

SECTION 03 11 00 CONCRETE FORMING

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form stripping and accessories.

1.2 RELATED SECTIONS

- A. Section 03 20 00 – Concrete Reinforcing
- B. Section 03 30 00 – Cast-in-Place Concrete

1.3 REFERENCES

- A. ACI 301 – Structural Concrete for Buildings
- B. ACI 318 – Building Code Requirements for Reinforced Concrete
- C. ACI 347 – Recommended Practice For Concrete Formwork
- D. PS 1 – Construction and Industrial Plywood

1.4 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 00 00
- B. Shop Drawings: Fabrication and erection drawings of forms. Show general construction of forms, jointing, location, and pattern of form tie placement, and calculations.

1.6 QUALITY ASSURANCE

- A. Designer's Qualifications: Professional Engineer, licensed in State of Utah, and having experience in concrete formwork.
- B. Design Forms:
 - 1. With the strength to withstand the pressure resulting from placement of concrete and construction loads while maintaining the specified tolerances.
 - 2. With sufficient strength to support loads, lateral pressure, and allowable stresses outlined in ACI 347 and for design considerations such as wind loads, allowable stresses, and other applicable requirements of controlling local building code.
 - 3. To permit easy removal.
 - 4. For required finishes

5. With sufficient rigidity to maintain tolerances specified in Section 03 35 00.
6. To enable placement in a pour pattern approved by the Engineer.

1.7 JOB CONDITIONS

- A. For reference purposes, establish and maintain sufficient control points and bench marks to check tolerances. Maintain in an undisturbed condition and until final completion and acceptance of Work.
- B. Regardless of tolerances specified, allow no portion of Work to extend beyond legal boundaries.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Smooth Forms: Faced with material, which will produce smooth, hard, uniform texture on concrete.
 1. Arrange facing material orderly and symmetrical, keeping number of seams to a practical minimum.
 2. Do not use material with raised grain, patches, or other defects, which will impair texture of concrete surface.
- B. Form accessories that are to be partially or wholly embedded in concrete are to be a commercially manufactured type:
 1. Do not use non-fabricated wire.
 2. Use form ties constructed so that ends or end fasteners can be removed without causing appreciable spalling of concrete faces.
 3. After ends or end fasteners of form ties have been removed, embedded portion of ties to terminate not less than two diameters from formed faces of concrete, but in no case less than ¾ inches.
 4. Use ties with ¾ inch diameter cones and 1-1/2 inch break back in both ends for water retaining structures. Ties are to be furnished with a water seal or stop.
- C. Premolded Expansion Joint Filler: ASTM D 1751 or D 1752.
- D. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- E. Fillets for Chambered Corners: Wood strips 1 x 1 inch size; maximum possible length.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Verify lines, levels, and measurements before proceeding with formwork.

3.2 FORMWORK CONSTRUCTION

- A. Make forms sufficiently tight to prevent loss of concrete.

- B. Unless indicated otherwise, place chamfer strips in corners of forms to produce beveled edges on permanently exposed exterior corners.
- C. To maintain specified finish tolerances, camber formwork to compensate for anticipated deflections.
- D. Provide positive means of adjustment using wedges, jacks, and struts to take up all settlement during concrete placing operation.
- E. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. At construction joints, overlap forms over hardened concrete at least 6 inches. Hold form against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain true surface.
- G. Construct wood forms for wall openings to facilitate loosening, or counteract swelling.
- H. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.
- I. Anchor formwork to supporting surfaces or member to prevent upward or lateral movement and deflection of any part of formwork system during concrete placement.
- J. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing.
- K. Position expansion joint material and items accurately and support to prevent displacement.
- L. To prevent entry of concrete, fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material.

3.3 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings for elements embedded in or passing through concrete.
- B. Coordinate work of other sections for the forming and setting of openings, slots, recesses, chases, sleeves, blots, anchors, and other inserts.
- C. Install accessories in accordance with manufacturer's instructions. Ensure items are not disturbed during concrete placement.

3.4 FORM FINISHES

- A. Use forms with smooth rubbed, scrubbed, sand floated finishes that meet ACI 347 unless indicated otherwise.
- B. For As-cast Finishes:
 - 1. Install form panels in orderly arrangement with joints planned in approved relation to building elements.
 - 2. Where an as-cast finish is required, no grouting will be permitted in the finishing operation.

3.5 APPLICATION OF FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

3.6 FORM REMOVAL

- A. Do not pry against face of concrete. Use only wooden wedges.
- B. When repair of surface defects or finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.
- C. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Perform needed repairs or treatment required on such sloping surfaces at once, followed by specified curing.
- D. Loosen wood forms for wall openings as soon as it can be accomplished without damage to concrete.
- E. Formwork for walls and other members not supporting the weight of concrete may be removed as soon as the concrete has hardened sufficiently to resist damage removal.

3.7 REMOVAL STRENGTH

- A. When removal of formwork or reshoring is based on concrete reaching a specified strength, it shall be assumed that concrete has reached this strength when either of the following conditions have been met:
 - 1. When test cylinders, field cured along with the concrete they represent, have reached the specified strength.
 - 2. When concrete has been cured per Section 03 39 00 for the same length of time as the site-cured cylinders that reached specified strength. Determine the length of time the concrete has been cured in the structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which the air temperature is above 50 degrees F. and concrete has been damp or sealed from evaporation and loss of moisture.

