**

**SECTION 310 - UNTREATED BASE**

Aggregate base course material for roadways shall conform to Section 310 of MAG Uniform Standard Specifications except as modified herein.

**Subsection 310.3 - Deficiency:**

Replace this section with the following:

When in the opinion of the Engineer there is reason to believe that a deficiency in thickness, or an excess of plasticity exists, additional aggregate base course material shall be placed. Such corrective measures shall be at no additional cost to the Owner.

**Subsection 310.4 - Payment**

Replace the section with the following:

Aggregate base course material shall be measured to the neat line as shown on the Drawings to the nearest square yard of full depth (4 inches) base course material. Payment shall be made at the unit price bid, and shall be full compensation for the placement and compaction of the roadway base material complete in place.

**BID ITEM 310 - AGGREGATE BASE COURSE (4-INCH)**

**SECTION 350 - REMOVAL OF EXISTING IMPROVEMENTS**

Removals shall conform to Section 350 of the MAG Uniform Standard Specifications except as modified herein.

**Subsection 350.1 - Description**

Add the following:

The work under this section shall include abandonment of the existing 10-inch VCP sewerline and manholes as shown on the plans and as specified herein.

### **Subsection 350.2 - Construction Methods**

Add the following:

#### **Removal of Existing Sewer Pipe:**

Where existing sewerline is to be removed, excavate soil over pipe and stockpile at least 10 feet away from side of trench. Remove pipe and underlying granular material down to undisturbed native soil. Use hand tools where required to remove all loose or contaminated material. Obtain Engineer's approval prior to placing concrete slurry in accordance with Subsection 615.9. All pipe to be removed shall be disposed of offsite in accordance with state and local requirements.

Where sewerline is abandoned in place outside of dam footprint flush and install permanent concrete plugs in ends of pipe as shown on the plans. Plugs shall be watertight and capable of withstanding internal and external pressures without leakage. Backfill excavation with excavated material compacted to at least 95 percent relative compaction.

Manholes shall be abandoned as indicated on the plans. Remove the top 5 feet of manhole riser and cone. Backfill manhole with ABC moistened and tamped to minimize settlement. Manhole covers, cones, and castings shall be salvaged for reuse by the Town of Wickenburg. Contact the Town Public Works Department for pickup.

### **Subsection 350.4 - Payment**

Payment for the abandonment of the existing 10-inch VCP sewer pipe and manholes as specified and shown on the plans, will be made at the lump sum price bid, and shall be full compensation for complete trench excavation, removal, backfill with concrete slurry and other work as required.

#### **BID ITEM 350 - REMOVE/ABANDON SEWER**

### **SECTION 405 - MONUMENTS**

Monuments shall conform to Section 405 of the MAG Uniform Standard Specifications except as modified herein.

#### **Subsection 405.1 - Description**

Add the following:

Settlement monuments shall consist of brass caps in accordance with MAG Standard Details 120-1. Where settlement monuments are placed on fill, installation shall conform to Detail 120-1 Type B. Monuments on concrete structures shall use Type B brass caps set in the concrete. If caps are not set when concrete is placed, then holes shall be drilled and brass caps set in concrete with epoxy approved by the Engineer. Contractor shall perform level survey within 10 days of completing installation of markers to nearest 0.01 foot using project benchmark. Survey notes shall be provided to Engineer.

#### **Subsection 405.5 - Payment**

Payment for settlement monuments shall be made on the basis of the price bid for each.

**BID ITEM 405 - SETTLEMENT MONUMENTS (MAG 120-1, Type B)**

**SECTION 420 - CHAIN LINK FENCE**

Chain link fence shall conform to Section 420 of the MAG Uniform Standard Specifications except as modified herein:

**Subsection 420.1 - Description**

The work under this section consists of constructing new 6-foot chain link fence and gates on the perimeter of the concrete spillway and stilling basin as shown.

**Subsection 420.5 - Payments**

Payment for installation of new 6-foot chain link fence shall be made on the basis of price bid per linear foot, and shall be full compensation for the installation complete including fence, gates, breakaway, fence posts and fence mounts embedded in the concrete structure.

**BID ITEM 420 - CHAIN LINK FENCE (6-FOOT)**

**SECTION 421 - WIRE FENCE**

Add the following Section 421 - WIRE FENCE to the MAG Uniform Standard Specifications.

**Subsection 421.1 - Description**

Four-strand, smooth wire fence shall be installed around the project site as shown.

**Subsection 421.2 - Measurement**

Fence will be measured by the linear foot in place. Gates, openings, and terminations will not be measured and shall be considered incidental to the fence.

**Subsection 421.3 - Payment**

Payment for wire fence shall be made on the basis of the unit price bid per linear foot.

**BID ITEM 421 - WIRE FENCE (4-STRAND)**

**SECTION 430 - LANDSCAPING AND PLANTING**

The preparation and revegetation by seeding of areas disturbed by construction and areas to be landscaped shall conform to Section 430 of the MAG Uniform Standard Specifications except as modified herein.

**Subsection 430.3.1 - Preparation of In-Place Soil**

Add the following:

The areas to be seeded shall be cultivated to a minimum depth of 3 inches. Finished surfaces shall be left in a roughened condition as approved by the Engineer.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris shall be removed or

disposed of as directed by the Engineer.

Seed bed preparation shall be discontinued when soil moisture conditions are not suitable for the preparation of a satisfactory seed bed as determined by the Engineer.

The fertilizer (ammonium sulfate, 21% elemental nitrogen, or its equivalent) shall be dry broadcasted at a rate of 80 pounds per acre with uniform coverage and cultivated to a depth of 3 inches. The application method shall be approved by the Engineer.

#### **Subsection 430.3.2 - Seeding**

Add the following:

The appropriate seed mix shall be applied in areas designated on the plans. All seeding operations shall be performed in such a manner that the seed is applied in the specified quantities uniformly on the designated areas. The method and rate of seed application shall be as specified in this section. Seeding shall be completed within 2 days after approval of the in-place soil preparation is given.

Designated areas shall be seeded by hydroseeding method at the following rates:

- Seed Mix "A" - Twenty-two (22) pounds of Pure Live Seed (PLS) per acre.
- Seed Mix "B" - Seventeen (17) pounds of Pure Live Seed (PLS) per acre.

The following materials shall be combined to form a seed mulch mixture for application:

1. 200 pounds of fertilizer (16-20-0) per acre (MAG 795).
2. 2,000 pounds of wood fiber mulch per acre. The wood fiber shall be natural wood fiber heat processed in such a manner so that it does not contain any growth germination inhibiting factors. The fiber shall be dyed green to allow visual monitoring during application.
3. 100 pounds of tackifier per acre. Tackifier shall be psyllium-based organic tackifier that contains no growth inhibitors, is nontoxic and biodegradable, and will meet or exceed the following specifications:
  - a. Fiber: Not less than 4 percent.
  - b. Protein: Not less than 1.5 percent.
  - c. Ash: Not greater than 3 percent.
  - d. pH: 6.0 to 8.0.
  - e. Settleable Solids: Not greater than 5 percent.
4. The seed mix shall be as specified in this section.

5. Sufficient water shall be added to the mulch/seed mix to form a homogeneous mixture capable of being applied by commercial hydromulching equipment.

The homogeneous mixture shall be applied to the seeding areas by means of hydraulic-type equipment which shall provide continuous mixing and agitation to the mixture of water, fertilizer, seed, and wood fiber. The mixture shall be applied through a pressure spray distribution system providing a continuous, nonfluctuating discharge and delivery of the mixture in the prescribed quantities on the specified areas.

The Contractor shall provide, on request for the Engineer, past performance data that indicates his equipment and procedures are suitable or shall demonstrate his performance. The Engineer has final approval as to equipment and procedure.

Seeding mixture and the application rates are listed below. Seeding rates are specified in pure live seed quantities (PLS). Any changes to the seed mixture by substitution of any alternative species shall be approved by the Engineer.

<b>Seed Mix A</b>		
<b>Basin Side Slopes Only</b>		
		<b>PLS, lb/ac</b>
Indian Wheat	Plantago Insularis	3.0
Purple Three Awn	Aristida Purpurea	3.0
Galleta	Hilaria Jamesi	1.0
Sand Dropseed	Sporobolus Cryptandeus	1.0
Desert Globe Mallow	Sphaeralcea Ambigua	1.0
Creosote Bush	Larrea Tridentata	0.5
Triangle Leaf Bursage	Ambrosia Deltoidea	2.0
White Bursage	Ambrosia Dumosa	1.0
Desert Marigold	Baileya Multiradiata	1.0
Needle Grama	Bouteloua Artisioides	1.0
Desert Lupine	Lupinus Arizonicus	1.0
Mex. Gold Poppy	Eschscholtzia Mexicana	1.0
California Buckwheat	Eriogonum Fasciculatum	1.0
Brittlebush	Encelia Farinosa	3.0

Seed Mix B Dam and Basin Only		
		PLS, lb/ac
Indian Wheat	Plantago Insularis	3.0
Purple Three Awn	Aristida Purpurea	3.0
Galleta	Hilaria Jamesi	1.0
Sand Dropseed	Sporobolus Cryptandeus	1.0
Desert Globe Mallow	Sphaeralcea Ambigua	1.0
Desert Marigold	Baileya Multiradiata	1.0
Needle Grama	Bouteloua Aristioides	1.0
Desert Lupine	Lupinus Arizonicus	1.0
Mex. Gold Poppy	Eschscholtzia Mexicana	1.0
California Buckeheat	Eriogonum Fasciculatum	1.0
Brittlebush	Encelia Farinosa	3.0

**Subsection 430.10 - Measurement and Payment**

Preparation and revegetation by seeding of the project site as described in this section and as shown shall be measured to the nearest acre, and paid for at the price bid per acre.

