

**SECTION 02100  
SITE PREPARATION**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

The work of this section consists of clearing, grubbing, stripping, and storage of topsoil and protection of vegetation to remain, including other related work.

1.02 JOB CONDITIONS

Bidders shall examine the work site to determine the character of materials to be encountered, trees to be removed or protected, and nature of the work in general. All required excavation is unclassified.

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

3.01 SITE CLEARING

- A. Clearing: Clear all trees, stumps, brush, roots, rubbish and other objectionable matter within clearing limits shown on the Drawings, staked in the field, or as directed by the Engineer. Do not disturb any vegetation or roots thereof designated to remain more than absolutely necessary to assure completion of new construction.
- B. Grubbing: Remove all stumps and roots within clearing limits to a depth of at least 12 inches below natural ground.
- C. Stripping: Remove all humus, vegetation, existing roadway aggregate or other objectionable material encountered within the top 6 inches of soil in areas of project construction, areas to be excavated, and areas where embankment or excess earth will be placed. Upon removal of objectionable material, the top 6 inches of soil shall be stripped and stockpiled as topsoil at a site designed by the Engineer. This material is to be stockpiled separately and not mixed with any other material.

3.02 PROTECTION

Trees, shrubs, roots, and other landscape features designated on Drawings or in the field for preservation, or those located outside of the construction limits shall be carefully protected from marring or damage during construction operations. Continual parking and/or servicing of equipment within areas designated for preservation will not be permitted. Trees and shrubs designated for preservation and pruning shall be trimmed as directed. At no time shall excavation be within the drip line of trees designated to remain.

**3.03 DISPOSAL**

All debris resulting from clearing and grubbing shall be removed from the project site and disposed of properly. Prior to disposal, the Contractor shall provide the Engineer with the locations of all disposal sites to be used.

END OF SECTION 02100

**SECTION 02140  
DEWATERING**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

- A. Design, furnish, install, operate and maintain all pumps, piping, drains, well points, wells, and other facilities for the control, collection and disposal of groundwater or surface water for the proper construction of all work specified herein.
- B. The dewatering system shall prevent loss of fines, boiling, quick conditions, and softening of foundation strata and shall maintain stability of excavation bottoms.

1.02 DEFINITIONS

- A. Special Dewatering: Dewatering by single or multiple stage well points or deep wells.
- B. Hydrostatic Groundwater Level: The groundwater level at any location at the time of construction and prior to dewatering.

1.03 SUBMITTALS

- A. 21 days prior to the start of construction, the Contractor shall submit a written plan that provides specific dewatering and sediment control measures during the construction period including a dewatering plan where dewatering is required. Include the sequence of operations and information on equipment, materials and suppliers. Include details regarding the anticipated types and locations of various dewatering features, as well as appropriate design calculations to substantiate the dewatering plan. The plan shall also indicate discharge treatment, discharge location, and receiving body.
- B. Measures given in the Drawings and Specifications are minimum requirements, the Contractor shall supplement the measures described to the extent necessary to achieve the required results. Engineer's review of the Contractor's proposed dewatering system does not relieve the Contractor of the full responsibility for the adequacy of the dewatering system.
- C. Submit a Water Quality Monitoring Plan to measure water quality per *WAC 173-201A-200*.

1.04 REGULATORY REQUIREMENTS

- A. All dewatering activities shall comply with all local, state, and federal regulations, including the requirements of the Washington State Department of Ecology (WDOE).

1.05 REFERENCES

- A. *NMFS Screen Criteria*
- B. *WAC 173-201A-200*
- C. *ASTM D4632* – Standard test method for grab breaking load and elongation of geotextiles.

**PART 2 - PRODUCTS**

2.01 COMPONENTS

The materials and construction of the dewatering wells, and any required observation wells shall be selected by the Contractor and their dewatering specialist.

**PART 3 - EXECUTION**

3.01 INSTALLATION

- A. Do not begin work until the necessary dewatering and sediment control measures for that particular phase of work has been implemented. Incorporate all sediment control features into the project at the earliest practicable time.
- B. At all times during construction, the Contractor shall provide ample means and devices to promptly remove and properly dispose of all water entering excavation such that the bottom is kept firm and acceptably free of standing water until the structures to be built therein are completed.
- C. The Contractor shall provide continuous superintendence during all periods of dewatering.
- D. The location of every element of the dewatering system shall be such that interference with excavation and construction activity is minimized.
- E. Discharged water shall be directed into settling basins or areas where silts and sediments may be filtered prior to entry into waterways or other property. At streamside construction and other locations where siltation or erosion may occur, hay-bale silt fencing and/or other control measures shall be installed as required to control and prevent siltation.
- F. The Contractor may use sheeting, at their option, to help achieve the dewatering requirement as specified in this Section. If sheeting is used, submit a sheeting design by a Structural Engineer registered in Washington State.
- G. Special dewatering shall be required in any location where the soil and/or groundwater conditions would otherwise tend to result in boiling or other disturbance to the subsoils and/or walls of the excavation.

3.02 DEWATERING

- A. Construct temporary channels, temporary culverts, earth berms, or sandbag berms to divert water around disturbed areas and work areas.
- B. Streams within this project area shall not be dewatered or diverted. Do not divert or dewater any area of the stream unless approved by the Engineer.
- C. Pumps: Install pumps as required to dewater foundations. When failure of pump would result in movement of sediment or turbidity beyond the work area, provide a backup pump that is readily available. Equip the pump with approved screens, appropriate suction and discharge hoses, fittings and flow regulation equipment as needed. Ensure that the pumps are clean, free of leaks and that the oil used as lubricant in the pump seal systems is food grade mineral oil.

1. Pump intakes: Use one of the following methods of screening on all draft hoses:
  - a. Perforated Plate: Screen openings shall not exceed 3/32 or 0.0938 inches
  - b. Profile Bar Screen: The narrowest dimension in the screen openings shall not exceed 0.0689 inches in the narrowest direction.
  - c. Woven Wire Screen: Screen openings shall not exceed 3/32 or 0.0938 inches the narrow direction.
  - d. Check intakes frequently and clean as needed with wire brushing, flushing, or any other acceptable method.
2. Sump Pumps: Supply pumps capable of dewatering the structure foundation and sediment retention pond. Ensure that pumps are clean and free of leaks. Remove sediment and turbidity in the Sump Pump discharge water prior to re-entering the work area.
3. Sump Water Discharge: Discharge sump water as approved by the Engineer. Apply one or more methods to remove sediment from sediment-laden water prior to release into the approved discharge location. Apply additional methods as needed to eliminate increase in turbidity. Use the following methods as needed:
  - a. Silt Bag Filtration: Discharge sump water into one or more silt bags. Silt bags are constructed of Mirafi 180N (or approved equal) with sewn seam strengths of 90% efficiency according to *ASTM D4632*. Construct bag to hold and filter sump water. Place silt bag(s) on level ground having layer of straw one foot thick minimum.
  - b. Settling Basin: Discharge sump water into settling basin or discharge location approved by the Engineer.

#### 3.04 OPERATION OF DEWATERING SYSTEMS

- A. Operate dewatering systems in a manner that will avoid harm to aquatic organisms.
- B. Prior to any excavation below the hydrostatic groundwater level, the dewatering system shall be operated to lower the water levels as required. Then it shall be operated continuously, 24 hours per day, 7 days per week, until all facilities and structures affected by the dewatering have been satisfactorily constructed, including placement of fill materials to an elevation above the hydrostatic groundwater level.
- C. Wherever special dewatering is used, the dewatering system shall lower the groundwater level in the entire excavation at least 1 foot below bottom grade or the bottom of over-excavation of unsuitable material.
- D. Positive measures shall be taken to prevent flotation or uplift of partially completed structures until they are able to sufficiently resist water pressures.
- E. The pumping and dewatering operations shall be carried out in such a manner that no disturbance to the bearing soil or to soil supporting overlying and adjacent structures from this or any other work will result.

- F. Where existing wells are utilized for the Contractor's dewatering purposes, the Contractor shall take full responsibility for the protection, maintenance, and any required development of the wells during the construction period.
- G. The Contractor shall provide complete standby equipment and power sources available for immediate operation as may be required to adequately maintain the dewatering on a continuous basis in the event that all or any part of the dewatering system may become inadequate or fail.

**3.05 REPAIR AND RESTORATION**

When failure to provide adequate dewatering and drainage causes disturbance to the soils below bottom grade, slope instability, or damage to foundations or structures, the Contractor shall, at their own expense, provide all materials and labor to perform all work required for restoration of subgrade soils, slopes, foundations, or structures to the satisfaction of the Engineer.

**3.06 REMOVAL**

- A. An adequate weight of backfill material to prevent flotation of pipes or structures shall be in place before any dewatering systems are shut off.
- B. At the completion of the dewatering work, all units of the dewatering system installed by the Contractor shall be removed and the holes backfilled with clean sand or cement grout.

END OF SECTION 02140

**SECTION 02200  
EARTHWORK**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

This section specifies general earthwork requirements.