3.8 REUSE OF FORMS

- A. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of concrete surface.
- B. Thoroughly clean and properly coat forms before reuse.

3.9 FIELD QUALITY CONTROL

- A. Before commencing a pour, verify connections, form alignment, ties, and inserts are placed and secure.
- B. Observe formwork continuously while concrete is being placed to verify that the forms are plumb and there are no deviations from desired elevation, alignment, or camber.
- C. If during construction any weakness develops and false-work shows undue settlement or discoloration, stop work, remove affected construction if permanently damaged, and strengthen false-work.

-END OF SECTION-

SECTION 03 20 00 CONCRETE REINFORCING

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel bars, wire fabric or rod mats for cast-in-place concrete.

1.2 RELATED SECTIONS

- A. Section 03 11 00 – Concrete Forming
- B. Section 03 30 00 – Cast-in-Place Concrete

1.3 REFERENCES

- A. ACI 318 – Building Code Requirements For Reinforced Concrete
- B. ACI SP-66 – American Concrete Institute – Detailing Manual
- C. ANSI/ASTM A 82 – Cold Drawn Steel Wire for Concrete Reinforcement
- D. ANSI/ASTM A 184 – Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
- E. ANSI/ASTM A 185 – Welded Steel Wire Fabric for Concrete Reinforcement
- F. ANSI/ASTM A 496 – Deformed Steel Wire Fabric for Concrete Reinforcement
- G. ANSI/ASTM A 497 – Welded Deformed Steel Wire Fabric for Concrete Reinforcement
- H. ANSI/AWS D1.4 – Structural Welding code for Reinforcing Steel
- I. ASTM A 615 – Deformed and Plain Billet Steel Bars for Concrete Reinforcement
- J. ASTM A 617 – Axle Steel Deformed and Plain Bars for Concrete Reinforcement
- K. ASTM A 704 – Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
- L. AWS D 12.1 – Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction
- M. CRSI – Concrete Reinforcing Steel Institute – Manual of Practice
- N. CRSI 63 – Recommended Practice For Placing Reinforcing Bars
- O. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 00 00.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Welder's certification.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice.
- B. Maintain one copy of each document on site.

- C. Submit certified copies of mill test report of reinforcement materials analysis.
- D. Provide Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

1.6 QUALIFICATIONS

- A. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Utah.
- B. Welder's Certificates: Submit under provisions of Section 01 00 00 Part 5, Quality Control, certifying welders employed on the Work, verifying AWS qualification within the previous twelve months.

1.7 COORDINATION

- A. Coordinate with placement of formwork, formed openings and other work.

PART 2 – PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A 615, 60 ksi yield grade; deformed billet steel bars, unfinished.
- B. Reinforcing Steel Mat: ASTM A 775, ASTM A 615, 60 ksi yield grade; steel bars, epoxy-coated.
- C. Stirrup Steel: ASTM A 615, 60 ksi yield grade, epoxy-coated.
- D. Welded Steel Wire Fabric: ASTM A 185 Plain Type in flat sheets, unfinished.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ANSI/AWS D1.4, where welding is approved by Engineer.

PART 3 – EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Maintain concrete cover around reinforcing as follows:

<u>Item</u>	<u>Coverage</u>
Walls	1-1/2 inches
Slabs on Fill	3 inches
Exposed to atmosphere	1-1/2 inches minimum

3.2 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 00 00.

3.3 SCHEDULES

- A. Reinforcement for Retaining Walls: Deformed bars.
- B. Reinforcement for Slab-on-Grade: Deformed bars.

-END OF SECTION

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, curing and finishes.
- B. See Section 31 05 13 for drainage fill under slabs-on-grade.

1.2 REFERENCES

- A. ACI 301: Specifications for Structural Concrete for Buildings
- B. ACI 305: Hot Weather Concreting
- C. ACI 306: Cold Weather Concreting
- D. ACI 309: Standard Practicing for Consolidation of Concrete

1.3 SUBMITTALS

- A. Product Data: For each manufactured material and product indicated.
- B. Design Mixes: For each concrete mix indicated.
- C. Shop Drawings: Include details of steel reinforcement placement including material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports.
- D. Material certificates.
- E. Test results from independent testing agency.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- B. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.
 - 1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
 - 2. Formwork and form accessories.
 - 3. Steel reinforcement and supports.
 - 4. Concrete mixtures.
 - 5. Handling, placing, and constructing concrete.
 - 6. Lightweight concrete.
- C. Pre-installation Conference: Conduct conference at Project site.
- D. Defective materials shall be removed from site at CONTRACTOR's expense. Any disputes shall be handled according to Standard General Conditions Article 16.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Formwork: Furnish formwork and form accessories according to ACI 301.
- B. Steel Reinforcement:
 - 1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
 - 2. Plain-Steel Wire: ASTM A 82, as drawn.
 - 3. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
 - 4. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.
- C. Concrete Materials:
 - 1. Portland Cement: ASTM C 150, Type I or II or I/II.
 - 2. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1-1/2-inch nominal size.
 - 3. Lightweight Aggregate: ASTM C 330.
 - 4. Water: Complying with ASTM C 94.
 - 5. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
- D. Admixtures:
 - 1. Air-Entraining Admixture: ASTM C 260.
 - 2. Water-Reducing Admixture: ASTM C 494, Type A.
 - 3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 - 4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
 - 5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- E. Vapor Retarder: Multi-ply reinforced polyethylene sheet, ASTM E 1745, Class C, not less than 7.8 mils thick; or polyethylene sheet, ASTM D 4397, not less than 10 mils thick.
 - 1. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.
- F. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- G. Curing Materials:
 - 1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf.
 - 3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
 - 4. Water: Potable.
 - 5. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.2 CONCRETE MIXES