**BID ITEM 430 - LANDSCAPING AND PLANTING**

**SECTION 505 - CONCRETE STRUCTURES**

Structural concrete shall conform to Section 505 of the MAG Uniform Standard Specifications except as modified herein.

**Subsection 505.1 - Description**

Add the following:

The work under this section shall include furnishing all materials, labor, and equipment for the construction of the concrete spillway, stilling basin, inlet and outlet structures for the 36-inch outlet drain pipe, slide gate actuator mount, pedestals and miscellaneous concrete structures as shown on the plans. The slide gate for the outlet works shall be installed in accordance with Section 788.

Shop Drawings shall be submitted for the following:

1. **Product Data:** Admixtures, bonding agent, bond breaker, grouts, and patching materials.
2. **Design Data:** Concrete mix designs signed by qualified mix designer as supported by performance history as per ACI guidelines.
3. **Placement Drawings:**
  - a. Concrete, identifying location of each type of construction joint.
  - b. Reinforcing steel.
4. Gradation for coarse and fine aggregates, and combined together. List gradings, percent passing through each sieve size.

5. Plastic Type Water Stops: Details of splices to be used and method of securing water stop in the forms and supporting water stop so as to maintain proper orientation and location during concrete placement.
6. Construction Joints: Layout and location indicating type to be used.
7. Joint fillers.
8. Performed control joints.
9. Water stop.

Formwork, falsework, and shoring designs shall be prepared by an Engineer licensed in the State of Arizona.

Do not backfill against walls until concrete has obtained 28-day compressive strength. Place backfill simultaneously on both sides of wall, where required, to prevent differential pressures.

#### **Subsection 505.3 - Forms**

Add the following:

Formwork shall be designed in accordance with ACI 347-89 and ACI 318-89 to provide the concrete finishes. Joints in forms shall be watertight. Limit panel deflection to 1/360 of each component span to achieve tolerances specified.

Wall forms shall be made of plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel in "new and undamaged" condition, of sufficient strength and surface smoothness to produce specified finish.

Form ties shall be made of steel. The spreader inserts shall be conical or spherical type and designed to maintain positive contact with forming material. Use inserts that will leave no metal closer than 1 inch to concrete surface when forms, inserts, and tie ends are removed.

Water stop ties shall be used for all walls as follows:

1. Integral steel water stop 0.103 inch thick and 0.625 inch in diameter tightly and continuously welded to tie.
2. Neoprene water stop 3/16 inch thick and 15/16 inch in diameter whose center hole is 1/2 diameter of tie, or a molded plastic water stop of comparable size.
3. Water stop shall be oriented perpendicular to tie and symmetrical about center of tie.
4. Ties shall be designed to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

Unless otherwise specified, follow the applicable recommendations of ACI 347-89 for erecting forms.

For wall forms, do not reuse forms with damaged surfaces. Also, locate form ties and joints in an uninterrupted pattern for smooth and uniform surface. Inspect form surfaces prior to installation to ensure conformance with specified tolerances. Provide forms with tolerances in accordance with ACI 347-89 and ACI 318-89. For straight vertical or horizontal wall

surfaces. flat planes shall be within 1/4 inch in 10 feet or within 1 inch from top to bottom for walls over 40 feet high. Depressions in wall surface shall be a maximum of 5/16 inch when 10-foot straightedge is placed on high points in all directions.

#### **Subsection 505.5 - Placing Reinforcement**

Add the following:

Unless otherwise specified, place reinforcing steel in accordance with CRSI Recommended Practice for Placing Reinforcing Bars.

#### **Subsection 505.6 - Placing Concrete**

Add the following:

Place concrete in accordance with ACI 301-89. Prior to placing concrete, remove loose soil and water from excavation and subgrade and debris and foreign material from forms. Obtain Engineer's approval of subgrade before placing reinforcing steel. Check reinforcing steel for proper placement and correct discrepancies. Before depositing new concrete on old concrete, clean surface using sandblast or bushhammer or other mechanical means to obtain a 1/4-inch rough profile, and pour a cement-sand grout to minimum depth of 1/2-inch over the surface. Proportion 1 part cement to 2.5 parts sand by weight. Maximum vertical drop to final placement shall be 6 feet, when not guided with chutes or other devices to prevent segregation caused by impact with reinforcing. Do not use aluminum pipe or aluminum conveying devices.

Steps performed in preparation for placing concrete shall meet requirements and recommendations of ACI 304R-89 and ACI 301-89, except as modified herein. Ends of chutes, piping, hopper gates, and other points of concrete discharge throughout the conveying, hoisting, pumping, and placing system shall be designed and arranged for concrete to pass without becoming segregated. Do not use chutes longer than 50 feet. The minimum slopes of chutes shall be angled to allow concrete to readily flow without segregation. Conveyor belts shall be approved by Engineer; wiped clean with device which does not allow mortar to adhere to belt; and conveyor belts and chutes covered.

Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during placing, for adequate redundancy to ensure completion of concrete placement without cold joints in case of a primary placing equipment breakdown. Minimum pump hose (conduit) diameter shall be 4 inches. Replace pumping equipment and hoses (conduits) that are not functioning properly.

Limit size of each placement to allow for strength gain and volume change caused by shrinkage. Where expansion joints or control joints are not shown or where expansion joints or control joints are spaced at more than 60 feet, or where wall expansion or control joints are spaced more than 30 feet from wall corners or intersections, provide intermediate construction joints at maximum spacing of 30 feet. Should placement sequence result in cold joint, install water stop in joint.

Minimum time between adjacent placements shall be 14 days for control joints and

construction joints, and 3 days for expansion joints.

Consolidate concrete with internal vibrators with minimum frequency of 8,000 cycles per minute and amplitude required to consolidate concrete in section being placed. Provide at least one standby vibrator in operable condition at placement site prior to placing concrete. Consolidation equipment and methods shall conform with the requirements of ACI 309R-87. Provide sufficient windows in forms or limit form height to allow for concrete placement through windows and for visual observation of concrete. Vibration consolidation shall not exceed a distance of 5 feet from point of placement. Vibrate concrete in vicinity of joints to obtain impervious concrete there.

When vibrating concrete, apply approved vibrator at points spaced not farther apart than vibrator's effective radius. Apply close enough to forms to vibrate surface effectively but not damage form surfaces. Vibrate until concrete becomes uniformly plastic. Vibrator must penetrate fresh placed concrete and into previous layer of fresh concrete below.

#### **Subsection 505.6.1 - Joints**

Add the following:

To new concrete wall horizontal construction joints, thoroughly clean and saturate joint with water. Cover horizontal wall surfaces with minimum 2 inches of grout, as specified in Section 732, and immediately place concrete. Limit concrete lift placed immediately on top of grout to 12 inches thick. Thoroughly vibrate to mix and consolidate grout and concrete together.

To old concrete (greater than 60 days old), mechanically roughen existing concrete surfaces to a clean, rough surface using a "Blastrac" by Wheelabrator-Frye, Inc.; or "Porta-Shotblast" by Nelco Manufacturing Corp, to remove existing concrete surface, and provide a minimum roughness profile of 1/4-inch. Saturate surface with water for 24 hours, cover with 2 inches of grout, and place grout as specified for new concrete.

Expansion, construction, and control joints shall be constructed as straight joints and made either vertical or horizontal. Concrete placement shall commence after the joint preparation is complete.

For construction joints, prior to placement of abutting concrete, clean contact surface by removing laitance and spillage from reinforcing steel and dowels. Then roughen surface to a minimum of 1/4-inch amplitude by either sandblasting after the concrete has fully cured, water blasting after the concrete has partially cured, or if the concrete is green, cutting the fresh concrete with high pressure water and hand tools. Perform cleaning so as not to damage water stop, if one is present.

For expansion joint without pourable filler, prepare surface by coating concrete surfaces above and below plastic water stop with bond breaker. Do not damage water stop.

For control joints, locate reinforcing and dowels as shown, and install PVC water stop.

Concrete surfaces shall be dense and smooth. Prepare surface by coating concrete surfaces above and below plastic water stop with bond breaker. Do not damage or coat water stop. Furnish correct type and size of reinforcing and dowels.