1.02 JOB SITE CONDITIONS

- A. Earthwork operations shall not be performed if the weather conditions, in the opinion of the Engineer, are inappropriate. Work in muddy or frozen ground will not be allowed.
- B. The Contractor shall maintain proper drainage at all times.
- C. Stockpiles:
  - 1. All stockpile locations shall be approved by the Engineer and shall be located so as not to interfere with other work or disturb adjoining property owners.
  - 2. Stockpiles shall not exceed 10 feet in height.
- D. Contractor is responsible for repairing any damage to roads or addition of rock to access work site.
- E. Work area shall be maintained to prevent stormwater or sediment runoff into the river.
- F. Consult the recommendations of the 2018 geotechnical report prepared by GeoEngineers, Inc., which is included as an attachment to these Specifications.

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used.

END OF SECTION 02200

**SECTION 02220  
EXCAVATION, BACKFILL, AND COMPACTION**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

This section consists of excavation, filling, compaction, grading, trenching, bedding and backfilling, placement of excess earth, and fill material.

1.02 RELATED SECTIONS

- A. Complete all topsoil stripping and clearing and grubbing in accordance with *SECTION 02100* prior to any excavation, embankment construction, or placement of excess earth.
- B. Keep excavations and trenches free from water during construction in accordance with *SECTION 02140*.
- C. Temporary sediment and erosion control measures shall be provided and maintained as specified in *SECTION 02270*.

1.03 REFERENCES

WSDOT – Standard Specifications for roads, bridges, and municipal construction (M41-10), latest edition.

1.04 SUBMITTALS

Submit the following information in accordance with *SECTION 02000*. Gradation analysis and certified test results for all imported fill material and onsite material to be incorporated into the work.

1.05 JOB SITE CONDITIONS

- A. Earthwork operations shall not be performed if the weather conditions, in the opinion of the Engineer, are inappropriate. Work in muddy or frozen ground will not be allowed.
- B. Maintain proper drainage at all times.
- C. Stockpiles:
  - 1. All stockpile locations shall be approved by the Engineer and shall be located so as not to interfere with other work or disturb adjoining property owners.
  - 2. Stockpiles shall not exceed 10 feet in height.
- D. Contractor shall maintain stormwater and erosion controls at all times.



- E. Delivery, Storage, and Handling of Geofoam
  - a. Geofoam shall be delivered labeled with material type.
  - b. Geofoam shall be stored above ground. Protected from moisture and sunlight prior to installation.
  - c. Geofoam shall not be exposed to open flame or other ignition sources.

**1.06 SAFETY AND PROTECTION**

- A. Contractor shall barricade open excavations occurring as part of this work and post warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required by applicable safety regulations.
- B. Contractor shall protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining washout, and other hazards created by all earthwork related operations.
- C. Contractor shall be responsible for contacting utility companies to locate service lines prior to any excavation.
- D. Contractor shall proceed with caution in the excavation so that damage to underground structures, both known and unknown, may be avoided.
- E. Contractor shall take extreme precautions for the protection of utility lines and other subsurface improvements. Any improvements damaged by construction operations shall be repaired at the Contractor's expense in compliance with the requirements of the utility owner and to the Engineer's satisfaction.
- F. Trenches and excavations shall be sheeted, shored, and braced where required in a manner consistent with established safe practices and in accordance with all applicable safety regulations.
- G. Contractor shall comply with *Chapter 49.17 RCW, the Washington State Industrial Safety and Health Act*, if trench excavation exceeds 4 feet in depth. Contractor shall also include cost of required safety systems in all bid schedules and shall list as a separate Bid Item on the Bid Proposal Form.
- H. Contractor shall provide all materials, equipment, and labor necessary to provide support to manholes, footings, and foundation walls during excavation and backfilling at all locations.

**PART 2 - PRODUCTS**

**2.01 EXCAVATION MATERIALS**

- A. Common Excavation includes all material other than rock as described below required for the construction of this project. It includes, but is not restricted to earth, gravel, hardpan, cemented gravel, soft or disintegrated rock, and boulders or detached pieces of solid rock not exceeding 1 cubic yard in volume.

- B. Rock excavation consists of rock boulders greater than 1 cubic yard in volume and bedrock. Rock excavation shall be approved by the Engineer and will be considered a change in the work.
- C. For the purpose of this bid, all excavated material shall be assumed to meet the specifications for common borrow.
- D. Excavated materials may be used for fill and backfill applications required for construction of this project; provided the material meets the specifications for the intended use and has been properly protected from water conditions that would render it undesirable.

**2.02 FILL MATERIALS**

- A. Common Borrow: Common borrow shall be defined as fill required to raise existing grade or backfill excavations beyond 5 feet of a structure or as trench backfill above pipes or conduits. Common borrow shall be material from common excavation or from a borrow site which is free of deleterious materials. Deleterious material includes wood, organic waste, or any other objectionable material greater than 3% by weight.
- B. Sand shall be clean and uniformly graded and meet the gradation of *WSDOT 9-03.1(2)B, Class 1*.
- C. Ballast Rock: Rock shall be hard, sound, and durable with at least one (1) face fractured. Rock shall be free of frozen material, debris, and organics, and meet the gradation of *WSDOT 9-03.9(1)*.
- D. Crushed Surfacing Base Course (CSBC) and Top Course (CSTC) shall be manufactured from ledge rock, talus or gravel, uniform in quality, substantially free of wood and other extraneous material, meeting the requirements of *WSDOT 9-03.9(3)*.
- E. Trench Backfill shall meet the requirements of *WSDOT 9-03.10* with 100% of material passing through a 2½ inch screen.
- F. Structural Fill shall meet the following requirements for Gravel Backfill:
  - 1. Foundations: *WSDOT 9:03.12(1) A or B*
  - 2. Walls: *WSDOT 9-03-12(2)*
- G. Pipe Bedding: Clean sand/gravel mixture free from wood waste or other extraneous materials and conforming to the gradation of *WSDOT 9-03.12(3)* when tested in accordance with *ASTM C136*.
- H. Drain Rock: Shall be washed and have the gradation of *WSDOT 9-03.12(4)*.
- I. Gravel Borrow: Selected granular material, free-draining mineral soil, free from organic matter, frozen or lumpy material, meeting the requirements of *WSDOT 9-03.14(1)*.
- J. Quarry spalls: Shall meet the gradation of *WSDOT 9-13.1(5)*

**PART 3 - EXECUTION****3.01 EXCAVATION**

- A. Excavation consists of the removal of material required to establish the proposed subgrade surface elevations. Excavations shall be conducted in such a manner as to avoid disturbance to all materials located outside the limits of the work area, unless specifically identified by the Engineer as an acceptable borrow source. Methods of excavation will be the Contractor's option, but Contractor shall exercise care when approaching final grade. If final grade is disturbed, it shall be replaced with suitable materials and compacted at Contractor's expense.
- B. Large rocks, which size qualifies them as common excavation, encountered during excavation or trenching may be partially removed as required to reach subgrade elevations. With Engineer's approval, Contractor has the option to remove these rocks by excavation and subsequent backfilling the overexcavated portions. No extras will be paid for such overexcavations.
- C. Protect bottoms of all excavations from freestanding water and frost. Protect excavations from caving, flooding, or other source of damages. Damage to excavation shall be repaired at the Contractor's expense.
- D. Any excess excavation performed by the Contractor for his convenience shall be at the expense of the Contractor.
- E. All disposal of excavated materials shall be at a permitted offsite location. Prior to disposal, Contractor shall provide the Engineer with a letter authorizing disposal at selected locations.
- F. Excavated materials of any nature in excess of quantities needed for fill or backfill for construction of this project shall be disposed of. This disposal will not be considered a change in work, and no extra payment will be made.
- G. Excavated materials determined by the Engineer to be unsuitable for use as common borrow shall be disposed of. This disposal shall be considered a change in work. Extra payment will be determined per the change clause in the *GENERAL CONDITIONS*. However, the disposal quantity considered for extra payment will be limited to the amount of common borrow imported to replace the unsuitable material.
- H. Any excavation and replacement of unsuitable materials below final grade will be as directed by the Engineer. "Unsuitable material" is any type of soil (particularly clays and silts) or organic materials that will not compact to specified compaction percentage or does not meet the specification for its intended use.

**3.02 ROCK REMOVAL**

- A. Large rocks greater than 1 cubic yard encountered within the excavation limits may be partially or entirely removed; however, the subsequent backfill for such overexcavation shall be done at the Contractor's expense.
- B. No blasting will be allowed on this project.

3.03 BACKFILL AND COMPACTION

- A. No backfill materials shall be placed until the foundation has been suitably dewatered and prepared as specified herein.
- B. When backfilling, extra care must be taken so that no damage will occur to foundations or related structures. Where backfill is to be placed against both sides of concrete walls, the backfill shall be brought up evenly on both sides of the wall.