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Compressive Strength (28 Days): 3000 psi, minimum. See structural notes on drawings.
 - 2. Slump: 4 inches.
 - a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6.0 percent within a tolerance of plus 1.0 or minus 1.5 percent.
 - 1. Air content of trowel-finished interior concrete floors shall not exceed 3.0 percent.

2.3 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with ASTM C 94 and ASTM C 1116.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 GENERAL

- A. Formwork: Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.
- B. Vapor Retarder: Install, protect, and repair vapor-retarder sheets according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 2. Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
- C. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- D. Joints: Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 1. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Contracting Officer.

2. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - a. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 3. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- E. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.2 CONCRETE PLACEMENT

- A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Consolidate concrete with mechanical vibrating equipment.

3.3 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.
 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 2. Do not apply rubbed finish to smooth-formed finish.
 3. Apply smooth-rubbed finish, defined in ACI 301, to smooth-formed finished concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.4 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- C. Scratch Finish: Apply scratch finish to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finish, unless otherwise indicated.
- D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- G. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.5 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions occur before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Cure formed and unformed concrete for at least seven days as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist with water or absorptive cover, water saturated and kept continuously wet.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat

areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Contracting Officer will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301.
1. Testing Frequency: One composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Testing Frequency: At least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

-END OF SECTION -

SECTION 03 60 00 CEMENT GROUT

PART 1 – GENERAL

1.1 DESCRIPTION

This section specifies grout for uses other than masonry.

1.2 QUALITY ASSURANCE

A. QUALITY CONTROL BY CONTRACTOR

1. To demonstrate conformance with the specified requirements for grout, the Owner shall provide the services of an independent testing laboratory that complies with the requirements of ASTM E329. The testing laboratory shall sample and test grout materials as required in this section. Costs of testing laboratory services shall be borne by the Contractor.

B. REFERENCES

1. This section references the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail. The references shall be the latest edition.

<u>Reference</u>	<u>Title</u>
ASTM C33	Standard Specification for Concrete Aggregate
ASTM C40	Standard Test Method for Organic Impurities in Sand for Concrete
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Course Aggregates
ASTM C150	Standard Specification for Portland Cement
ASTM C289	Standard Test Method for Potential Reactivity of Aggregates (Chemical Method)
ASTM C494	Standard Specification for Chemical Admixtures for Concrete

<u>Reference</u>	<u>Title</u>
ASTM E329	Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
CRD - G588	Corps of Engineers Specification for Nonshrink Grout

1.3 INFORMATION TO BE PROVIDED

The following information shall be provided in accordance with the General Conditions and Division 1 General Requirements.

A. **PRODUCT DATA**

Three copies of manufacturer's data shall be provided for the following:

1. Bonding Compounds
2. Nonshrink Grout
3. Pressure Grout
4. Retardants

B. **LABORATORY TEST REPORTS**

Before delivery of materials, three copies of the reports of the tests specified herein shall be provided. Test reports on previously tested materials shall be accompanied by the manufacturer's statement that the previously tested material is the same type, quality, manufacture, and make as that proposed for use in this project. Test reports are required for the following:

1. Cement
2. Aggregates
3. Retardants
4. Bonding Compounds

C. **EVIDENCE OF TESTING LABORATORY COMPETENCE**

The Contractor shall require that the laboratory provide directly to the Construction Manager evidence of the most recent inspection of its facilities by the Cement and Concrete Reference Laboratory of the National Bureau of Standards. The laboratory shall also show evidence of current ACI certification. The evidences shall show that deficiencies mentioned in the report of that inspection have been corrected. The evidence of the inspection shall be provided prior to delivery of materials to the job site.

PART 2 – PRODUCTS

2.1 **MATERIALS**

A. **CEMENT**

Portland cement shall be ASTM C150, Type II or Type V, Low Alkali, containing less than 0.60 percent alkalis.

B. **AGGREGATE**

1. **GENERAL:** Aggregate shall be nonreactive and shall be washed before use. When sources of aggregate are changed, test reports shall be provided for the new material. The tests specified shall be performed prior to commencing grout work.
2. **FINE AGGREGATE:** Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine and shall conform to ASTM C33 as modified herein. When tested in accordance with ASTM C136, gradation shall be such that 100 percent by weight will pass a standard No. 8 mesh sieve and no less than 45 percent by weight will pass a standard No. 40 mesh sieve.
3. Variation from the specified gradations in individual tests will be acceptable if the average of three consecutive tests is within the specified limits and the variation is within the permissible variation listed below.