Join water stops at intersections to provide continuous seal. Center water stop on joint. Secure water stop in correct position to avoid displacement during concrete placement. Repair or replace damaged water stop. Place concrete and vibrate to obtain impervious concrete in the vicinity of all joints. For joints in slabs, make sure that the space beneath plastic water stop is completely filled with concrete. Also, during concrete placement, make a visual inspection of the entire water stop area. Limit concrete placement to elevation of water stop in first pass, vibrate the concrete under the water stop, lift the water stop to confirm full consolidation without voids, then place remaining concrete to full height of slab. Apply procedure to full length of plastic water stops.

Plastic water stops shall be installed in accordance with manufacturer's written instructions. Splice in accordance with the water stop manufacturer's written instructions using a thermostatically controlled heating iron. Butt splice unless specifically detailed otherwise. Allow at least 10 minutes before the new splice is pulled or strained in any way. Finished splices shall provide a cross section that is dense and free of porosity with tensile strength of not less than 80 percent of the unspliced materials. Wire looped plastic water stop may be substituted for plastic water stop.

Premolded joint filler shall be sufficient in width to completely fill the joint space where shown. If a water stop is in the joint, cut premolded joint filler to butt tightly against the water stop and the side forms. Precut premolded joint filler to the required depth at locations where joint filler or sealant is to be applied. Form cavities for joint filler with either precut, premolded joint filler, or smooth removable accurately shaped material. Vibrate concrete thoroughly along the joint form to produce a dense, smooth surface.

For bituminous-type premolded joint filler, drive nails approximately 1 foot 6 inches on center through the filler, prior to installing, to provide anchorage embedment into the concrete during concrete placement. Secure premolded joint filler in forms before concrete is placed. Install in walkways, at changes in direction, at intersections, at each side of driveway entrances, and at 45-foot intervals, maximum.

Install coated and lubricated steel expansion joint dowels parallel to wall surface and in true horizontal position perpendicular to the joint in both plan and section view, so as to permit joint to expand or contract without bending the dowels. Secure dowels tightly in forms with rigid ties. Install reinforcing steel in the concrete as shown to protect the concrete on each side of the dowels and to resist any forces created by joint movement.

Preformed control joints shall be as specified in Section 730.

Steel expansion joint dowels shall be as specified in Section 731.

### **Subsection 505.6.2 - Adverse Weather Concreting**

Prepare ingredients, mix, place, cure, and protect concrete during hot weather in accordance with ACI 305.

Prepare ingredients, mix, place, cure, and protect concrete during cold weather in accordance with ACI 306.

### **Subsection 505.8 - Curing**

Add the following:

Use one of the following methods as approved by Engineer.

Walls shall have only water curing procedures used. Method 1: Leave concrete forms in place and keep entire surfaces of forms and concrete wet for 10 days. Method 2: Continuously sprinkle with water 100 percent of exposed surfaces for 10 days starting immediately after removal of forms.

Slabs shall use one of the following methods: Method 1: Protect surface by water ponding for 10 days; Method 2: Cover with burlap or cotton mats and keep continuously wet for 10 days; Method 3: Cover with 1-inch layer of wet sand, earth, or sawdust, and keep continuously wet for 10 days; or Method 4: Continuously sprinkle exposed surface for 10 days. Other agreed-upon methods that will keep moisture present and uniform at all times on surface of slabs. Do not use curing compounds.

### **Subsection 505.9 - Finishing Concrete**

Add the following:

Prior to starting patching work, obtain quantities of color-matched patching material and manufacturer's detailed instructions for use to provide a structural patch with finish to match adjacent surface. Develop patching techniques with epoxy manufacturer on mockup panel. Dress surface of patches that will remain exposed to view to match color and texture of adjacent surfaces. Patching of concrete shall provide a structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Engineer.

For floor slabs and tops of walls, screed surfaces to true level planes. After initial water has been absorbed, float with wood float and trowel with steel trowel to smooth finish free from trowel marks.

For unexposed slab surfaces, screed to true surface, bull float with wood float, and wood trowel to seal surface.

For exterior slabs, bull float with wood float, wood trowel, and lightly trowel with steel trowel. Finish with broom transverse to water flow to obtain nonskid surface. Finish exposed edges with steel edging tool

Tolerances: Slabs shall not vary from level or true plane more than 1/4 inch in 10 feet when measured with a straightedge.

Spray evaporation retardant onto surface of fresh flatwork concrete immediately after screeding to react with surface moisture. Reapply as needed to ensure a continuous moist surface until final finishing is completed.

#### **Subsection 505.9.3 - Finishing Green Concrete**

Add the following:

Patch and repair in accordance with Section 505.9.6.

#### **FINISH SCHEDULE:**

Walls: Nonexposed surface - Class I; exposed surface - Class II.

Slabs: Heavy broom finish transverse to slope or water flow.

#### **Subsection 505.9.6 - Finishing and Patching Surfaces**

Add the following new section:

When patching *defective* areas, remove *defective* concrete to a depth of sound concrete. Small shallow holes caused by air entrapment at surface of forms shall not be considered *defective* unless amount is so great as to be considered not the standard of the industry. Obtain Engineer's approval of chipping work.

Cut out honeycombed and *defective* areas. Cut edges perpendicular to surface at least 1 inch deep. Do not feather edges. Soak area with water for 24 hours. Patch with nonshrink grout as specified in Section 732. Finish surfaces to match adjacent concrete. Keep patches damp for minimum 7 days or spray with curing compound to minimize shrinking.

To patch form tie holes, fill with Category I grout as specified in Section 732. Use only enough water to dry pack. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water. Make sure color of patch after curing matches color of adjacent concrete.

#### **Subsection 505.10 - Payment**

Payment for concrete structures shall be made at the price bid per cubic yard of in-place concrete for the respective items of work. Furnishing and installing the slide gate, stem, trashrack, orifice plate, and gate operator system, complete, shall be considered incidental to ITEM 505-2.

**BID ITEM 505-1 CONCRETE SPILLWAY AND STILLING BASIN**

**BID ITEM 505-2 INLET/ OUTLET STRUCTURES FOR OUTLET PIPE**

**BID ITEM 505-3 MISCELLANEOUS CONCRETE**

#### **SECTION 515 - STEEL STRUCTURES**

Miscellaneous metal fabrication shall conform to Section 515 of the MAG Uniform Standard

Specifications except as modified herein.

**Subsection 515.1 - Description**

This section shall include the fabrication, painting and installation of the sedimentation markers shown on the plans.

**Subsection 515.2.1 - Miscellaneous Metal Fabrication**

Add the following:

Sedimentation marker posts shall be made of 4-inch diameter structural steel tubing having a wall thickness of 0.125 inches minimum. Steel shall be A-36. Welding shall be done in the shop.

**Subsection 515.5 - Painting**

Add the following:

After the posts have been installed in the field and prior to painting, thoroughly clean posts of any dirt, oil, or concrete. If primer has been damaged during installation, touch up with an approved prime coat. Field paint the posts with two coats (4-mil dry film thickness) of white alkyd enamel paint. Depth marks shall be painted with two coats (4-mil dry film thickness) of black alkyd enamel paint.

**Subsection 515.7 - Payment**

Payment for sedimentation markers will be made on the unit price bid per each, and shall be full compensation for furnishing and installing the markers complete as shown.

**BID ITEM 515 - SEDIMENTATION MARKERS**

**SECTION 601 - TRENCH EXCAVATION, BACKFILLING AND COMPACTION**

Trench excavation, backfill and compaction for pipe shall conform to Section 601 of the MAG Uniform Standard Specifications except as modified herein. Additional requirements for installation, backfilling, encasement, and testing are provided in Sections 615, 618, 625, and 635.

**Subsection 601.2.1 General**

Add the following:

Excavate the trench to the lines and grades shown or as established by the Engineer with proper allowance for pipe thickness and for pipe base or special bedding when required. If the trench is excavated below the required grade, correct any part of the trench excavated below the grade at no additional cost to the Owner, with bedding of the type specified. Concrete slurry shall be used to correct overexcavation for the outlet pipe upstream of the chimney drain through the dam and to 12-inch sewer pipe under the dam.

For all pipe crossings within the dam footprint, do not use sheeting but slope the trench as necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public. Remove all loose soil from the walls, slopes, and bottom of the trench using motorized equipment and hand-shovel methods. Obtain approval of the Engineer prior to start of pipe installation. All trenches within the limits of

the dam foundation and in the dam embankment must be approved by a representative of Arizona Department of Water Resources, Dam Safety and Flood Engineering Unit prior to placing the pipe and beginning any backfill. Maintain trench side slopes until the pipe has been placed and backfilled up the adjacent grade.

**Subsection 601.4.2 - Bedding**

Replace the second paragraph with the following:

Consolidation of bedding material with water shall not be permitted. Bedding material shall be mechanically compacted as specified in the Standard Specifications and as specified herein.

**Subsection 601.4.4 - Compaction Densities**

Add the following:

Bedding and backfill material shall be compacted to at least 95% relative compaction when tested in accordance with ASTM D698. Corrections for oversize material may be applied to either the as-compacted field dry density or the maximum dry density, as determined by the Engineer. Whichever correction method is used, the uncorrected maximum density and material curve must be indicated for each test.