Where backfill is to be placed against one side of concrete walls, backfill shall not be placed until the concrete has developed sufficient strength to resist the loading imposed by the backfill. Any abutting concrete walls or beams shall also have attained sufficient strength. In any case, the backfill placement shall not begin until 72 hours after concrete placement and shall not exceed the following schedule (unless high-early strength concrete has been approved for use):

Age of Concrete	Backfill Depth
72 hours	1/2 Wall Height
7 Days	2/3 Wall Height
28 Days	Full Wall Height

- C. Each lift of fill material shall be spread uniformly in horizontal layers and compacted in accordance with the following table:

TABLE 02220 - 3.03C			
Type of Material	Max. Loose Lift Placed (inches)	Percent Compaction*	Application
Common borrow	24	90	General fill**
Sand	6	95	Pipe and conduit bedding, fill under structures
Ballast rock	8	90	Fill under other materials, where noted
Crushed surfacing base course	<u>Total Depth</u> 2	95	Subgrade for crushed rock or asphalt pavement surface/finished crushed rock surface such as parking lots, driving areas
Trench backfill	6	90	Fill above pipe bedding
Structural fill	6	95	Fill under structures and wall backfill***
Structural fill	12	90	Fill around structures**
Pipe bedding	6	95	Pipe and conduit bedding
Drain rock	6	95	Backfill in drain trenches
Gravel borrow	12	90	Select Fill****
Quarry spalls	12	90	Rock lining for outfall channel

\* Percent compaction at maximum dry density as determined in accordance with ASTM D1557.

\*\* All fill and backfill not under structures and beyond 5-foot concrete slabs, walls, and footings.

\*\*\* All fill and backfill under concrete slabs and footings (interior and exterior) and all fill and backfill within 5 feet of concrete slabs, walls and footings.

\*\*\*\* All fill under roadways and trench backfill under paving.

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- D. Compaction shall be accomplished with power-operated tampers, rollers, idlers, or vibratory equipment. Water jetting for compaction purposes will not be permitted.
- E. Any application of water or any working of fill material required to bring it within acceptable moisture content and density limits during compaction operations shall be done at the Contractor's expense.
- F. Backfill materials shall not be placed, spread, or compacted at an unsuitably high moisture content during adverse weather conditions. When work is interrupted by heavy rain, backfill operations shall not be resumed until field tests indicate the moisture content density of the backfill areas are within specified limits.

### 3.04 TRENCH EXCAVATION

- A. Except with specific approval of Engineer, no more than 200 feet of open trench shall be excavated in advance of laying pipe. All operations shall be carried out in an orderly fashion.
- B. Width of trenches for pipes shall not be less than outside pipe diameter plus 16 inches, nor greater than outside pipe diameter plus 36 inches of the pipe installed unless otherwise shown on the Drawings.
- C. Side walls of the trench shall be vertical from the trench bottom to at least the height of the top of the pipe.
- D. Where soil encountered in the bottom of the trench is unstable or unsuitable as a base, such soil shall be removed to a depth specified by the Engineer and replaced with compacted common borrow or other material as directed by the Engineer. This overexcavation and replacement shall only be done as directed by the Engineer and will be paid for as an extra.
- E. Bottom of trench shall be carried to the lines and grades shown on the Drawings with proper allowance for thickness and type of pipe bedding specified.
- F. Excavation below designated lines shall be filled at the Contractor's expense. Excess excavation below pipes shall be replaced with gravel borrow or as directed by the Engineer.
- G. Excavated material shall be placed a sufficient distance from the trench walls to avoid sliding of materials into the trench.
- H. The Contractor shall not excavate across any existing roads without notifying the Engineer at least 48 hours in advance.

### 3.05 PIPE BEDDING PLACEMENT

- A. After bottom of trench has been excavated to proper depth and grade and brought to a reasonably flat surface and dewatered, bedding material shall be placed as shown on the Drawings.

- B. Pipe bedding shall be placed in trench without causing any excavated material to slide into trench or any cave in of trench walls. Pipe bedding shall be placed and compacted into a 6 inch minimum depth and shall provide a continuous, uniform bedding for the full length of the pipe.
- C. Utility lines and flexible pipe, such as PVC, shall be backfilled to 6 inches above the top of pipe or line using bedding material only. Rigid pipe, such as steel, may be backfilled using gravel material as specified.
- D. Any pipe bedding material required due to unauthorized overexcavation or made unsuitable due to mixture with trench side material or excavated material shall be removed and replaced at the Contractor's expense.
- E. Fill placed between the invert of the pipe and centerline of the pipe shall be placed in 6 inch maximum loose lifts and compacted to 95 percent of maximum dry density as determined by *ASTM D1557*. Backfill from the pipe centerline to the top of the trench shall be placed in 12 inch maximum loose lifts and compacted to 90 percent of maximum dry density.

**3.06 TRENCH BACKFILL.**

- A. Trenches at pipe joints shall not be backfilled until pipeline has been tested.
- B. Remove screeds, shoring, wood forms, debris, and other decomposable matter from areas to be filled.
- C. Initial Backfill: Place backfill by hand in a maximum of 6 inch lifts using bedding material to the level shown on the Drawings. Backfill shall contact entire periphery of pipe.
- D. Place and compact each subsequent lift so that pipe is not displaced. Misalignment of pipe or other damage shall be repaired at the Contractor's expense. Material shall be carried up evenly on both sides of pipe. Compact in accordance with *TABLE 02220 - 3.03C*.
- E. Excess trench material shall be left neatly mounded over trenches (except in roadways or parking areas) so that a depression is not formed if backfill settles. Maximum mounding shall be 3 inches. Any depression formed by settlement within 1 year from final acceptance shall be filled at the Contractor's expense.

**3.07 ROAD AND PARKING FILL**

- A. Base course and top course shall each be placed in two (2) lifts on top of a prepared and compacted subgrade.
- B. Contractor shall provide the water and equipment necessary for adequately distributing moisture on the material. Apply water lightly and frequently to avoid having free water running out of the material and building up on the subgrade.
- C. No materials shall be placed when snow is falling or blowing or when the weather is such that, in the Engineer's opinion, satisfactory results cannot be obtained.

3.08 FIELD QUALITY CONTROL

- A. Field observation and testing shall be performed by the Contractor as required to control his work.
- B. Density and moisture-content testing of embankment fill and excess earth placements will be performed by the Engineer's testing lab in accordance with *ASTM D2922* and *ASTM D3017*, respectively.
- C. Fill Around Structures: The variation above or below the testing edge of a 10 foot straightedge between any two (2) contacts with the finished surface shall not exceed 1/10 foot.
- D. Any area which has been tested and shown as not meeting the requirements of these Specifications shall be reworked and retested at the Contractor's expense until it complies.

END OF SECTION 02220

**SECTION 02270  
SLOPE PROTECTION AND EROSION CONTROL**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

This section specifies riprap, sediment control, silt fences, and slope protection as required for completion of this project.

1.02 REFERENCES

*AASHTO T-85 Standard method of test for specific gravity and absorption of course aggregate.*

*WSDOT Standard specification for road, bridge, and municipal construction.*

**PART 2 - PRODUCTS**

2.01 RIPRAP

- A. All rock shall be sound, free of cracks, seams, and objectionable quantities of dirt, sand, clay, frozen material, debris, and organics.
- B. Specific gravity of rock shall be not less than 2.55 and absorption not more than 3% when tested in accordance with *AASHTO T-85*.
- C. Light, loose riprap shall meet the grading requirements of *WSDOT 9-13-1(3)*.
- D. Rock shall be angular to sub-angular and meet the gradation of *WSDOT 9-13-4(2), Class A*.
- E. Source of materials for backfill and riprap shall be the responsibility of the Contractor, subject to approval of the Engineer.
- F. Measurement of riprap shall be by trip tickets supplied to the Engineer using a factor of 1.33 tons per cubic yard.

2.02 RECLAIMED ARMOR STONE

Reclaimed armor stone shall be rock material removed during excavation, and conforming to the requirements for Riprap, Article 2.01 of this Section.

2.03 SILT FENCE

Material shall meet the requirements *WSDOT 9-33.2(1), Table 6*.



**2.04 POSTS**

Silt fence support posts shall be steel or wood of sufficient length to support the fence without sagging, bending, or otherwise collapsing.

**2.05 SUPPORT WIRE**

Support filter fabric where shown on the Drawings or required for strength with 14 gauge woven wire mesh field fencing.

**2.06 STRAW WATTLES**

Straw wattles shall consist of straw wrapped in biodegradable tubular plastic or similar encasing material. Wattles shall be 8 to 10 inches in diameter.

**PART 3 - EXECUTION**

**3.01 RIPRAP**

- A. The limiting dimensions and slopes as shown on the Drawings shall be subject to such reasonable variations as may be necessary in placing the rock; however, rock shall be placed at least to the limits and cross sections shown.
- B. Each rock shall rest securely upon the underlying material and shall be in close contact with adjacent rock to produce a reasonably well-graded mass with a minimum practical percentage of voids.
- C. Riprap shall be placed to full depth in one operation and in a manner that will avoid displacement of underlying material. Placing riprap in layers will not be permitted.
- D. Larger stones shall be well distributed, and the entire mass of stones shall be roughly graded to conform to gradation specified herein. Finished riprap shall be free of objectionable pockets of small stones and clusters of large stones. Hand placing may be necessary, but only to the extent required to obtain the results specified above. The desired distribution of the various sizes of stones throughout the mass may be obtained by selective loading at the quarry, by controlled placing of successive loads during placing, or by a combination of these. Methods causing segregation of the various sizes will not be permitted.
- E. A tolerance of plus 6 inches and minus 1.0 inches from the thickness shown on the Drawings shall be allowed in the finished surface, except the maximum tolerance shall not be continuous over an area greater than 200 square feet.