<u>Sieve Size</u>	<u>U.S. Standard Permissible variation in individual tests, percent</u>
30 or coarser	2
50 or finer	0.5

Other tests shall be in accordance with the following specifications:

<u>Test</u>	<u>Test Method</u>	<u>Requirements</u>
Organic Impurities	ASTM C40	Color lighter than standard
Amount of Material Passing No. 2 Sieve	ASTM C117	3% maximum by Weight
Soundness	ASTM C88	10% maximum loss with sodium sulfate
Reactivity	ASTM C289	Innocuous aggregate
Sand Equivalent	CALTEST 217	Minimum 80

C. ADMIXTURES

1. GENERAL: Admixtures shall be compatible with the grout. Calcium chloride or admixtures containing calcium chloride are not acceptable. Admixtures shall be used in accordance with the manufacturer's recommendations and shall be added separately to the grout mix.
2. WATER REDUCING RETARDER: Water reducing retarder shall be ASTM C494, Type D and shall be Pozzolith 300-R; Sika Chemical Corp. Plastiment; or equal.
3. LUBRICANT FOR CEMENT PRESSURE GROUTING: Lubricant additive for cement pressure grouting shall be Intrusion Prepakt Intrusion Aid, Sika Chemical Corporation Intraplast-N, or equal.

D. WATER

Water for washing aggregate, for mixing and for curing shall be free from oil and deleterious amounts of acids, alkalies, and organic materials; shall not contain more than 1000 mg/l of chlorides as Cl, nor more than 1300 mg/l of sulfates as SO₄; and shall not contain an amount of impurities that may cause a change of more than 25% in the setting time of the cement nor a reduction of more than 5% in the compressive strength of the grout at 14 days when compared with the result obtained with distilled water. Additionally, water used for curing shall not contain an amount of impurities sufficient to discolor the grout.

2.2 GROUT

A. DRYPACK GROUT

Drypack grout shall be a mixture of approximately one part cement; 12 to 2 parts sand, water reducing retarder, and sufficient water to make a stiff workable mix.

B. CEMENT GROUT

Cement grout shall be a mixture of one part cement, two parts sand, proportioned by volume, admixtures for pressure grouting, and sufficient water to form a workable mix.

C. NONSHRINK GROUT

Nonshrink grout shall be nonrusting metallic aggregate grout and shall be Embecco 636; U.S. Grout Corp. Five Star Grout; or equal.

D. EPOXY GROUT

Epoxy grout shall be Adhesive Engineering Concrecive 1380 as applicable or equal.

2.3 PRESSURE GROUTING EQUIPMENT

- A. Pressure grouting equipment shall include a mixer and holdover agitator tanks and shall be designed to place grout at pressures up to 50 psi. Gages shall be provided to indicate pressure used. The mixer shall be provided with a meter capable of indicating to one-tenth of a cubic foot the volume of grout used.

PART 3 – EXECUTION

3.1 GENERAL

- A. Holes required for grouting shall be blown clean. Horizontal holes for grouting shall be drilled at a slight downward angle to facilitate holding the grout until setting is complete. Bolts or reinforcing steel installed in horizontal grout holes shall be bent slightly accordingly.
- B. Bonding compound for use with grout is specified in Section 03300.

3.2 DRYPACK GROUT

- A. Drypack grout shall be used for built-up surfaces, setting miscellaneous metal items and minor repairs. Surfaces required to be built up with drypack grout shall be roughened by brushing, cleaned, and coated with the bonding compound specified in paragraph 03300-2.05 before the application of the grout. The drypack grout shall be applied immediately following the application of the bonding compound in bands or strips to form a covering of the required thickness. The covering strips shall be smooth. Construction joints in the grout shall be sloped and shall be cleaned and wetted before application is resumed.
- B. Drypack grout shall be cured in accordance with Section 03300.
- C. Grout shall not be placed during freezing weather unless adequate protection is provided.

3.3 CEMENT GROUT

- A. Cement grout shall be used for filling nonbearing portions of equipment pads and pressure grouting.
- B. Except for the specialized equipment for pressure grouting, mixing and placing apparatus shall be similar to that normally used for cast-in-place concrete. Grout shall be mixed for a period of at least one minute. Diluted grout shall be agitated to keep ingredients mixed.

3.4 NONSHRINK GROUT

- A. Nonshrink grout shall be used for the bearing surfaces of machinery and equipment bases, column baseplates and bearing plates. It also shall be used for setting bolts and reinforcing steel in holes for grouting. Embeco 636 shall be used for grouting any rotating equipment, pumps, motors, etc., weighing over 500 pounds.
- B. Where specified, grout shall meet CRD-G588. Grout shall be placed in accordance with manufacturer's instructions.

3.05 EPOXY GROUT

- A. Epoxy grout shall be used for repairing cracks by pressure grouting, repairing structural concrete, and setting reinforcing dowels into holes for grouting. Concrete shall be primed in accordance with the grout manufacturer's instructions.