**SECTION 615 - SEWERLINE CONSTRUCTION**

Sewerline construction shall conform to Section 615 of the MAG Uniform Standard Specifications except as modified herein.

**Subsection 615.1 Description**

Add the following:

Ductile Iron Pipe for the new sewerline shall be 12-inch diameter and shall conform to Section 740, as specified herein. Installation of manholes shall conform to Section 625. Abandonment of existing sewerline and manholes shall conform to Section 350.

**Subsection 615.3 Laying Pipe**

Add the following:

Corrosion protection shall be provided for all ductile iron pipe by use of polyethylene wrap. Before installing the polyethylene wrap, the exterior of the pipe shall be free of foreign material. The polyethylene wrap shall be cut approximately 2 feet longer than that of the pipe section. After assembling the pipe joint, the polyethylene shall be overlapped approximately 1 foot and sealed at all joints with approved adhesive tape. Additional tape shall be used at 3-foot intervals along the pipe. Any rips, punctures, or other damage to the polyethylene shall be repaired immediately with adhesive tape.

When fittings cannot be practically wrapped in a tube, a flat sheet or split tube shall be used. All seams shall be securely taped.

Where the pipe is to be backfilled with concrete slurry, support the pipe on concrete blocks

or alternative material approved by the Engineer. Remove the polyethylene wrap and encase the wrap in the concrete at the ends of the encased pipe. Take care during installation of pipe to remove all loose soil and debris that is present in the pipe trench. Anchor the pipe in the trench where required to prevent flotation caused by concrete slurry. Obtain Engineer's approval of pipe in trench and removal of loose soil and debris prior to placing concrete slurry.

Ductile Iron Pipe Connected to Concrete or Clay Pipe: Connect ductile iron to standard sewer pipe by means of a watertight durable, flexible coupling approved by the Engineer.

#### **Subsection 615.5 Jointing**

Add the following:

Where pipe is connected to manholes or concrete structures, a standard pipe joint shall be located within 1.5 feet of the outside face of the structure for pipe 18 inches and smaller and within one pipe diameter for 21 inch and larger pipe.

Pipe shall be cut at right angles to the centerline of the pipe in a neat workmanlike manner without damage to the pipe so as to leave a smooth end. All pipes shall be cut with an approved mechanical cutter. The cut end of pipe to be used with rubber gasket joints shall be tapered by grinding or filing about 1/8 inch back at an angle of approximately 30 degrees with the centerline of the pipe, and any sharp or rough edges shall be removed.

#### **Subsection 615.9 Backfilling**

Add the following:

Concrete slurry material shall be a mixture of fine aggregate conforming to ASTM C33, Portland cement conforming to ASTM C150, Type II or ASTM C595, Type IP (MS) and clean water. The minimum cement content shall be for Class C concrete in accordance with Section 725.1. Only the amount of water necessary to make a mixture that will flow easily and can be pumped without segregation shall be used and in no case shall the water cement ratio exceed 1.0.

Once trench and pipe is approved for backfilling by Engineer and a representative of Arizona Department of Water Resources, Dam Safety and Flood Engineering Unit, place concrete slurry in trench with continual use of a concrete vibrator. Place slurry on one side of the pipe and vibrate it until it rises to at least the 1/3 pipe diameter on the other side before placing slurry on both sides of the pipe. Take care not to slough soil into the concrete slurry. Concrete slurry shall extend across full width of trench. Vibrate slurry until all air voids are removed and slurry surface is level. Take care along the edges of the trench to vibrate the slurry and make a tight fit to the trench walls. End of concrete slurry shall form 1:1 slope unless shown on the Drawings.

Cure concrete slurry surface with curing compound and soaker hose as required to prevent rapid moisture loss and shrinkage cracks. Allow concrete to cure for 60 hours or more before placing fill on concrete slurry. Place Zone 1 or Zone 2 material as indicated on the Drawings at the moisture content and compaction specified for the overlying embankment. The first

2 vertical feet of backfill over the slurry encasement shall be manually compacted with hand-held compaction equipment over a width of one pipe diameter on each side of the pipe centerline. Fill material that is to be manually compacted shall be placed in loose lifts no more than 6 inches thick. Backfill above and outside these limits may be compacted with heavy compaction equipment as specified in Section 211. No rubber tire heavy equipment, dozers, or heavy motorized equipment weighing more than 1,000 pounds shall be driven over the concrete slurry until 7 days has elapsed since the slurry was placed and until there is at least 4 feet of fill over the slurry.

Where granular bedding and Zone 1 material is shown for the new sewer pipe outside the dam area, the pipe zone shall be considered to include the full width of the excavated trench from the bottom of the pipe to a point 12 inches above the top outside surface of the barrel of the pipe. Particular care must be given to the area of the pipe zone from the invert to the spring line of rigid pipe to provide firm support and prevent any lateral movement of the pipe during the final backfilling of the pipe zone.

#### **Subsection 615.10 Testing**

Add the following:

Internal hydrostatic testing is required for the sanitary sewerline manholes, vents, and covers.

Make all arrangements for furnishing water from the nearest hydrant or other suitable source for testing purposes. Perform the tests and provide all hoses, tank trucks, plugs, and other necessary equipment to conduct the tests. Test pressures shall be to full detention basin head of Elevation 2163.5.

Upon satisfactory completion of the testing, slowly drain the sewerline into the existing sewer system.

#### **Subsection 615.12 Cleanup**

Add the following:

Prior to testing, final manhole-to-manhole inspection, and acceptance of the sewer system by the Engineer, flush and clean all parts of the system. Remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment.

Upon the Engineer's final manhole-to-manhole inspection of the sewer system, if any foreign matter is still present in the system, flush and clean the sections and portions of the lines as required.

#### **Subsection 615.13 - Payment**

The sewerline will be paid for on the basis of the unit price bid per linear foot for sanitary sewer installed and backfilled, complete.

**BID ITEM 615 - SANITARY SEWER (12-INCH DIP)**

## **SECTION 618 - STORM DRAIN CONSTRUCTION (DAM OUTLET PIPE)**

Installation of the outlet pipe through the dam shall conform to Section 618 of the MAG Uniform Standard Specifications except as modified herein.

### **Subsection 618.1 Description**

Add the following:

This section covers installation of the 36-inch outlet drain pipe.

### **Subsection 618.2 Materials**

Add the following:

Reinforced concrete pipe shall be in accordance with Section 735.

### **Subsection 618.3 Construction Methods**

Add the following:

Concrete for thrust blocking and closure collars be proportioned in accordance with Section 505 and shall have a minimum compressive strength of 2,500 psi at 28 days.

Construct dam embankment to at least 24 inches above the crown of the pipe but not more than 48 inches prior to excavating outlet pipe trench. Construct the entire pipeline within the dam prior to backfilling and resuming embankment placement. Excavate the pipe trench to the dimensions shown on the plans and remove all loose soil using motorized and hand methods. Obtain Engineer's approval of completed trench prior to placing concrete blocks and pipe. The completed trench must also be approved by a representative of Arizona Department of Water Resources, Dam Safety and Flood Engineering Unit prior to placing the concrete thrust blocks, concrete blocks for pipe support, and pipe, as well as prior to beginning backfill.

Concrete pipe shall be laid so the inside joint space does not exceed 50 percent of the pipe manufacturer's recommended maximum allowable joint space. If interior joints on concrete pipe are greater than 3/8 inch after water testing, thoroughly clean the joint surfaces, and fill and seal the entire joint with premixed mortar conforming to ASTM C387 only after the backfill has been placed, unless otherwise approved by the Engineer. Trowel smooth on the inside surface. Water shall not be allowed to rise in or around, or pass over any joint before it has substantially set.

Concrete slurry shall be as specified in Section 615 and shall be placed to the limits shown on the Drawings. Use a concrete vibrator to move the slurry under the pipe and remove air pockets. Place concrete slurry on one side of the pipe until it comes up to the 1/3 pipe diameter on the other side. Then place slurry on both sides and vibrate thoroughly until top of slurry is smooth. Take care to thoroughly mix the slurry into the walls of the trench and remove any voids or zone of slurry mixed with clumps of adjacent soil.

### **Subsection 618.3.1 Testing**

Add the following:

Contractor shall provide testing equipment to test the entire completed pipeline before the inlet and outlet structures are constructed. The pipe shall be filled with water and pressured to 20 psi. Duration of test will be 2 hours during which the maximum water loss shall not exceed 5 gallons. Equipment to accurately measure water loss shall be provided by the Contractor.

Fill the pipe 24 hours prior to start of testing to permit water to absorb into pipe walls. Provide Engineer 72 hours notice prior to conducting leakage tests. Obtain Engineer's approval of completed test prior to placing backfill over concrete slurry.

### **Subsection 618.5 - Measurement**

Outlet pipe (36-inch diameter) will be measured between the work points as shown on the Drawings to the nearest lineal foot between the inlet and outlet structures.