**3.02 TEMPORARY SILT FENCES**

- A. The Contractor shall be fully responsible to install and maintain temporary silt fences at the locations and manner shown on the Drawings.
- B. The silt fence shall prevent soil carried by runoff water from going beneath, through, or over the top of the silt fence, but shall allow the water without soil to pass through the fence.

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- C. The minimum height of the top of the silt fence shall be 30 inches above the original ground surface, and fence shall follow the contours of the ground.
- D. Damaged and otherwise improperly functioning portions of silt fences shall be repaired or replaced to the Engineer's satisfaction at the Contractor's expense.
- E. Sediment deposits shall either be removed when the deposit reaches approximately half the height of the silt fence, or a second silt fence shall be installed as determined by the Engineer.
- F. At the completion of all earthwork, remove only those silt fences that are no longer necessary to control sediment. Review with Engineer prior to removing silt fences. Remove and properly dispose of all accumulated deposits, silt fence, and associated components.
- G. Attach support wire and filter fabric with staples or wire rings.

END OF SECTION 02270

**SECTION 02601  
WATER SYSTEM**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

The work under this Section includes providing all labor, materials, tools and equipment necessary for furnishing and installing buried water pipe and water pipe fittings, electrical continuity, disinfection and testing. The Contractor shall install the water pipe and fittings to the horizontal and vertical alignment shown on the plans and shall complete all associated work described in this section.

1.02 DESIGN CRITERIA

- A. Water Service pipe
- B. Fittings and Values
- C. Testing and Disinfection Methods

**PART 2 - PRODUCTS**

2.01 PVC PIPE AND FITTINGS

- A. Unless indicated otherwise on the Drawings, all PVC pipe and fittings will be *ASTM D1785*, Schedule 80, manufactured from *Type I, Grade I* material. Joints will be plain end, solvent-welded, flanged or threaded as show on the Drawings.
- B. GENERAL: All water pipe shall be clearly marked with the manufacturer's name, type, class, and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

2.02 REDUCED PRESSURE BACKFLOW ASSEMBLY

- A. Reduced pressure backflow assembly and hot box shall comply with all of the responsible utility district's requirements.
- B. Including slab, outlet, and heat tape.

2.03 UNDERGROUND LOCATOR TAPE

Underground locator tape shall be blue, 6 inch wide, 4-mil thick, polyethylene tape with black lettering with the following wording: "Caution: Water Line Buried Below". Locator tape shall be installed 12 inches above the top of all water pipe.

**PART 3 – EXECUTION**

**3.01 GENERAL**

- A. Contractor shall preserve and protect all existing utilities and other facilities including but not limited to telephone, television, electrical, water and sewer utilities, surface or storm drainage, highway or street signs, mailboxes, or survey monuments. The Contractor shall immediately repair or replace utilities or other facilities damaged during construction. The Contractor shall support and protect any underground utility conduits, pipes, or service lines where they cross the trench.
- B. Contractor shall connect to existing service meter, route existing line after backflow assembly.
- C. Contractor shall give at least 48 hours' notice to the Owner prior to:
  - 1. Needing water or sewer main line locates;
  - 2. Interruption of water service in any area; or
  - 3. Use of water from any fire hydrant.
- D. Contractor and Fabricator to verify all fit-ups prior to order.
- E. Bent strap tests are to be performed in accordance with the PPI bent strap test by cutting a 1 inch wide section of the joint for at least 6 inches either side of the joint. *ASTM D2657*. The joint will be bent until the ends meet per Performance Pipe Joint Procedures of PPI. If a strap test fails, the problem in the processes shall be identified and the operator will be retrained and required to make an additional set of test joints. This process will be continued until a set of test joints passes the test.

**3.02 INSTALLATION**

- A. Water pipe shall be installed in accordance with the manufacturer's printed specifications and instructions, and in conformance with *NSF 61*.
- B. The water pipe shall be handled carefully to prevent damage to the pipe, pipe lining, or coating. Water pipe and fittings shall be loaded and unloaded using hoists and slings to avoid shock or damage, and under no circumstances shall they be dropped, skidded, or rolled. If any part of the coating or lining is damaged, repair thereof shall be made in a manner satisfactory to the Engineer at the Contractor's expense. All water pipe and fittings shall be inspected for defects. Damaged pipe will be rejected, and the Contractor shall immediately place all damaged pipe apart from the undamaged and shall remove the damaged pipe from the site with 24 hours.
- C. Whenever it becomes necessary to cut a length of water pipe, the cut shall be made by abrasive saw or by special pipe cutter.
- D. All pipe ends shall be square with the longitudinal axis of the water pipe and shall be reamed and smoothed to assure a good connection.

## DIVISION 2 - SITE WORK

- E. The water pipe shall be laid to the horizontal and vertical alignment shown on the plans. A minimum 3 foot cover shall be maintained from finish grade to top of water pipe. Fittings shall be installed at the location shown on the plans, or as required.
- F. Water encountered during trenching operations shall be removed and/or controlled to prevent entry of water and other deleterious material into the pipe and fittings.
- G. To prevent dirt and other foreign material from entering the pipe and fittings during handling and installation, the open end of the pipe shall be protected by a watertight plug at all times, except when jointing the next section of pipe.
- H. Under no circumstances shall pipe deflections, either horizontal or vertical, exceed the manufacturer's printed recommendations. Where deflections would exceed the manufacturer's recommendations, fittings shall be used.
- I. Vertical deflections to avoid obstructions that exceed allowable water pipe joint deflections shall be accomplished by the use of fittings, and either joint restraints or vertical thrust blocking conforming to the plans. Additional fittings to those indicated on the plans will be required to accomplish these vertical deflections.
- J. All joints with 50 feet of tees, or bends greater than, or equal to 45 degrees, shall be restrained.
- K. Continuous water service shall be provided for all structures, except for interruptions necessary for connection of temporary or new piping to the existing service or mainline piping.
- L. Interruption of water services, disconnected or interrupted as a part of this project, shall be limited to 4 hours. Notification of the residents and building managers affected by any water service interruptions shall be made a minimum of 24 hours in advance of the interruption of service.
- M. Contactor shall maintain continuous water service at a volume and pressure to match existing, to all structures, with either existing, temporary or new piping, except as provided in this section.
- N. Installation of PVC pipe shall comply with manufacture printed specifications. The Contactor shall ensure appropriate and proper fit up prior to installation.

### 3.03 FLUSHING, TESTING AND DISINFECTION

Comply with all of the responsible utility districts standards and the following WSDOT procedures:

- A. Hydrostatic pressure test 7-09.3 (23)
- B. Disinfection 7-09.3(24)

END OF SECTION 02601

**SECTION 02622  
PVC DRAIN PIPING**

**PART 1 - GENERAL**

1.01 SUMMARY

This section specifies the furnishing and installation of drain piping. The work shall include installing new 4 inch PVC, Schedule 80, tees into new 4 inch PVC rainwater drain lines.

1.02 DESIGN CRITERIA

Pipe Sizes - All references to pipe sizes refer to the nominal diameter.

1.03 SUBMITTALS

Not Used.

1.04 QUALITY ASSURANCE

- A. All piping and installation shall be done in accordance with state and local codes and current industry practices.
- B. Contractor to field verify location of all utilities and buried lines in the work area. Contractor shall be liable for repair costs resulting from damages to utilities or buried lines.

**PART 2 - PRODUCTS**

2.01 DRAINAGE SYSTEM PIPE

All drainage system pipe and fittings shall be polyvinyl chloride (PVC) pipe and fittings, *ASTM D2729*, Schedule 80, 4 inch diameter.

**PART 3 - EXECUTION**

3.01 INSTALLATION

- A. All utility materials shall be installed per manufacturer's recommendation and instructions.
- B. Installation shall be done in accordance with state and local codes.
- C. Work shall be coordinated with the designated WDFW representative. A minimum 2 working days' notice is required prior to beginning work.
- D. Contractor shall field locate drain line pipe openings to align with vertical down spout locations.

## DIVISION 2 - SITE WORK

- E. Contractor shall field locate drain lines as close as possible to building wall to allow down spouts to be inserted into drain line pipe.
- F. Upon completion of work, Contractor shall leave the area in a clean condition. Contractor shall remove all remnants and debris related to the work and dispose of in an approved manner.

END OF SECTION 02622

**SECTION 02670  
WELL DRILLING AND TEST PUMPING**

**PART 1 - GENERAL**

## 1.01 DESCRIPTION OF WORK

- A. These specifications detail the materials, construction, and testing of the well, and are part of the agreement to perform and complete the work as specified herein. All work shall be completed in accordance with the Washington Administrative Code (WAC) Chapter 246-191 (Group B Public Water Systems), WAC Chapter 173-160 (Minimum Standards for Construction and Maintenance of Wells) and American Water Works Association (AWWA) Standard No. A100-15 (AWWA Standard for Water Wells).
- B. The purpose of this work is to construct and test one Group B water system well at the Eells Springs Hatchery. The hatchery is located at 7570 W Eells Hill Road, Shelton, WA 98584. The new Group B water system well shall be 6 inch diameter.