3.06 PRESSURE GROUTING

- A. Prior to grouting, systems and holes to be grouted shall be washed clean. Washing is not required for grouting soil voids outside pipe cylinders or casing pipes. Grouting, once commenced, shall be completed without stoppage. In case of breakdown of equipment, the Contractor shall wash out the grouting system sufficiently to ensure fresh grout and adequate bond and penetration will occur upon restarting the grouting operation. Grout pressure shall be maintained until grout has set.

END OF SECTION

SECTION 03 61 00
SEWER CONCRETE WET WELL REHABILITATION

PART 1 – SCOPE OF WORK

- 1.1 This specification shall govern all work, materials, and equipment required for concrete wet well rehabilitation for the purpose of eliminating infiltration, providing corrosion protection, repair of voids, and restoration of the structural integrity of the wet well and channels.
- 1.2 Described are procedures for wet well preparation, cleaning, application and testing. The applicator, approved and trained by the manufacturer shall furnish all labor, equipment and materials for applying a structural repair and protection liner, with machinery specially designed for application. All aspects of the installation shall be in accordance with the manufacturer's recommendation and approved by the manufacturer. Approved lining materials are those manufactured by:
- A. DINJER – Colorado Springs, CO 719.686.5988
 - B. PERMACAST MS-1000
 - C. S-301P.O.- Warren Environmental

1.3 SUBMITTALS

- A. Section 01 30 00 - Submittals.
- B. Product Data: Technical data sheet on each product used; Material Safety Data Sheet (MSDS); grade of materials; design thickness.
- C. Design Variations: Description of variations from application procedures, surface preparation, application equipment, or testing. (If applicable.)
- D. Quality Assurance/Control: Submit certifications as required under Article 1.5 - Quality Assurance.
- E. Provide a list of at least 5 (five) previous clients, including contact information, to verify satisfactory performance on projects of similar or greater size and complexity.
- F. Plan to prevent debris from entering area to be treated.

1.4 QUALITY ASSURANCE

- A. Provide certification from product manufacturer that contractor is a certified, licensed applicator of the product.
- B. Provide certification that the equipment to be used for concrete coating has been manufactured or approved by the product manufacturer. Application equipment for structural epoxy must be as developed by Warren Environmental Systems or Strong Companies..

1.5 EXTENDED WARRANTY

- A. Work shall be unconditionally guaranteed for workmanship and resistance against deterioration for a minimum period of five (5) years from the date of final acceptance. All defects discovered within this period, as determined by

the Owner, shall be repaired or replaced in a satisfactory manner, and within a reasonable time, at no cost to the Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store materials in accordance with manufacturer's recommendations and **MSDS**.
- B. Materials are to be kept dry, protected from weather, and stored under cover at a temperature between 50°F and 100°F, do not store near flame, heat, or strong oxidants.

PART 2 – MATERIALS

2.1 SILICA MODIFIED CEMENTITIOUS LINER

- A. Cementitious liner, shall be used to form a Structural/Structurally enhanced monolithic liner covering all interior wet well surfaces as indicated on plans and shall have the following minimum requirements at 28 days.
 - 1. 28 Day Compressive Strength (ASTM C-109) 9,000psi
 - 2. 28 Day Tensile Strength (ASTM C-496) 800 psi
 - 3. 28 Day Flexural Strength (ASTM C-78) 1,000 psi

2.2 WATER

- A. Shall be clean and potable. Questionable water shall be tested by a testing laboratory in accordance with ASTM C-94; Potable water need not be tested.

2.3 EQUIPMENT

- A. Equipment used for mixing, pumping, and troweling or spraying shall be adequate in size and capacity to accomplish the rehabilitation Work in a timely manner.
- B. Specially designed machines consisting of an optimized progressive cavity pump capable of producing a minimum of 250 psi pumping pressure, contra-blend mixer with twin ribbon paddle with end discharge, and an air system for spray application of product, shall be used for applying the Cementitious lining.
- C. The Contractor will be responsible to ensure that application and installation of the Cementitious liner is made in accordance with, and approved by the manufacturer.
- D. For structural epoxy application, heated, plural component, specially designed equipment for use in the spray or spincast application of the specified system approved for use by the structural epoxy manufacturer as designed and developed by Warren Environmental, Inc., or an approved equivalent. There will be no exception to this equipment specification, the product may also be hand trowel applied

2.4 EPOXY LINING FOR CHEMICAL CORROSION PROTECTION OF CEMENTITIOUS LINER

- A. The protective coating shall be a 100% solids epoxy with no volatile organic compounds and gray or white in color to optimize visual inspection. Minimum physical properties shall be:
 - 1. Tensile Strength ASTM D-638 6,000 psi
 - 2. Flexural Strength ASTM D-790 9,000 psi
- B. The epoxy shall be uniformly centrifugally cast or troweled onto the fresh mortar lining before re-exposure to the chemicals can contaminate the underlying mortar. If application is delayed beyond 24 hours, the mortar liner shall be rinsed to neutralize its surface and the epoxy shall then be applied. The epoxy shall have a minimum thickness of .125 inches (125 mils) and shall not run or sag during placement.