### **Subsection 618.6 - Payment**

Payment for the 36-inch outlet pipe and all concrete end structures and concrete slurry backfill will be made on the unit price bid per linear foot of pipe installed and backfilled complete.

### **BID ITEM 618-1 - REINFORCED CONCRETE PIPE (36-INCH)**

## **SECTION 625 - MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS**

Sanitary sewer manholes and drop sewer connections shall conform to Section 625 of the MAG Uniform Standard Specifications except as modified herein.

### **Subsection 625.2 - Materials**

Add the following:

Precast manhole riser sections shall be a minimum of 48 inches in diameter, conforming to ASTM C478. Minimum wall thickness shall be 4 inches or 1/12 times inside diameter, whichever is greater. Cones shall have same wall thickness and reinforcement as riser section. Top and bottom of sections shall be parallel. Source tests shall be conducted prior to delivery of any size precast manhole section to jobsite. Conduct yard tests at point of manufacture. Precast sections to be tested will be selected at random from stockpiled material to be supplied for the job. All test specimens shall be mat tested and meet the permeability test requirements of ASTM C14.

### **Subsection 625.3 - Construction Methods**

Add the following:

Backfill around manholes shall use highest class of trench backfill immediately adjacent. Remove water from the excavation. Place a minimum of 6 inches of rock base and thoroughly compact with a mechanical vibrating or power tamper. Construct concrete base as shown. Vibrate to densify concrete and screed so first precast manhole section to be placed has a level, uniform bearing for full circumference. Deposit sufficient mortar on base

to assure watertight seal between base and manhole wall, or place first precast section of manhole in concrete base before concrete has set. Properly locate and plumb first section. If material in bottom of trench is unsuitable for supporting manhole, excavate below the base as directed by Engineer, and backfill to required grade with rock.

Placing precast manhole sections shall be installed as follows: Thoroughly clean ends of sections to be joined. Thoroughly wet joint with water prior to placing mortar. Place mortar on groove of lower section. Set next section in-place. Fill joint completely with mortar of proper consistency. Trowel interior and exterior surfaces smooth on standard tongue-and-groove joints. Prevent mortar from drying out and cure by applying an approved curing compound or comparable approved method. Do not use mortar mixed for longer than 30 minutes. Chip out and replace cracked or defective mortar. Complete manholes shall be rigid and watertight up to the external water head of Elevation 2163.5.

Preformed plastic or rubber gaskets, if used in lieu of mortar joints, shall be installed in accordance with manufacturer's instructions. Carefully inspect precast manhole sections to be joined. Do not use sections with chips or cracks in the tongue. Use only pipe primer furnished by gasket manufacturer. Install gasket material in accordance with manufacturer's instruction. Completed manholes shall be rigid and watertight. Rubber gasket joints shall be installed in manufacturer's instructions.

Manhole invert shall be constructed as shown with smooth transitions to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections that tend to obstruct flow. Where full section of pipe is laid through manhole, break out top section as shown and cover exposed edge of pipe completely with mortar. Trowel mortar surfaces smooth.

Manhole steps shall be installed at 16 inches on center in all manholes, and located to provide a continuous vertical ladder. Do not vary spacing between any two adjacent steps by more than 1/2 inch. The distance between wall of manhole and center of rung, measured at the point of embedment, shall be not less than 4 inches nor more than 6-1/4 inches. Minimum embedment in manhole wall shall be 3 inches. Remove and reset installed steps not meeting the above tolerances.

Flexible joints shall be used in all pipe not more than 1-1/2 feet from manhole walls. Lay pipes entering manholes on compacted base rock extending to undisturbed earth. Where last joint of the line laid up to manhole is between 1-1/2 and 6 feet from manhole wall, provide a flexible joint in the manhole wall using "Kor-N-Seal" flexible rubber boot with stainless steel accessories as manufactured by Kor-N-Seal Co. (NPC Systems, Inc.), Milford, New Hampshire 03055. "Z-Lok XP" or "A-LOK" flexible connectors as manufactured by A-Lok Products, Inc., Tullytown, Pennsylvania 19007. Shorten pipes laid out of manhole to ensure first joint is no more than 1-1/2 feet from manhole base.

Manhole extensions shall be installed as shown, to height not exceeding 12 inches. Lay grade rings in mortar with side plumb and tops level. Seal joints with mortar as specified

for manhole sections, and make watertight.

Manhole frames and covers shall be installed on top of manholes to positively prevent infiltration of surface or groundwater into manholes. Set frames in bed of mortar with mortar carried over flange as shown. Set tops of covers flush with surface of adjoining ground surface unless otherwise shown or directed.

Watertight manholes and prevent manhole frames and covers from blowing off during sewer surcharging by installing watertight manhole frame fasteners as shown. Install fasteners at the locations shown.

Manholes over existing sewers will require approval by Engineer of plans for diverting sewage flow before starting. Engineer's approval does not eliminate Contractor's responsibility for maintaining adequate capacity for flow at all times and for adequately protecting new and existing work. Construct manholes over existing operating sewerlines at locations shown. Perform necessary excavation and construct manhole. Apply a bonding agent on all surfaces to be in contact with concrete and construct new base under existing sewer. Place precast sections as specified. Break out existing pipe within new manhole, cover edges with mortar, and trowel smooth. Maintain flow through existing sewerlines at all times, and protect new concrete and mortar work for 7 days after placing concrete.

Connection of sewers to existing manholes shall be at locations shown. Break out existing manhole bases or grout as necessary. Clean all surfaces and apply a bonding agent. Grout to provide smooth flow into and through existing manholes. Provide diversion facilities and perform work necessary to maintain sewage flow during connection to manholes.

Hydrostatic testing shall occur when, in Engineer's opinion, the groundwater table is sufficiently low to permit visual detection of leaks. Hydrostatic test all of the project manholes. Procedure shall be to plug inlets and outlets and fill manhole with water to height determined by Engineer. A manhole may be filled 24 hours prior to time of testing, if desired, to permit normal absorption into the pipe walls to take place. Leakage in each manhole shall not exceed 0.1 gallon per hour per foot of head above the invert. Repair manholes that do not meet the leakage test, or do not meet specified requirements from visual inspection. If more than 25 percent of the manholes tested fail the hydrostatic test, test all or as many manholes as Engineer deems necessary.

**Subsection 625.5 - Payment**

Payment for the sanitary sewer manholes shall be made on the basis of the unit price bid for each type of manhole.

**BID ITEM 625-1 - STANDARD MANHOLE (MAG 420)**

**BID ITEM 625-2 - DROP MANHOLE (MAG 420, 426)**

**SECTION 635 - SPILLWAY DRAIN PIPE AND GEONET**

Add the following, Section 635, SPILLWAY DRAIN PIPE AND GEONET, to the MAG

Uniform Standard Specifications.

**Subsection 635.1 - Description**

This section covers the work necessary for construction of the horizontal drains under the stilling basin and chute slab, and the pipe drain associated with the outlet to the stilling basin, complete.

**Subsection 635.2 - Materials**

Like items of materials provided herein shall be the end products of one manufacturer to achieve standardization. PVC pipe, specials, joints, gaskets, and testing shall be in accordance with Section 757, except as modified herein.

**Subsection 635.3 - Drain Pipe**

Schedule 80 PVC in 4- and 8-inch diameters as required. Pipe shall conform to ASTM D1785. Use Schedule 80 fittings conforming to ASTM D2467 with primer and adhesive solvent connections conforming to ASTM D2564. Slotted pipe shall be factory slotted with 3 rows of slots, 12 slots per foot per row, each slot 0.10 inch wide and 2 inches long for the 4-inch diameter pipe.

**Subsection 635.4 - Geonet**

The geonet shall be installed beneath the 2:1 slope at the downstream end of the stilling basin. It shall consist of two layers of nonwoven filter fabric surrounding a layer of high-density polyethylene pervious sheet. The filter fabric shall consist of nonwoven polyethylene, or a polypropylene arranged to form a cloth. Weight of each layer of fabric shall be at least 12 oz/yd<sup>2</sup>, grab tensile strength 200 pounds per inch minimum, fabric thickness 30 to 100 mils. Fabric shall be secured to pervious sheet of drainage core consisting of Bottle Drain II as manufactured by Exxon Chemical Company, Summerville, SC; Tensor DC6105 as manufactured by Tensor Environmental Systems, Inc., Atlanta, GA; or approved equal. All materials shall be resistant to degradation by sunlight for a period of 1 year. Wrap geonet rolls with protective plastic wrap and store at a location that will not cause damage.

**Subsection 635.5 - Installation**

For pipes extending through Zone 1 material, overbuild Zone 1 to at least the dimensions shown on the plans prior to excavating the trench. Slope shall be 1 horizontal to 1 vertical or flatter. Flatten trench excavation slopes if necessary to maintain undisturbed Zone 1 material in the sides of the trench. The completed trench must be approved by the Engineer and a representative of the Arizona Department of Water Resources, Dam Safety and Flood Engineering Unit prior to setting the pipe and placing the backfill. Remove all loose uncompacted soil prior to setting pipe and placing backfill. Provide concrete slurry encasement where shown in accordance with Section 615. Vibrate slurry into trench side to create tight fit.