All work must meet these technical specifications. The well location will be staked by the Owner. The well shall be installed at the location specified by the Owner, which shall be in generally flat and open area that is freely accessible by vehicles equipped with typical street tires. It is the responsibility of the Contractor to review the site and assess the location to verify accessibility.

The Mason County Group B water system workbook portion of the water system approval process must be completed by a professional engineer or by a certified water system designer certified to design in Mason County, Kitsap County or Thurston County. Mason County certified water system designers are as follows:

- Davis Drilling (360) 801-6107;
  - Nicholson Drilling (360) 876-4421; and
  - Top Dog Drilling (360) 275-7501.
- C. Drilling methods are at the Contractor's discretion but anticipated to be air rotary. Information regarding design and construction of the new well is based largely on existing wells in the area.
- D. The new finished well shall be 6 inches in diameter to accommodate a nominal 4 inch submersible pump (i.e. Grundfos Model 35S30) or an equivalent pumping system.
- E. The well will be drilled to an expected 100 feet below ground surface or until a low-permeability soil layer is encountered, whichever is less. The actual well depth will be determined by the Owner or Engineer.
- F. According to the 2018 Geotechnical Report (*ATTACHMENT 2*), soil in the flat portions of the hatchery site is mapped as Alluvium (map unit Qa). The map describes this material as gravel, sand, and silt that was deposited by flowing water in streams and flood plains. Soil in the upper portion of the steep slope area, to the south of the hatchery, is mapped mostly as Vashon Advance Outwash (map unit Qga). This material is generally described as sand and gravel that was deposited in front of the advancing Vashon ice sheet, and subsequently compacted by the weight of glacial ice.



## DIVISION 2 - SITE WORK

This unit typically has moderate permeability and high shear strength. Soil in the lower portion of the steep slope is mapped as Alluvial Fan material (map unit Qaf) and Mass Wasting deposits (map unit Qmw). These units are described as containing silt, sand, gravel and cobbles where streams emerge from valleys and deposits on potentially unstable slopes. Alluvial Fan deposits have variable permeability and relatively low shear strength. Small pockets of Vashon Drift, Undifferentiated (map unit Qgd) are also mapped on the lower slope. This material is described as glacially consolidated sand, silt and gravel. This unit typically has variable permeability and high shear strength.

- G. The Contractor shall sufficiently develop the well using methods approved by the Engineer.
- H. A successful well shall be designed as determined from materials and conditions observed during drilling.
- I. The well will be designed to keep entrance velocities into the well screen less than 0.1 ft/sec. The well casing will be low carbon steel. The well screen shall be stainless steel and sized to match the well casing. The screen will be secured to the riser pipe with a rubber packer or equivalent approved system.
- J. DFW anticipates that the well screen will be sized to telescope through 6 inch casing, at least 5 feet long, and have a minimum slot size of 0.100 inches; however, the Contractor shall verify these specifications based on their experience in the formation or similar formations and data gathered during installation. The well screen will be designed by the Engineer in consultation with the Contractor. The well should be constructed to obtain the greatest possible yield within the limits of well depth and diameter. A natural filter pack is anticipated, although the Owner or Engineer may elect to design a filter pack for installation by the Contractor. The Contractor shall not be paid for time during analysis of drill cuttings, screen/filter pack design, and construction and shipping of the screen assembly.
- K. It is anticipated that the well will have a natural filter pack. Gravel-pack completion may be required and will be treated as a change of conditions as needed.
- L. The well casing must extend at least 6 inches above the finished ground surface, or at least 6 inches above the pump house finished floor. Further, the top of the well casing must be at least 24 inches above the 100-year flood elevation (*WAC 246-291-125(1) and WAC Chapter 173-160*).
- M. The Contractor shall get appropriate approvals and submit appropriate well installation documentation to the Washington Department of Ecology. Copies of approvals and documentation shall be provided to DFW. The Contractor will not mobilize to the site until the approvals have been secured. The Contractor shall perform a pump test to demonstrate the source's capacity to meet or exceed the proposed water system demand. The pump test shall be conducted in accordance with Washington Department of Health requirements for a Group B water system per *WAC 246-291-125(3)* and additional requirements from Mason County. The Contractor will be responsible for providing the pump, flow meter and other equipment necessary to perform the well capacity test.
- N. The Contractor shall construct a pumphouse located at the wellhead. The pumphouse shall include a concrete floor with day-lighted drain, 2x4 construction, insulation, sheeted inner walls, hardiplank siding, a locking man door, a metal roof, and electrical. The dimensions shall be a 10 feet by 10 feet footprint or otherwise approved by the Engineer.

The pumphouse shall contain four 119-gallon bladder tanks (Pentair WellMate WM-Series or approved equal). The Owner shall provide two brand-new 119-gallon bladder tanks and the Contractor shall procure the two 119-gallon bladder tanks; a total of four tanks.

## PART 2 - PRODUCTS

### 2.01 EQUIPMENT

- A. Drilling Machine: The Contractor shall supply capable and experienced personnel to perform the work, and shall furnish drilling equipment, complete with all necessary tools and appurtenances, of adequate capacity to complete the well as specified. All equipment shall be in good operative condition and shall comply with all applicable federal, state, and local safety regulations. Equipment and operators shall have the capacity and experience to install a well with the anticipated dimensions.

Drilling shall be done with a drill rig that is capable of drilling a 6 inch diameter hole to the required depth. Include drilling tools, casing jacks, in-hole cutters, and all other auxiliary equipment normally used for drilling in Washington State.

- B. Test Pump: The test pump shall have the capability of pumping at least 100 gallons per minute (gpm) from at least a 100-foot depth in a 6 inch diameter casing. Pump accessories shall also include means of varying the discharge and accurately measuring the discharge rate. The Contractor will need to provide power supply for the test pump.

### 2.02 MATERIALS

- A. All materials to remain in the finished well shall be free of defects.
- B. Drive Shoe: The permanent casing shall have a forged or cast drive shoe from an industry-approved manufacturer. A shoe or armor plate on any temporary casing shall be of sufficient strength to allow that casing to be driven to the required depth.
- C. Surface Casing: The surface casing shall meet the requirements of holding an oversized hole to the minimum drilled depth of 18 feet and sustain roundness until extracted at surface-seal completion. This casing remains the Contractor's property.
- D. Permanent Casing: Permanent casing shall be new steel, seamless or welded, and free of dents, corrosion, and defects. The steel pipe shall have a diameter of 6 inches and a minimum wall thickness of 0.375 inches.
- E. Riser and Spacer Casings: If used, riser and spacer casings shall be new or equal and have a wall thickness as directed.
- F. Extra Materials: Extra materials such as gravel pack or special fabrications shall be provided by the Contractor as directed by the Engineer during the course of the work.
- G. Sealants: Sealants shall be used in constructing the surface seal and, if necessary, in decommissioning all or part of the borehole, as directed by Engineer.

Neat cement grout shall be neat Portland Cement (*ASTM C150, Type I or II*) mixed with bentonite and water. Each 94-pound sack of cement shall be mixed with a bentonite suspension consisting of 4 to 4½ pounds of powdered bentonite in not more than 6 gallons of clean, potable water.

If bentonite slurry is used, it shall be prepared to achieve at least 20 percent solids by weight in accordance with *WAC 173-160-221*. Unhydrated bentonite (pelletized, granulated, powder, or chip) shall not be placed in the borehole without prior approval of the Engineer.

- H. Well Screen and Fittings: Well screen and fittings shall be approved by the Engineer and provided by the Contractor. Screen shall be continuous wire-wrap Type 304 stainless steel. Wire shall have a triangular cross-section (V-wire); "T" shaped wire shall not be used. The screen sections shall be acquired by the Contractor from a manufacturer approved by the Engineer.

A K-packer, if used, shall be constructed of self-sealing neoprene rubber built on a body of the same material as the riser pipe.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

All tools, pumping, and drilling equipment must be thoroughly sterilized just prior to entering the well. Approved sterilization methods shall be steam cleaning and/or strong chlorine solution wash (100 parts per million (ppm) of chlorine).

#### **3.02 SCHEDULE AND CONTINUITY OF WORK**

Contractor shall provide to Owner a drilling schedule as soon as possible but no less than one week prior to start of construction. The Contractor shall perform this work in a continuous manner, a minimum of 8 hours per day, a minimum of 5 days per week, until completion of the project. The Owner may, at its option, terminate the contract in the event of excessive unauthorized delays by the Contractor. In the event of termination of the contract, Contractor shall be paid only for work satisfactorily completed up to that time, and only to the extent that the work is usable by a different contractor in completing the work.

#### **3.03 INSTALLATION**

- A. Surface Seal: The surface seal shall consist of a cement or bentonite grout placed from at least 18 feet. The sealant shall be tremied into a cased annulus of at least 4 inches in diameter greater than the permanent casing. The outer temporary casing shall be fully withdrawn as the sealant is placed from the bottom up. The surface seal shall conform to the requirements of *WAC 173-160-231*.
- B. Drilling: The hole shall be drilled in such a manner that any over-excavation (i.e., hole collapse or heave) is minimized. The Engineer shall have authority to stop progress immediately if there is apparent over-excavation, and drilling shall not resume until definite procedures have been taken to remedy the problem. Formation water generated during drilling may be directed on the ground in a manner that does not cause erosion and that does not allow the water to flow into an existing surface water course. Drilling shall be performed by an experienced and licensed well driller and a helper (*WAC 173-162*). Only competent workmen shall be employed on the job. The Engineer shall determine the final drilling depth based on field conditions.