2.5 STRUCTURAL EPOXY LINING SYSTEM

- A. The product shall be S-301, by Warren Environmental, Inc. (shown below) or engineer approved equivalent. All proposed equivalent products shall be submitted for approval 10 days prior to the letting date. Minimum physical properties shall be:
 - 1. 100% Solids High Build Epoxy: (ASTM C722)
 - 2. 100% solids epoxy resin (ASTM D1763)
 - 3. Compressive Strength (ASTM D 695) 8,800
 - 4. Tensile Strength (ASTM D 638) 6,000
 - 5. Flexural Strength (ASTM D 790) 11,000
 - 6. Hardness, Shore D (ASTM D 2240) 70

PART 3 – EXECUTION

3.1 PREPARATION

- A. Existing coatings should be removed or thoroughly abraded (in some cases) per manufacturer recommendations to provide adequate surface profile for mechanical bond of the new system. Applicator is to maintain strict adherence to surface preparation requirements of the specific project and to the manufacturer's recommendations with regard to proper surface preparation and compatibility with existing coatings.
- B. Active leaks shall be stopped using quick setting specially formulated mixes, according to manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during the application after which the weep holes shall be plugged with the quick setting mix prior to the final liner application. When severe infiltration is present, drilling may be required in order to pressure grout using a Cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.
- C. Use only skilled workmen who are certified by product manufacturer, trained and experienced in high build epoxy coating rehabilitation. The foreman must have at least five (5) years of experience in epoxy restoration.
- D. Rehabilitate structures as identified on the Drawings.

- E. Do not allow extraneous material to enter the area to be treated. Extraneous material is defined as soft concrete debris, construction debris, or other materials. Active flows shall be diverted using bypass pumping as required to ensure that the liquid flow is maintained off the surfaces to be lined. Contractor shall provide submittal explaining how they will prevent debris and active flow from contaminating work area.
- F. Clean surfaces to be rehabilitated with high-pressure water spray (minimum 4000 psi) to remove loose concrete or brick, biological growths, and other contaminants. If surface cannot be prepared sufficiently with high-pressure water spray, then use means necessary, as recommended by manufacturer. Concrete surfaces with high pH levels or new concrete surfaces may require the application of a minimum of 10% solution of muriatic acid or the use of a detergent or degreaser. If an acid or detergent solution is used, the surface shall be thoroughly rinsed and neutralized prior to the application of the epoxy. All surfaces to be coated with epoxy shall be clean and structurally sound. All contaminants shall be removed. Loose and protruding pipe, brick mortar, concrete and roots shall be removed. Any effort required to provide adequate surface preparation shall be at the expense of the Contractor and will not be considered grounds for change order. All concrete that is not sound or has been damaged by chemical exposure shall be removed down to a sound concrete surface.
- G. Metal components shall be removed or sandblasted to a NACE No. 2 "Near White Blast Cleaning", or waterblast with sand injection. Minimum surface profile shall be CSP 3.
- H. Submit written bypass pumping and emergency response plans to Owner for approval prior to beginning of bypass operations.

3.2 CEMENTITIOUS LINER SYSTEM

- A. Mixing
 - 1. For each bag of product, use the amount of water specified by the manufacturer and mix using the approved equipment and in accordance with the manufacturer's equipment.
 - 2. Place the mix into the holding hopper and prepare another batch with timing such that the nozzleman can spray in a continuous manner without interruption until each application is complete.
- B. Application
 - 1. Patch any voids or irregularities deeper than $\frac{3}{4}$ " from the average surface location with drypack grout.
 - 2. Commence pumping the mixed mortar and begin spray applying the material at the lowest point desired for the new wall and work upward. The material may applied to the specified thickness in one or more passes.
 - 3. If additional thickness is desired at any level, simply recommence material application until that area is thickened. Additional layers may be applied at any time.
- C. Finishing
 - 1. Trowel the surface of the liner to create a uniform finish. Caution shall be taken to prevent over working the material. Thickness may be verified at any point with a wet gage. Brushing is an optional procedure for texturing its finish for improved mechanical adhesion of epoxy.

- D. Weather -
 - 1. Apply Cementitious lining in accordance with manufacturers requirements concerning weather conditions.
- E. Product Testing -
 - 1. Four - 2 inch cubes shall be cast each day or from every 50 bags of product used, and shall be properly labeled and sent in for testing in accordance with the manufacturer's directions, for compression strength testing as described in ASTM C-109.
- F. Epoxy Lining For Chemical Corrosion Protection of Grout Patch System
 - 1. Preparation & Procedure: cement grout patch material shall be applied to the prepared surfaces as specified in the preceding sections, at the thickness necessary to restore the full cross-sectional thickness of the original wall.
 - 2. Application: Epoxy lining may be applied by brush, spray or SpinCaster[®] directly over the cement grout patch liner after 60 minutes or as soon as the liner has set and lost the sheen from its surface. As a corrosion barrier, the epoxy liner may be applied directly over the primed surface as soon as the primer is dry to the touch.
 - 3. Design Thickness: Epoxy lining shall be applied to a minimum thickness of 65 mils (.065 inches) or as directed by the Engineer.
 - 4. Quality Assurance & Testing: All work shall be performed by factory certified applicators. Thickness readings may be verified with a wet gage at any random point of the newly coated surface. Any area found to be less than the minimum coating thickness shall immediately receive additional material and be retested. Visual inspection shall verify a smooth, glossy finish. When completely cured, the entire coated interior shall be tested at the prescribed voltage with a holiday detector for pinholes and voids in the presence of the owner's inspector. Any defects shall be marked and recoated.