Where Zone 2 backfill is to surround concrete outlet pipe that is encased in slurry, place and compact Zone 2 material as required for the chimney drain as specified in Section 211.

Drain pipes in the stilling basin and chute shall be installed as the Zone 2 material is placed and compacted. Place Zone 2 material in 6-inch loose lifts and compact as required for the chimney drain. Place pipes through cutoff walls in stilling basin prior to placing concrete. Vibrate around pipe to thoroughly consolidate concrete against pipe. Place temporary plugs on pipe ends to prevent infiltration of soil and foreign material. After walls are constructed, extend pipe up outside of walls as shown on the plans. Take care to not force the pipe into couplings and thereby place permanent stress on the pipe. Encase pipe in concrete above footings and where it may be damaged. After walls have been completed, clean concrete around pipe discharge point. Install animal guard in the end of each drain pipe.

Backfill pipe with required Zone 1 or Zone 2 material where shown. Remove all uncompacted soil from excavation prior to placing new fill. Moisture condition and compact all backfill to the same level as the surrounding embankment.

**Subsection 635.6 - Payment**

The PVC drain pipe for the stilling basin drain and for the stilling basin underdrain system shall be made at the price bid per linear foot of pipe for each of the respective sizes, which shall be full compensation for the placement and connection of the pipe system complete. No separate payment will be made for geonet, fittings, or other materials required to complete the work.

**BID ITEM 635-1 - STILLING BASIN UNDERDRAIN PIPE (4-inch)**

**BID ITEM 635-2 - STILLING BASIN DRAIN PIPE (8-inch)**

**SECTION 640 - DIVERSION AND CARE OF WATER**

Add the following Section 640 - DIVERSION AND CARE OF WATER to the MAG Uniform Standard Specifications.

**Subsection 640.1 - Description**

This section covers the work necessary for diversion of surface and subsurface flow around the construction areas, and handling and removal of all other water during the entire construction period, complete, including related appurtenances.

**Subsection 640.2 - Plan**

The diversion and care of water plan shall address the handling and removal of water from all sources. Design, construction, implementation, and operation of the diversion and care of water plan is the sole responsibility of the Contractor. Water shall be removed so work can be performed in the dry without damage to foundation soils. Prior to beginning any work on diversion and care of water from worksite excavations and foundations, the Contractor shall submit his plan for diversion and care of water to Engineer. The plan shall show the proposed method for diversion of surface water from around the construction site and protection of the site from surface water and all water during construction, dewatering, and removal of water from excavation and foundations.

**Subsection 640.3 - Codes, Ordinances, and Statutes**

Contractor shall familiarize himself with, and comply with, all applicable codes, ordinances, and statutes, and bear sole responsibility for penalties imposed for noncompliance.

**Subsection 640.4 - Diversion, Dewatering, and Removal**

The Contractor shall provide all labor, materials, and equipment necessary to accomplish the work specified in this section.

The Contractor shall construct and maintain all necessary cutoffs, cofferdams, channels, flumes, drains, sumps, pumps, and/or other temporary diversion and protection works necessary for diversion and care of all water during construction, and until project is completed.

The Contractor shall furnish, install, maintain, and operate all necessary pumps, equipment, and other facilities for dewatering and removal of water from the various parts of the project and for maintaining the foundations, excavations, and embankment free from water as necessary for constructing each part of the project in the dry.

Drain or otherwise positively dewater borrow areas, embankment areas, structural excavations, trenches, the dam foundation excavation, and other areas as necessary to permit satisfactory construction at all times. When an excavation extends below the water table, dewatering shall be accomplished in a manner that will prevent loss of fines from the foundation, will maintain stability of the excavated slopes and bottom of the excavation, and will result in all construction operations being performed in the dry. The use of a sufficient number of properly screened sumps, wells, or other equivalent methods will be necessary for dewatering. The Contractor will also be required to control seepage along the bottom of the excavation, which may require pipe drains leading to sumps from which the water shall be pumped.

During the excavating, placing, and compacting of the embankment materials in the dam, trench excavation, placing pipe, trench backfill, or structural excavation, the water level at every point in the excavation shall be maintained below the bottom of the excavation until the compacted embankment in the foundation excavation has reached a depth of 10 feet, after which the water level shall be maintained at least 10 feet below the top of the compacted embankment.

After having served their purpose, all materials placed for temporary diversion, protection, handling, and removal of water shall remain the property of the Contractor and shall be removed from the site. Remove all cofferdams or other temporary diversion and protective works upstream and downstream from the embankment so as not to interfere in any way with the operation or usefulness of the detention basin and the downstream area. Remove, level, and grade all cofferdams or other temporary diversion and protective works constructed upstream from the embankment and not a part of the permanent embankment to the extent necessary to prevent any obstruction to flow of water.

**Subsection 640.5 - Damage**

The Contractor shall be responsible for, and shall repair at his expense, any damage to the embankments, foundations, structures, or any other part of the project caused by surface water, groundwater, or failure of any part of the diversion or protective works. In the event the construction area is flooded or otherwise damaged by water, clean up and repair the damage, dry out or remove material in foundations and embankments deemed too wet, weakened, or contaminated for proper foundation or fill material by Engineer, all at the Contractor's expense. The Contractor shall be responsible for, and shall repair at his expense, any damage to areas downstream of the construction site caused by failure of any part of the diversion or protective work. The Contractor shall inspect, monitor, an repair cofferdam and other diversion works to maintain them in a safe condition. Erosion damage to any fills shall be repaired using materials and methods approved by the Engineer. Contractor shall repair all erosion damage to a condition that existed prior to erosion occurring.

**Subsection 640.6 - Sediment Control**

The Contractor shall furnish, install, maintain, and operate all facilities necessary to control sediment or other contaminants so they do not enter natural waterways, water courses, or other areas as required by federal, state, and local ordinances and as specified in Division 1, GENERAL REQUIREMENTS.

**Subsection 640.7 - Payment**

No separate bid item is provided for the work. Contractor shall apportion costs into applicable bid items.

**SECTION 703 - RIPRAP**

Riprap shall conform to Section 703 of the MAG Uniform Standard Specifications except as modified herein.

**Section 703.2 - Size of Stone**

Riprap shall consist of hard, durable angular quarry rock conforming to the following gradation:

<u>Size</u>	<u>Percent Passing by Weight</u>
48 inches	90 - 100
36 inches	70 - 85
24 inches	30 - 50
16 inches	5 - 15
8 inches	0 - 5

**SECTION 725 - PORTLAND CEMENT CONCRETE**

Portland Cement Concrete shall conform to Section 725 of the MAG Uniform Standard Specifications except as modified herein.

### **Subsection 725.1 - General**

Add the following:

All concrete shall be Class AA unless otherwise shown. Mix design properties are as follows. Minimum allowable 28-day compressive field strength shall be 4,000 psi when cured and tested in accordance with ASTM C31-90a and C39-86. The coarse aggregate size shall be 1-1/2 inches and smaller. Slump range shall be 3 to 5 inches. Air entertainment shall be between 3 and 6 percent by volume. The maximum water/cement ratio shall be 0.40. Water reducers shall be used in concrete without plasticizers. Superplasticizers use is optional when approved by Engineer.

### **Subsection 725.2 - Portland Cement**

Add the following:

Portland Cement shall conform with the requirements of ASTM C150-89, Type II or ASTM C595, Type 1P (MS).

### **Subsection 725.3 - Aggregates**

Add the following:

Aggregates shall be furnished from one source. Natural aggregates shall be free from deleterious coatings and substances in accordance with ASTM C33-90, except as modified herein and shall be free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete. Aggregates shall be nonpotentially reactive in accordance with ASTM C33-90, Appendix XI, paragraph X1.1. Test for fine and coarse aggregates soundness in accordance with ASTM C33-90 and ASTM C88-90 using sodium sulfate solution.

Fine aggregates shall be composed of clean, sharp, natural sand, and shall conform to the requirements of ASTM C33-90. The amount of materials passing 200 Sieve shall be 4 percent maximum. Limit deleterious substances in accordance with ASTM C33-90, Table 1 with material finer than 200 sieve limited to 3 percent, coal and lignite limited to 0.5 percent.

Coarse aggregate shall be composed of natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials that contain no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension). Amount of materials passing 200 Sieve shall be 0.5 percent maximum. Deleterious substances shall be limited in accordance with ASTM C33-90, Table 3 for exposed architectural concrete.

### **Subsection 725.4 - Aggregate Grading**

Add the following:

Submit gradation for coarse and fine aggregates, and combined together. List gradings, percent passing through each sieve size.

### **Subsection 725.6 - Admixtures**

Add the following:

Admixtures shall conform with the requirements of: Air-Entraining, ASTM C260-86; Water-

Reducing, ASTM C494-90, Type A or D; Superplasticizers, ASTM C494-90, Type F or G; and Fly Ash, ASTM C618-91, Class C or F.