## DIVISION 2 - SITE WORK

- C. Sampling: Grab samples (i.e., samples collected from a bailer) taken shall be representative of formations drilled to the extent practical. Grab samples shall be taken at least every 10 feet or at formation change, and at least every 3 feet starting 10 feet above the target screen interval. The Contractor shall provide individual containers for the samples and label them as to true depth. The samples shall be provided to the Engineer for review.
- D. Records: The Contractor shall keep a daily written log of operations including formations drilled, size and length of the casing placed, tools used, beginning and end of shift, depth to water; location, size, and length of screen; and progress of development work. A duplicate copy of the daily log shall be furnished to the Engineer at the beginning of the following day's work.
- E. Welding: All steel casings, risers, and liners shall be joined by arc welding such that the welded joint has 100 percent of the strength of the new casing. The Contractor assumes full responsibility for any casing breakage during the course of the work. Stainless steel screens shall be welded with stainless steel welding rod according to manufacturer's specifications.
- F. Alignment: The basic alignment required is that all casings, liners, risers, screens, and tools can be freely run through the well and that a test pump and permanent pump can be freely set in the well. Other alignment tests will not be required unless doubt arises during the work. If the Engineer requires an alignment test, the Contractor shall be required to conduct a test as specified by the *AWWA Standard for Deep Wells, Publication AWWA A100-06, Testing for Plumbness and Alignment*. If an alignment test is demanded by the Owner or Engineer, the bid hourly rig rate shall be paid for this test unless the results of the test show alignment does not meet above-specified conditions, in which case the Contractor shall bear the expense of the test and the expense of correcting the misalignment.
- G. Screen Setting and Pullback: Depth intervals over which well screen is to be placed will be specified by the Engineer, based on driller's recommendations, cuttings samples, or any other means used to determine the appropriate screened interval. The Engineer will provide the Contractor with final screen design within five business days of collection of last sample.

Riser/screen assembly shall be lowered into the fully-cased well by a method approved by the Engineer. Prior to the installation of the permanent screen assembly, the Contractor may cut off the drilling shoe to allow the casing to be readily pulled back and to minimize the smearing of any clay that may exist within the target formation. The casing shall be extracted by equipment and methods best suited for its extraction by the Contractor, to the elevation directed by the Engineer. The screen assembly shall be constantly checked for position during pullback. The pullback method to be used shall be submitted to the Engineer for authorization prior to mobilizing that equipment.

Prior to installation, the Contractor shall inspect the well screen casing assembly and remove any tags, labels or other deleterious material. The actual screen sections, weld rings, blank sections, riser pipe, K-packer section, tail pipe, and any other fittings comprising the screen assembly shall be measured and recorded by the Contractor to the nearest 1/8 inch or 0.01 foot to yield exact lengths of the screen assembly and components.

## DIVISION 2 - SITE WORK

The Contractor assumes full responsibility to successfully retract the casing and install the screen.

- H. Filter Pack: In consultation with the Contractor, the Engineer may elect to install a filter pack. The Contractor shall install the filter pack using a tremie. At no time shall the tremie pipe be located a distance greater than 20 feet above the interval being filled. Filter pack sand shall be placed from the bottom of the well to the specified depth and shall completely fill the annulus in the specified interval. Care must be taken to avoid bridging during installation of the sand. The level of the filter pack shall be measured periodically during placement.
- I. Development: The Contractor shall develop the well to provide a gradation of the natural filter pack and remove fines from the formation surrounding the screen. The preferred development method shall be surging and bailing using a surge block and bailer. Development shall occur in 5 feet or less intervals, starting at the top and working downward, throughout the screen length. Development will continue in stages until each interval does not produce measurable material and until the water in the well is visibly clear of sediment or otherwise approved by the Engineer. Development water may be directed on the ground in a manner that does not cause erosion and that does not allow the water to flow into an existing surface water course.
- J. Capping: At all times during the progress of the work, the Contractor shall protect the well in such a manner as to effectively prevent either tampering with the well or entrance of foreign matter into it. The completed well shall have a 1/4 inch steel plate bolted in place to a flange welded on the casing.
- K. Disinfection: To prevent the reintroduction and contamination of the well by iron or sulfur fixing bacteria, the Contractor shall disinfect the well in accordance with *WAC 246-291-220* and the *American Water Works Association (AWWA) Standard C654-13, "Disinfection of Wells"*. Do not use Chlorine in hatchery wells for fish production. All chlorinated discharge must be neutralized using dichlorination chemicals.
- L. Well Decommissioning: In the event the Contractor fails to complete the well, it shall be decommissioned. All well decommissioning will be in accordance with decommissioning procedures in *WAC 173-160*. If failure is due to lost tools, misalignment, or other reason determined to prevent the reasonably expected scope of this Contract, no payment will be due the Contractor for work performed. If the well is decommissioned by direction of the Owner, the payment for the abandonment procedures will be due.
- M. Standby Time: Standby time will be credited only for periods during which work is stopped at the direction of Engineer or the Owner. This does not include time when the Engineer is completing screen design (including sieve analysis), or when the well screen manufacturer is constructing or shipping the screen or blank casing. Idle time required for maintenance or failure of equipment shall not be considered standby time.
- N. Grading: The Contractor shall grade the area around the finished well to assure that drainage does not drain to the well but away from it. Once all work is completed, the site shall be left in a clean condition, similar to how it was found.

3.04 PUMPING TESTS

- A. The Contractor shall provide, install, and operate a temporary pump and discharge system with portable power supply. A pump test shall be conducted required for Group B water system in accordance with *WAC 246-291-125*. A calibrated, in-line flow meter, orifice manometer, or other approved device for discharge measurements shall be supplied and installed. A discharge line shall be installed as necessary to prevent erosion and flooding. A water-sampling port shall be installed in the discharge system for water-quality sampling during the pumping test. The port shall have a valve capable of regulating flow. A check valve shall be installed in the discharge system to prevent water in the riser pipe from dropping back into the well. Discharge water shall be conveyed to an area designated by Engineer 1,000 feet or less from the production well. In consultation with the Engineer, Contractor shall furnish and install a means to disperse the pumping test discharge water as needed to minimize erosion and runoff.
  
- B. In the event of pump or other equipment malfunction causing the discharge to stop or vary unacceptably, the test shall be considered terminated. Recovery time to allow the water to return to static level will then be required, and the test will be restarted and run for the completed duration specified without credit for the aborted period.

END OF SECTION 02670

**SECTION 02730  
WELL DECOMMISSIONING**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

- A. Contractor shall furnish all labor, materials, equipment, and services for abandonment/decommissioning of the well as called for in these specifications. The existing domestic well to be decommissioned is located behind the existing apartment/warehouse as shown on the Drawings.
- B. The depth of the existing domestic well is assumed to be 50 feet; however, a boring log of this well is not available.
- C. The Work shall be performed by a registered well driller in the State of Washington.

1.02 RELATED WORK

Not Used.

1.03 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only. The list provided below is not intended to be all inclusive of each regulation prevailing over the work. The latest version of the document listed shall govern the work performed.

- A. State of Washington Administrative Code *WAC 173-160-381*.
- B. Revised Code of Washington *RCW 173-160-381*
- C. American Society for Testing Materials, Standard Specification for Portland Cement, C150-07.

1.04 DEFINITIONS

All terms not defined herein shall have the meaning given in the applicable publications and regulations.

- A. ASTM: American Society for Testing and Materials.
- B. Contractor: Refers to the General Contractor and/or Subcontractor responsible for the Work under contract with Project Manager.
- C. WDFW: Washington Department of Fish & Wildlife
- D. WDOE: Washington Department of Ecology.

- E. Project Manager: Authorized representative of the WDFW. Project Manager shall be the Architect or Designer of Record for the project.
- F. OSHA: Occupational Safety and Health Administration.

1.05 SUBMITTALS

- A. The well Contractor shall complete and file all well abandonment records of the decommissioning procedure as required by WDOE regulations.
- B. Per *ASTM Section 01730*, the driller shall complete a Project Summary Report. The contractor shall submit 1 paper copy and 1 digital copy in PDF format to the Project Manager. The decommissioning report shall include:
  - 1. Copies of all DOE required documents.
  - 2. A project summary including:
    - a. A summary of the project including start and end dates, activities performed, quantities of pipe removed, quantities of Bentonite used, and any issues encountered during the project.
    - b. Photographs of the project in progress and at completion.
    - c. Copies or originals of all documents be submitted to Department of Ecology pertaining to the well decommissions.

**PART 2- PRODUCTS**

2.01 MATERIALS

- A. All materials used in well decommissioning shall comply with *RCW 18.104* and all other DOE regulations and guidelines.
- B. Neat Cement Grout
  - 1. Cement conforming to *ASTM Standard C150* and water, with not more than 6 gallons of water per 94 lbs. Type II cement, must be used for openings less than or equal to 1½ inch openings.
- C. Cement-Bentonite Grout
  - 1. 20 parts of cement conforming to *ASTM Standard C150* to 1 part bentonite. The ratio of cement to water shall be 94 lbs of cement to 8 gallons of water. Type H cement must be used for openings larger than 1½ inches.