3.3 STRUCTURAL EPOXY SYSTEM

- A. Application -
 - 1. All active infiltration leaks shall be sealed using hydraulic urethane grout recommended by epoxy manufacturer. Applicants shall notify owner of any noticeable disparity in the surfaces that may interfere with the proper preparation or application of the product. Applicator and Owner and Owner's Representative shall visually inspect surface preparation prior to application or repair work commencing.
 - 2. If reinforcing bar is exposed, use repair mastic as approved by manufacturer. Rebar repairs shall be embedded in 1-1 1/2" of epoxy mastic.
 - 3. Spray, trowel or spin-cast the structural epoxy to a minimum total thickness of as recommended by the manufacturer. The cured surfacing shall be monolithic with proper sealing of connections to all unsurfaced areas and shall be placed and cured in one or two applications, depending on existing conditions. Coating thickness shall be designed for hydrostatic loading.
 - 4. Epoxy shall be applied when ambient temperatures are above 40 degrees Fahrenheit. Application below 40 degrees Fahrenheit shall not be allowed.

5. When cured, the system shall form a continuous, tight-fitting, hard, impermeable surface that is suitable for sewer system service and chemically resistant to any chemicals, bacteria or vapors normally found in domestic or industrial sewers. Chemical resistance shall conform to ASTM D543.
 6. The system shall effectively seal the interior surfaces of the structure and prevent any penetration or leakage of groundwater infiltration.
 7. Certified Applicator or approved substitution shall be required.
- B. Testing And Inspection -
1. During application, applicator shall perform wet gauge testing at periodic intervals, minimum of one test every vertical and horizontal foot in accordance with ASTM D4414. Owner's representative may also perform wet gauge testing at their discretion. Add material as necessary.
 2. Perform visual inspection. Mark areas identified for repair and add additional material. Lightly sand areas prior to application of additional material or other methods as recommended by manufacturer. Groundwater infiltration of the system shall be zero. All pipe connections shall be open and clear, no cracks, voids, pinholes, uncured spots, dry spots, lifts, delamination or other defects shall be evident in the system.
 3. Surface preparation work shall be thoroughly inspected by Owner's representative prior to application of the manhole lining system.
 4. The Owner's representative shall inspect, utilizing man entry inspection procedures, all structural repairs made during the surface preparation process. Any structural repair deficiencies identified by the Owner's representative shall be corrected prior to rehabilitation product application.
 5. A comprehensive visual surface inspection shall be performed by Owner's representative for all rehabilitated structures. Owner's representative may, at his/her discretion, perform additional entry inspections as deemed necessary. Owner reserves the right to reject sub-standard workmanship.

3.4 SAFETY

- A. Conform to all OSHA requirements as well as those required by the manufacturer's material safety data sheets shall be complied with fully.

-END OF SECTION-

SECTION 03 61 10 BYPASS PUMPING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section specifies bypass pumping of the existing Sanitary Sewer System at the locations shown on the drawings.

1.2 PERFORMANCE REQUIREMENTS

- A. It is essential to the operation of the existing sanitary sewer system that there be no interruption in flow through the duration of the project. Provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and backup units as required), conduits, and all necessary power to intercept the sewer flows before they reach the point where they would interfere with the work, carry them past the work and return them to the existing sewers downstream of the work.
- B. Design, install and operate the temporary pumping system.
- C. Convey wastewater safely past the work area. Do not stop or impede the flows under any circumstances.
- D. Maintain flow around the work area in a manner that will not cause surcharging or damage to sewers, and that will protect public and private property from damage and flooding and any spills.
- E. Protect water resources, wetlands, and other natural resources.

1.3 DESIGN REQUIREMENTS

- A. Provide all pipeline plugs, pumps of adequate size to handle peak flow and temporary suction and discharge piping to ensure that the total flow of the sewer line can be safely diverted around the work. Bypass pumping systems shall be operated 24 hours per day 7 days per week, including holidays during bypass pumping operations. A system operator shall be on site full time during bypass pumping operations.
- B. Provide 100% redundancy in pumps and capacity to bypass the main flow of the sewer line. Each pump system shall have the capacity to pump the estimated peak flow at the suction end of the bypass pumping system. Each pump system shall be isolated by individual valves and ready for immediate use in the event of an emergency or breakdown. Equip each pump system with an auto start device that will start/stop the pump in response to changing conditions in the suction hole.
- C. Install redundant piping. Bypass pipelines shall be of adequate size to convey the required flow for the system pumps.