**Subsection 725.8 - Mixing**

Add the following:

Mixing shall consist of a minimum of 70 and maximum of 270 revolutions of mixing drum. Nonagitating equipment is not allowed.

**SECTION 726 - CONCRETE CURING MATERIALS**

Concrete curing materials shall conform to Section 726 of the MAG Uniform Standard Specifications except as modified herein.

**Subsection 726.1 General**

Add the following:

Do not use curing compound. Use only water curing methods.

**Subsection 726.2 - Materials**

Evaporation retardant with optional fluorescent color tint additive that disappears completely upon drying. Evaporation retardant manufacturers and products are Master Builders Co., Cleveland, OH, CONFILM; and Euclid Chemical Co., Cleveland, OH, Eucobar. No "or-equal" or substitute products will be considered.

**727 - STEEL REINFORCEMENT**

Steel reinforcement shall conform to Section 727 of the MAG Uniform Standard Specifications except as modified herein.

**Subsection 727.1 - General**

Add the following:

Deformed Bars shall conform with the requirements of ASTM A615-90, Grade 60.

**SECTION 729 - EXPANSION JOINT FILLER**

Expansion Joint Filler shall conform to Section 729 of the MAG Uniform Standard Specifications except as modified herein.

**Subsection 729.1 - Premolded Joint Filler**

Add the following:

Bituminous type joint fillers shall conform with the requirements of ASTM D994-71e or D1751-83, thickness as shown.

**SECTION 731 - STEEL EXPANSION JOINT DOWELS**

Add the following, Section 731 - STEEL EXPANSION JOINT DOWELS, to the MAG Uniform Standard Specifications.

### **Subsection 731.1 General**

Dowels shall conform with the requirements of ASTM A36-90 round smooth steel bars. Bar Coating shall consist of two coats of fusion-bonded epoxy paint.

### **SECTION 732 - GROUT**

Add the following, Section 732 - GROUT, to the MAG Uniform Standard Specifications.

#### **Subsection 732.1 - General**

Grout for horizontal construction joints in walls shall be flowable, consisting of sand, water, and minimum 12 sacks of cement per cubic yard.

When grouting horizontal construction joints in reinforced concrete walls, use positive measuring device such as a bucket or other device that will contain only enough sand-cement grout for depositing in one place in wall to ensure that portion of form does not receive too much grout. Limit grout placement to 2-inch maximum thickness. Do not deposit grout from pump hoses or large concrete buckets, unless inspection windows close to joint are available to allow visual measurement of grout thickness and means for excess grout removal are available.

#### **Subsection 732.2 - Nonshrink Grout**

Furnish nonshrink grout for applications in grout category in the following.

Grout categories are as follows:

1. Filling Tie Holes: Category I.
2. Patching Concrete Walls: Category II.

##### **Category I:**

1. Nonmetallic and nongas-liberating flowable fluid.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Test in accordance with ASTM C1107-91:
  - a. Flowable consistency 140 percent, five drops in 30 seconds, in accordance with ASTM C230-90.
  - b. Flowable for 15 minutes.
4. Grout shall not bleed at maximum allowed water.
5. Minimum strength of grout, 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
6. Manufacturers and Products:
  - a. Master Builders Co., Cleveland, OH; SET GROUT.
  - b. Euclid Chemical Co., Cleveland, OH; NS Grout.
  - c. Dayton Superior Corp., Miamisburge, OH; Sure-Grip High Performance Grout.

##### **Category II:**

7. Nonmetallic, nongas-liberating flowable fluid.
8. Prepackaged natural aggregate grout requiring only the addition of water.

9. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
10. Test in accordance with CRD-C621-83 and ASTM C1107-91, Grade B:
  - a. Fluid consistency 20 to 30 seconds in accordance with CRD-C611-81.
  - b. Temperatures of 40, 80, and 100 degrees F.
11. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
12. Minimum Strength of Grout: 2,500 psi at 1 day; 4,500 psi at 3 days; and 7,000 psi at 28 days.
13. Manufacturers and Products:
  - a. Master Builders Co., Cleveland, OH; Master Flow 928.
  - b. Five Star Products Inc., Fairfield, CT; Five Star 100.
  - c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.

Manufacturer's Certificate of Compliance will be submitted for:

14. Grout free from chlorides and other corrosion-causing chemicals.
15. Nonshrink grout properties of Category II, verifying expansion at 3 or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.

Mix, place, and cure nonshrink grout in accordance with grout manufacturer's representative training instructions.

#### **SECTION 734 - BOND BREAKER**

Add the following, Section 734 - BOND BREAKER, to the MAG Uniform Standard Specifications.

##### **Subsection 734.1 - General**

**Bond Breaker:** Nonstaining type, providing a positive bond prevention. Manufacturers and products are: (1) Williams Distributors, Inc., Seattle, WA; Williams Tilt-Up Compound; (2) SCA Construction Supply Div., Superior Concrete Accessories, Franklin Park, IL; Silcoseal 77; (3) Burke Co., San Mateo, CA; Burke Clean Lift Bond Breaker or Burke Tilt Free Bond Breaker.

#### **SECTION 735 - REINFORCED CONCRETE PIPE**

Reinforced concrete pipe for the outlet through the dam shall be 36-inch inside diameter and shall conform to Section 735 - Reinforced Concrete Pipe of the MAG Uniform Standard Specifications except as modified herein. Alternatively, the pipe may be designed to conform to Section 758 - Concrete Pressure Pipe, Steel Cylinder Type.

##### **Subsection 735.2 - Quality**

Add the following:

Reinforced concrete pipe manufactured by any method utilizing a rotating packer or platform will not be acceptable unless the manufacturer can demonstrate by physical testing that the

concrete to steel bonding has not been impaired as a result of torsion induced into the steel reinforcement during casting.

**Subsection 735.4 - Materials**

Add the following:

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Pipe shall be designed in accordance with applicable ASTM and AWWA standards for a D-load of 6,000 lb/ft/~~diameter-feet~~. Internal operating pressure is not anticipated to exceed 15 psi and external soil load is 30 feet. The pipe shall be designed and manufactured to withstand the above design criteria without including the strength of the concrete slurry backfill. The pipe and joints shall be designed for an internal testing pressure of 20 psi after the pipe is installed and encased in concrete slurry. Contractor shall submit design calculations performed by licensed engineer on design of pipe and joints. Testing of pipe at location of manufacture shall be in accordance with applicable MAG sections.

Cement shall conform to one of the following, ASTM C150, Type II; or ASTM C150, Type I limited to a maximum Tricalcium Aluminate (C3A) content of 12 percent and combined with fly ash as specified hereinafter; or ASTM C595, Type IP blended hydraulic cement provided the cement conforms with ASTM C150 and the fly ash is as specified hereinafter. The minimum Portland cement content for concrete without fly ash shall be 564 pounds per cubic yard.

The minimum cementitious materials (Portland cement plus fly ash) for concrete with fly ash shall be 564 pounds per cubic yard and in no case shall the Portland cement content be less than 479 pounds per cubic yard. The amount of fly ash shall not be less than 15 percent nor more than 25 percent of the cementitious materials.

The water/cement (cementitious materials) shall not exceed 0.49.

Elliptical reinforcing is not permitted.

The area of the outer circular reinforcing cage shall not be less than 75 percent of the inner cage for ASTM C16 pipe.

The Contractor shall provide the Engineer with a Certificate of Compliance from the pipe manufacturer that the pipe and concrete mix conform in all respects to these specifications and other nonconflicting requirements of the referenced ASTM Specifications.

Each piece of pipe shall be clearly identified as to class and date of manufacture.

The placement of reinforcement in all sizes of pipe shall be such that the circumferential reinforcement is not closer than 1 inch to the inside surface of the pipe. No variation from this requirement will be permitted.

Fly ash, if used in the concrete mix, shall be Class C or Class F fly ash conforming to ASTM C618, including the requirements of Tables 1 and 2, except as modified below:

Loss on Ignition, Maximum: 3 percent.

Water Requirement, Maximum: 100 percent.

Percent of Control:

$\frac{\text{CaO (\%)}}{\text{Fe}_2\text{O}_3 (\%)}$ , Maximum 1.5

In lieu of meeting the requirements of the chemical ratio listed above, the Contractor and/or supplier shall test the fly ash in accordance with ASTM C1012 and furnish test data confirming that the fly ash in combination with the cement to be used meets all strength requirements, is compatible with other approved admixtures, and provides sulfate resistance equivalent to or better than ASTM C150, Type II cement. The tests shall be conducted using the proposed fly ash and cement samples together with control samples using Type II cement without fly ash.

Fly ash shall be tested in conformance with ASTM C311-77, including the following restriction: Prior to the acceptance of any Class C or Class F fly ash, the Contractor and/or supplier shall present the Engineer with a quality history of the fly ash representing a minimum of 20 of the most current ASTM C618 analysis. The analysis shall show those items pertinent to this specification. Source acceptance shall be at the discretion of the Engineer in accordance with data submitted. Continuing quality analysis shall be submitted throughout the life of the project from the source approved. Under no circumstances shall the fly ash source be changed without the approval of the Engineer. The Contractor and/or supplier shall certify that all shipments meet the conditions of this specification.