**D. CONCRETE**

1. Portland Cement: *ASTM Specification C150*, Type I, Type II, and Type III, of American manufacture.
2. These different types of cements shall not be used interchangeably in the same element or portion of the work.
3. Fine Aggregate: shall be graded natural sands - conforming to *ASTM C150*.
4. Coarse Aggregate: shall be hard, durable, uncoated crushed stone or gravel conforming to *ASTM C 33*.

**E. TOPSOIL AND SEEDING**

All seeding materials shall be approved by the Project Manager prior to application. Seeding materials shall be local grass seeding suitable for the site and considered not detrimental to the existing vegetation. Decision on grass seed selection by the Project Manager shall be final.

**PART 3- EXECUTION**

**3.01 GENERAL**

All work shall comply with *WAC 173-160-381*, *RCW 18.104*, and all federal, state and local codes. Work shall be performed in accordance with WDOE guidelines and industry standard practices.

**3.02 PREPARATION OF SITE**

- A. Remove all liners, debris, accumulated sediments, and obstructions from the well casing, except well screens and packers.
- B. Contractor responsible for disconnection of power to the site. Contact local utility service to coordinate disconnection and return of meter.

**3.03 WELL CASING REMOVAL**

- A. Withdraw the casing and fill the bore hole with concrete, neat cement grout, neat cement, unhydrated bentonite, or bentonite slurry as the casing is being withdrawn.
- B. If the casing cannot be pulled, perforate the casing from the bottom to within 5 feet of the land surface and pressure seal the casing.
  1. Perforations shall be at least 4 equidistant cuts per row, and 1 row per foot.

## DIVISION 2- SITE WORK

2. The perforations must be sufficient enough to allow neat cement grout or neat cement, or bentonite slurry to migrate outside the casing and effectively prevent the movement of water.
3. Apply enough pressure to force the sealing material through the perforations, filling any voids on the outside of the casing.
4. The casing shall be filled completely with neat cement grout, neat cement, or bentonite slurry. The screen and up to 5 feet of riser pipe may be filled with unhydrated bentonite. The remainder of the riser pipe must be removed.
5. The casing may be cut off at a maximum of 5 feet below land surface

### 3.04 CLEAN-UP & DISPOSAL

- A. The Contractor shall finish the ground surface above the abandoned well to match existing conditions in the surrounding area.
- B. The Contractor shall remove any project generated waste materials and debris from the worksite and the access road. Damaged areas of the worksite and access road shall be repaired the WDFW satisfaction.
- C. All materials generated from the project including piping and casing shall be considered the property of the Contractor. The Contractor shall remove the materials and be responsible for the proper disposal of those materials.
- D. The Contractor shall remove any piping and other pump or well related materials left on site from previous work.

### 3.05 PROJECT CLOSEOUT DOCUMENTATION.

- A. The Contractor is responsible to submit all required documents to WDOE to assure compliance with *WAC 173-160-381*.
- B. The Contractor shall submit a Project Completion Report to the Project Manager per 1.05 of this section.

END OF SECTION 02730

**SECTION 02740  
SEPTIC SYSTEMS**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

The work of this section consists of disconnecting the existing septic system from the existing restroom facility (to be demolished) and then connecting to the newly constructed office/storage building.

1.02 JOB CONDITIONS

Bidders shall examine the work site and the Drawings to determine the character of materials to be encountered.

1.03 PERMITS

A copy of the *Permit to Construct a Sewage Disposal System*, issued by Mason County Health Department, has been included in these specifications.

1.04 QUALIFICATIONS

The septic system installer must be licensed in Mason County, Washington.

**PART 2 - PRODUCTS**

2.01 SUBMITTALS

- A. Provide complete submittals including cut sheets for all materials for approval prior to beginning work.
- B. Provide complete layout plans for installed components where applicable for approval prior to beginning work.
- C. All materials shall meet State and local standards.

**PART 3 - EXECUTION**

3.01 INSTALLATION

- A. All materials shall be installed per State and local standards.
- B. All materials shall be installed per the manufacturer's recommendations and as detailed and/or noted on the Drawings.

END OF SECTION 02740

**SECTION 02930  
LAWNS AND GRASSES**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

This section specifies seed, fertilizer, and mulch to restore areas disturbed by excavations and construction equipment.

1.02 SEQUENCING

Seeding shall take place after ground disturbing activities have been completed. Notify Engineer at least 72-hours prior for seeding.

**PART 2 - PRODUCTS**

2.01 SEED

Seed shall meet the following requirements:

<b>TABLE 02930 - 2.01</b>			
<b>Kind/Variety Seed in Mixture</b>	<b>Percent by Weight</b>	<b>Percent Pure Seed</b>	<b>Minimum Percent Germination</b>
Chewing Fescue	40	39.20 Minimum	90
Colonial Bentgrass var. Astoria	10	9.80 Minimum	85
Perennial Rye	40	39.20 Minimum	90
White Clover Pre-Inoculated	10	9.80 Minimum	90
Inert and Other Crops		1.0 Maximum	
Noxious Weed			None
“Ladino”	Not Acceptable		

2.02 FERTILIZER

Fertilizer shall consist of a commercial fertilizer with the following formulation:

- A. Nitrogen (inorganic as Ureaform) - 12.8 percent
- B. Phosphoric Acid (P205) - 18.0 percent
- C. Potash (K20) - 18.0 percent

2.03 MULCH

Mulch shall consist of a straw mulch or wood cellulose fiber.

**PART 3 - EXECUTION**

3.01 PREPERATION

Ensure backfilled excavations have been compacted to match surrounding terrain and scarify disturbed areas to a minimum 2 inch depth.

3.02 SEEDING, FERTILIZING, AND MULCHING

- A. The hydro-seeding operation shall include the installation of seed, fertilizer, mulch, and tackifier with a tracer to verify uniform application in accordance with *WSDOT Spec. 8-01.3(4)A*.
- B. Seed shall be applied at a rate of 0.3 pounds per 100 square feet.
- C. Mulch shall be applied at a rate of 4.6 pounds per 100 square feet

3.03 WATERING

Contractor shall be responsible for watering of seeded areas until final project completion.

END OF SECTION 02930

**SECTION 02955  
UNDERGROUND PIPE RESTORATION**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

Rehabilitate the existing 12 inch diameter steel water supply pipe for Spring 3 by trenchless liner system with a 50 year design life as shown on the Drawings.

1.02 RELATED WORK

- A. Provisions of the GENERAL CONDITIONS, SUPPLEMENTAL CONDITIONS, and DIVISION 1 of the Contract are by this reference a part of this division and shall govern work under this division where applicable.

1.03 REFERENCES

- A. *ASTM*            *American Society of Testing and Materials*
- B. *ANSI*            *American National Standards Institute*
- C. *NSF*             *NSF International (Public Health and Safety Organization)*
- D. *OSHA*           *Occupational Safety and Health Administration*

1.04 SUBMITTALS

- A. Prior to starting work, submit one set of the following items in accordance with section 00704.03 of the GENERAL CONDITIONS:
1. Certification from liner manufacturer that Contractor is approved installer
  2. Field test results from two similar cured in place pipe (CIPP) projects over the last three years.
  3. Design calculations for wall thickness.
  4. Certification of factory hydrostatic testing.
  5. Copies of certified independent laboratory tests on the liner showing values for short term Flexural Modulus of Elasticity, Flexural Strength, Tensile Strength and other related properties. The testing laboratory must be a certified independent facility not affiliated with the proposed CIPP manufacturer/installer.
  6. Piping, fittings and appurtenant items which will be utilized in mechanical coupling system.
  7. Edge guards or other means of protecting the liner from host pipe edges at insertion points

8. Inspection reports and videos made before and after host pipe cleaning.
- B. Prior to final acceptance, submit the following:
1. Inspection reports and videos made before and after liner installation.
  2. Copy of test reports for QA/QC of installation and curing process.

## **PART 2 - PRODUCTS**

### **2.01 LINER MATERIAL**

- A. Flexible multi-layer pipe liner by Rädlinger (Primus Line) or approved equivalent, made of three layers meeting the following criteria: An inner liner or layer consisting of low friction polyethylene, a middle layer made of a seamless woven Kevlar fabric, giving the liner its strength to accommodate the specified operating pressure, an outer layer or liner made of abrasion resistant polyethylene to protect the inner layers.
- B. Liner minimum long term operating pressure shall be 150 psi
- C. NSF/ANSI 61 certification for the potable water transportation

### **2.02 LINER SIZE AND LENGTH**

- A. The liner shall be fabricated to a size that when installed will neatly fit the internal circumference of the water main to be lined. The liner thickness shall be designed to adequately resist the full internal pressure including allowances for surge pressure and all external pressures and conditions (e.g. deflection, ring bending, buckling and minimum stiffness).
- B. The length of the liner shall be of sufficient length to effectively span the distance and carry out the insertion and seal of the liner at the end points. The Contractor shall verify the lengths in the field before cutting the liner to length.
- C. Allowance for circumferential and longitudinal stretching of the liner during insertion shall be made as per the manufacturer's standards.