1.4 SUBMITTALS

- A. Shop Drawings: Detailed plans and descriptions outlining all provisions and precautions regarding the handling of existing wastewater flows. This plan must be specific and complete including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and or

required to ensure proper protection of the facilities, including protection of public and private property from damage and flooding by surcharging of sewers. The plan shall include but not be limited to details of the following:

1. Staging areas for pumps.
2. Sewer plugging method and types of plugs.
3. Number, size, material, location and method of installation of suction piping.
4. Number, size, materials, method of installation and location of installation of discharge piping.
5. Bypass pump sizes, capacity, number of each size to be onsite and power requirements.
6. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted).
7. Standby power generator size, location.
8. Downstream discharge plan.
9. Method of protecting discharge manholes or structures from water infiltration, erosion and damage.
10. Thrust restraint block sizes and locations.
11. Sections showing any suction and discharge pipe depth, embedment, select fill and special backfill where required.
12. Method of noise control for each pump and/or generator.
13. Any temporary pipe supports and anchoring required.
14. Plans for access to bypass pumping locations.
15. Calculations for selection of bypass pumping size.
16. Schedule for installation of and maintenance of bypass pumping lines.
17. Emergency action and contaminant plans detailing the actions to be taken in the case of a pump failure or other emergency overflow.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate bypass pumping, shutdowns and tie-ins with Taylorsville Bennion Improvement District.

1.6 BYPASS PUMPING OPERATION

- A. Employ vendor specializing in design and operation of temporary bypass pumping system.
- B. System operators shall be full-time employees of vendor with experience in operating and maintaining bypass systems.
- C. Contractor is responsible for any spillage of wastewater that results in civil or criminal charges from any local, state or federal agency and shall bear the costs for these charges and any required restoration.
- D. Maintenance service: Ensure that the temporary pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating.
- E. Extra Materials: Spare parts for pumps and piping shall be kept onsite as necessary.

PART 2 – PRODUCTS

2.1 BYPASS PIPING MATERIALS

- A. Piping: At the beginning of the project, all discharge piping shall be high density polyethylene pressure piping conforming to ASTM D3350 with a minimum SDR of 32.5.
- B. Joints shall be butt fusion welded.
- C. Discharge piping shall be as manufactured by Phillips Driscopipe, INC., or approved equal.

2.2 EQUIPMENT

- A. All pumps used shall be fully automatic, self-priming units that do not require the use of foot valves or vacuum pumps in the priming system. The pumps shall be diesel powered. All service connection pumps shall be trailer mounted. All pumps used must be constructed for dry running for long periods of time to accommodate the cyclical nature of effluent flows.
- B. Provide the necessary automatic start/stop controls and a visual alarm indicating a pump malfunction for each pump.
- C. The flow back-up pumps shall be online, isolated from the primary system by a check valve.
- D. Incorporate noise prevention measures for any and all equipment being used to ensure minimum noise impact on the surrounding areas.
 - 1. These measures include but are not limited to hospital grade silencers or mufflers, equipment modifications and special equipment or sound barrier walls as necessary to limit noise levels below 55 decibels at a distance of 25 feet in the direction of any residential home.
 - 2. In the event the CONTRACTOR fails to comply with maximum permissible noise level decibels in the operation of the flow bypass pumping system, the ENGINEER may order the CONTRACTOR to restore gravity flow in the line and stop operation of the flow bypass pumping system until such time as specified noise levels are achieved.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Precautions:
 - 1. Locate existing utilities in the areas selected to locate the bypass pipelines. Locate bypass pipelines to minimize any disturbance to existing utilities and private property and obtain approval of the pipeline locations from private property owners, TBID, Salt Lake County and the ENGINEER.
 - 2. Bypass pump all wastewater flows during all portions of the work and coordinate all bypass pumping operations with private property owners, TBID, Salt Lake County and the ENGINEER.

3.2 INSTALLATION

- A. Plugging or blocking of wastewater flows shall incorporate a primary and

secondary plugging device. When plugging or blocking is no longer needed for performance and acceptance of work, it shall be removed in a manner that permits the sewage flow to slowly return to normal without surge, surcharging or causing other major disturbances downstream.

- B. When working inside manholes, exercise caution and comply with OSHA requirements when working in the presence of sewer gasses, combustible or oxygen deficient atmospheres and confined spaces.
- C. The bypass pipeline shall be located off streets, sidewalks and shoulders of the roads. When the bypass pipeline crosses local streets, trails, walkways and private driveways, place the bypass pipelines in trench and cover and temporary pavement or other approved methods. Obtain TBID, Salt Lake County and ENGINEER approval for placement of the temporary pipeline.
- D. Protect the bypass discharge line from damage in high traffic work areas.

3.3 FIELD QUALITY CONTROL

- A. Test: Perform a hydrostatic pressure test for each section of discharge piping with a maximum pressure equal to 1.5 times the maximum operating pressure of the system. Engineer shall witness the test to ensure that there are no leaks in the discharge piping prior to actual operation.
- B. Operator shall inspect bypass pumping system every hour, or on a schedule approved by ENGINEER.
 - 1. An inspection log shall be kept at each pumping location. Each inspection log shall be marked with a time clock stamp to ensure required maintenance and inspections are being performed.

3.4 CLEANING

- A. Wastewater remaining in the bypass discharge pipeline and/or pumping equipment shall be discharged to a working sewer before the bypass pumping is broken down.
- B. After completion of the bypass pumping operation, clean up all areas disturbed by these operations, restoring same to a condition, including pavement restoration, at least equal to that which existed prior to the start of the work.

END OF SECTION