Concrete Pipe: Joints shall be rubber gasketed type. Rubber gasketed type with "captive gasket in groove" design will be required on all pipe 36-inch diameter. Joints to conform to ASTM C443, including Performance Requirements for Joints. Gaskets shall conform to Section 765.

#### **Subsection 735.7 - Tests and Acceptance**

Manufacturer of pipe shall perform tests as specified in MAG Section 735.7 or may propose alternative procedures to Engineer. Manufacturer may submit existing test data of comparable loading on same size pipe if data are less than 6 months old. Contractor shall notify Engineer at least 72 hours prior to performing tests on pipe at manufacturing plant.

#### **SECTION 740 - DUCTILE IRON PIPE**

Add the following, Section 740 - DUCTILE IRON PIPE, to the MAG Uniform Standard Specifications.

#### **Subsection 740.1 - General**

This section covers the requirements for 12-inch diameter ductile iron pipe, joints, and fittings used for sanitary sewer. The size, type, dimensions, and quantities shall be as shown on the

plans.

### **Subsection 740.2 - Materials**

#### **Ductile Iron Pipe:**

Mechanical joint ductile iron pipe varies slightly with different manufacturers. Install the particular pipe furnished in accordance with the particular manufacturer's recommendations, as approved by the Engineer.

Lay and join ductile iron pipe with rubber gasket type joints, in accordance with the manufacturer's recommendations, as approved by the Engineer. Provide all special tools and devices such as special jacks, chokers, and similar items required for the installation.

Ductile iron pipe shall be centrifugally cast of 60-42-10 iron and shall conform to ANSI A21.51 or AWWA C151. Thickness Class 51 shall be used. The pipe shall be lined and seal coated in accordance with lining specification.

Ductile iron pipe used in sewer mains shall be lined with a ceramic epoxy coating (PROTECTO 401 or approved equal). PROTECTO 401 is manufactured by Vulcan Painters, Inc., P.O. Box 1010, Bessemer, Alabama 35021.

The coating shall have a 40-mil nominal dry film thickness, and shall be spark tested for holidays at 2,500 volts. The pipe supplier shall submit a certification that the delivered pipe meets the specifications of the coating manufacturer.

#### **Ductile Iron Pipe Joints:**

Furnish ductile iron pipe with the push-on joints conforming to AWWA C111.

Furnish complete information on basic gasket polymer and results of tests for physical properties. Lubricant for jointing shall be as approved by manufacturer.

**Joints for Dissimilar Gravity Sewer Pipe:** An approved flexible mechanical compression joint coupling with No. 305 stainless steel bands manufactured by Joints, Inc. (Calder) of Gardena, CA; Fernco Joint Sealer Co., of Ferndale, MI; or equal.

#### **Tee Fittings:**

Joints on all tee fittings shall be the same as the joints used on the sewer pipe. Caps or plugs shall be furnished with each tee outlet or stub with the same type gasket and joint as furnished with the service connection pipe specified. The plug or cap shall be banded or otherwise secured to withstand all test pressures involved without leakage.

Furnish all tee outlets with gasketed type joint or approved adapter to join service connection pipe used.

Tee fittings shall be fabricated by the pipe manufacturer. Tee stubs shall not protrude inside the sewer pipe. Fabrication details for tees shall be submitted to the Engineer for review prior to delivery of tees to the jobsite.

Tees fabricated by inserting a stub into a hole cut in the sewer pipe shall be grouted with a nonshrinking grout. Surfaces to receive grout shall be coated with an epoxy bonding agent prior to grouting.

### **SECTION 788 - SLIDE GATE**

Add the following section to the MAG Uniform Standard Specifications.

#### **Subsection 788.1 - Description**

The work under this section shall consist of furnishing and installing the 24-inch x 24-inch slide gate, stem, and operator complete.

Submit manufacturer's catalog information, descriptive literature, specifications, dimensional layouts, and identification of materials of construction.

1. Gate opening and closing thrust forces that will be transmitted to support structure with operator at extreme positions and load.
2. Gate operator and stem calculations for gate and service condition.
3. Oil seal and stem bearing details.
4. Operation and maintenance manual.

#### **Subsection 788.2 - General**

Rising stem type with upward-acting type assembly for wall surface mounting on concrete structures. Manufacturers shall be HydroGate Corp., Rodney Hunt Co.; or Waterman Industries, Inc., or equal.

#### **Subsystem 788.2.1 - Guide Frames**

Type 316 stainless steel meeting ASTM A167-91 and ASTM A267-91 requirements.

**Vertical Guides:** Design for maximum rigidity, and extend in one continuous piece from the gate invert to form posts for support of gate operators of self-contained gates.

**Weight:** Not less than 9 pounds per linear foot for stainless steel.

Incorporate a replaceable WHMW polyethylene bearing strip in a retainer slot on the downstream side (unseating head side) of the gate.

Join vertical guide frames and invert with factory welded corners.

Size guided slot to provide a minimum disc engagement of 1 inch on each side.

**Subsection 788.2.2 - Disc**

Disc Plate (Sliding Member): One-piece stainless steelplate. Reinforce as required so that the disc will not deflect more than 1/360 of the gate span, when the upstream liquid depth (seating head side) is as shown on the plans and the downstream liquid depth is zero.

Reinforce gate disc with one-piece stainless steel angles or channels welded to the disc plate. Bolted reinforcements will not be permitted.

**Subsection 788.2.3 - Operator Support Yoke**

For self-contained gate operators, attached to the vertical extensions of the guide frames.

Constructed from at least two stainless steel angles, or two other suitable shapes, and bolt in place to provide a rigid assembly.

Maximum deflection not to exceed 1/4 inch under full operator applied loading.

**Subsection 788.2.4 - Stems**

1-1/2-inch diameter, ASTM A276-91 Type 316 stainless steel.

Threads to be Acme type with RMS surface roughness of 63 micro-inches or less on the flanks for manually operated gates.

Stems to withstand in compression, without damage, the thrust equal to at least 2-1/2 times the rated output of the hoisting mechanism, with a 40-pound effort applied to the handwheel or crank.

Stem Housing: Furnish pipe casing, bushings, bearings, and couplings, etc., as shown on the plans.

**Subsection 788.2.5 - Manual Handwheel Operator and Stem**

Manual cast iron handwheel operator shall withstand a minimum of 250 percent of design torque or thrust at extreme operator positions without damage. The manual effort shall not exceed 30 pounds.

Sealed, ball thrust, roller or needle bearing type and equipped with bronze lift nut, internally threaded with Acme threads. Materials shown on the plans.

**Subsection 788.3 - Installation of Slide Gate and Stem**

Install slide gate in accordance with the manufacturer's written instructions. Construct gate stem pedestals and gate lift pedestal at locations shown on plans. Carefully install anchor bolts on pedestals at proper orientation and alignment for stem guides.

Brace gate thimble internally during concrete placement. Accurately place anchor bolts using templates furnished by the manufacturer. Disassemble factory assembled gate components before installation. Finger tighten all bolts internally and obtain Engineer's approval of

complete assembly.

Manual cast iron handwheel operator shall withstand a minimum of 250 percent of design torque or thrust at extreme operator positions without damage. The manual effort shall not exceed 40 pounds. Gear box shall be in weatherproof housing suitable for portable electric drill operation after removal of handwheel. Furnish one adapting chuck to fit sluice gate operators and to fit electric drill operators.

**Subsection 788.3.1 - Field Quality Control**

Perform performance test under approved simulated operating conditions.

Adjust, realign, or modify units and retest if necessary.

**SECTION 796 - PLASTIC WATER STOP**

Add the following, Section 796 - PLASTIC WATER STOP, to the MAG Uniform Standard Specifications.

**Subsection 796.1 - General**

Plastic water stop shall be extruded from an elastomeric plastic compound of which the basic resin shall be polyvinyl chloride (PVC). Reclaimed PVC in the compound is not acceptable.

The specific gravity shall be approximately 1.37. The Shore Durometer Type A hardness shall be approximately 80. The performance requirements are the Corps of Engineer's Specification CRD-C-572. Type shall consist of a center bulb with a number of parallel ribs or protrusions on each side of strip center. Corrugated or tapered type water stops are not acceptable. The thickness shall be constant from bulb edge to the outside stop edge. The minimum weight per foot of water stop shall be 1.62 pounds for 3/8 inch by 6 inch.

Manufacturers and Catalog Numbers are Vulcan Metal Products, Inc., Construction Materials Division, Birmingham, AL; Catalog No. 3/81-15M; Type 8069 (6 inch by 3/8 inch); Vinylex Corp., Knoxville, TN; Catalog No. RB6-38H (6 inch by 3/8 inch); Greenstreak Plastic Products, St. Louis, MO; Catalog No.: Style 732 (6 inch by 3/8 inch); and A. C. Horn, Inc., Beltsville, MD; Catalog No. Type 9 (6 inch by 3/8 inch).