### **2.03 TERMINATION FITTINGS**

The liner termination fittings used in this composite system shall be compression type, supplied by liner manufacturer and meet the following criteria:

- A. Fabricated from *ASTM A395* cast iron material with an epoxy coating for corrosion protection
- B. Include two (2) 12 inch diameter, 150 psi rated ANSI-flanges each for connection to the 12 inch host pipe via flange coupling adapters.

**PART 3 - EXECUTION**

**3.01 PREPARATION**

**A. Air Quality and Safety**

1. The Contractor shall perform all work in full compliance with all State and Federal laws, rules and regulations regarding Air Quality and Safety.
2. The Contractor shall carry out his operations in strict accordance with all OSHA and manufacturer's safety requirements. Emphasis shall be placed upon safety requirements for entering confined spaces and working with hot water.
3. The Contractor shall erect such signs and other devices as are necessary for the safety of the work site and shall secure the site and perform all work to the safety requirements of all pertinent regulatory agencies.

**B. Excavation, Pipe Removal and Survey**

1. The Contractor shall be familiar with site conditions and accessibility for machinery, unwinding unit and winches as well as traffic safety measures.
2. The length and width of insertion/extraction pits shall be as recommended by the pipe liner manufacturer and as approved by the Engineer.
3. The Contractor shall excavate the insertion/extraction pits at the locations and to the dimensions specified and approved.
4. The Contractor shall excavate and remove the minimum length of pipe necessary for the liner insertion and receiving operations as per manufacturer's recommendations and as directed by the Engineer.
5. The existing main shall be cut square using an approved cutting machine, leaving no split or fractured ends. All cut faces of the existing main shall be chamfered on the inside surface to a suitable profile to prevent damage to the liner pipe during or after insertion.
6. Edge guards or other means of protecting the liner from host pipe edges at insertion points shall be installed as approved by the Engineer.
7. After cutting the main, the Contractor shall conduct a thorough pipeline location survey to find and document the location of any bends, intrusions, offsets, valves or other fittings that may impede the insertion and/or proper inflation of the cured-in-place-pipe liner.
8. The Contractor shall perform a television inspection and video recording of the existing water main, utilizing a radial eye camera, to build the rope connection between the pits and to identify the condition of the host pipe.



9. The Contractor shall spot-repair any major leaks or offset pipe alignments found in the television inspection that may impede the insertion and/or proper inflation of the cured-in-place-pipe liner.

C. Cleaning

1. The Contractor shall clean the existing water main using a cleaning method that is approved by the Engineer. The cleaning method shall remove all rust, scales, tuberculation, deposits, loose or deteriorated remains of any original coatings and other foreign materials from the inside of the pipe so as to produce a smooth interior surface finish, while capturing any asbestos fibers that might be released into the airstream.
2. After cleaning, and again immediately before pipe liner insertion the main shall be plunged with a tight fitting rubber plunger and foam swab to clear the pipe bore of debris and water.
3. Post-Cleaning Inspection: The Contractor shall perform a television inspection and video recording of the existing water main after the cleaning of the water main is completed. This inspection will be performed, utilizing a radial eye camera, to verify the rust and scale deposits have been adequately removed and the condition of the water main makes lining feasible. Repeat steps 1-3 as needed until satisfactory pipe condition is verified.

3.02 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall deliver, store and handle pipe liner and other materials as recommended by the manufacturers to prevent damage.
- B. Liner materials that are defective or damaged prior to installation shall be rejected and replaced at the Contractor's expense. Liner materials damaged during installation shall be repaired or replaced as recommended by the manufacturers and approved by the Engineer.

3.03 INSTALLATION, TESTING & INSPECTION

- A. The Contractor shall designate a location where liner will be prepared for installation, allowing the Engineer and/or his representative access to inspect the materials.
- B. Insertion of the liner shall be per Manufacturer's specifications.
- C. Install the termination fittings, connect to the host pipe and close the flexible liner, turning it into round shape using compressed air according to the Manufacturer's specifications.
- D. Perform a leak test and preliminary television inspection with video recording of the newly installed liner to determine if the liner is properly installed. If results are acceptable then this shall become the final TV inspection.
- E. If leak test or television inspection detect problem areas, make corrections, re-test and re-inspect until satisfactory.

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- F. Provide Owner with a video showing the pre-lined and post-lined condition of the water supply pipe interior.

### 3.04 COMPLETION

- A. After final television inspection showing satisfactory lining results is completed, connect the newly lined segment at each end to the existing pipeline as necessary to restore continuous, leak-free flow from the intake to the hatchery building.
- B. Perform hydrostatic pressure test to demonstrate soundness of pipe connections. Correct any connections as needed to Owner's satisfaction.
- C. Restore pipe bedding material as needed, backfill and compact access pits to match surrounding grade, reseed disturbed lawn area.

END OF SECTION 02955

**SECTION 03000  
GENERAL CONCRETE PROVISIONS**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

This Section specifies general requirements for all sections of *DIVISION 3 - CONCRETE*.

1.02 RELATED WORK

Provisions of the *GENERAL CONDITIONS*, *SUPPLEMENTAL CONDITIONS*, and *DIVISION 1* of the Contract are by this reference a part of this division and shall govern work under this division where applicable.

1.03 REFERENCES

References listed in *DIVISION 3* are from the following organizations' latest editions of their publications and reference standards (unless indicated otherwise):

- A. *AASHTO*      *American Association of State Highway and Transportation Officials  
(Standard Specifications for Highway Bridges, 17<sup>th</sup> Edition)*
- B. *ACI*            *American Concrete Institute (ACI 318-19)*
- C. *APA*            *American Plywood Association*
- D. *ASTM*          *American Society for Testing and Materials*
- E. *AWS*            *American Welding Society*
- F. *CRSI*            *Concrete Reinforcing Steel Institute*
- G. *IBC*            *International Building Code, Latest Washington State Approved Edition*
- H. *WSDOT*        *Washington State Department of Transportation (Standard Specification  
for Road, Bridge, and Municipal Construction)*

1.04 SUBMITTALS

Submittals for items in all sections of *DIVISION 3* shall be made in accordance with *SECTION 00704.03 Shop Drawings* and *SECTION 01300 Contractor Submittals*.

- A. Product Data: Submit manufacturer's data for all items in Division 3 indicating shapes, sizes, and chemical, physical, and structural properties.

## **DIVISION 3 - CONCRETE**

- B. Shop Drawings: Submit shop drawings including complete plan and profiles, size, details, spacings, splicing details, supporting and spacing devices, schedules for fabrication, and assembly of members, and other pertinent data. Indicate welds by AWS symbols and show size, length, and type of weld. Identify details by reference to sheet and detail number on the Drawings.

### 1.05 QUALITY ASSURANCE

All installation and product use shall be in accordance with the manufacturer's written instructions.

## **PART 2 - PRODUCTS**

### 2.01 MATERIALS

See other Sections of *DIVISION 3*.

## **PART 3 - EXECUTION**

3.01 See other Sections of *DIVISION 3*.

END OF SECTION 03000

**SECTION 03100  
CONCRETE FORMWORK**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

This section specifies formwork for cast-in-place concrete, with shoring, bracing, and anchorage. Also included are openings, form accessories, and stripping of forms.

1.02 SYSTEM DESCRIPTION

Design, engineer, and construct formwork, shoring, and bracing to meet design and code requirements so that resultant concrete conforms to required shapes, lines, and dimensions.

1.03 QUALITY ASSURANCE

Construct and erect concrete formwork in accordance with *ACI 301* and *347*.

1.04 REGULATORY REQUIREMENTS

Conform to the *IBC*.

**PART 2 - PRODUCTS**

2.01 FORM MATERIALS

- A. All materials shall conform to *ACI 301*.
- B. Fillets for chamfered corners shall be of wood strips or rigid plastic in maximum lengths.
- C. Forms for all concrete exposed to view shall be *APA PS-1 B-B Plyform Class I Exterior* or as approved by the Engineer.

2.02 FORM DESIGN

- A. As a minimum, all forms shall be 3/4 inch plyform with all edges supported, except for special locations as approved by the Engineer.
- B. As a minimum, forms shall have double 2 inch by 4 inch walers at 24 inches o.c. and a maximum snap tie spacing of 24 inches o.c., or single wale camlock-style forms where approved by the Engineer. For exposed surfaces, deflection of plywood, studs, or wales shall be limited to L/400 of the span (or L/360 of the span for unexposed surfaces).
- C. For narrow walls, etc. where the bottom of the form is inaccessible, lower form boards shall be left loose so that they may be removed for cleaning out extraneous material immediately before placing the concrete.

- D. The Contractor shall be responsible for ensuring the adequacy of all formwork to produce in the finished structure the lines, grades, and tolerances indicated on the Contract Drawings.

### 2.03 FORMWORK ACCESSORIES

- A. Form-Release Agent: Nontoxic, colorless material compatible with concrete tints, non-residual, and which will not stain concrete, absorb moisture, or impair subsequent applications. *L&M Construction Chemicals "Debond"* or approved equal. Form-release agents for concrete in contact with process water shall be certified by the U.S. Department of Agriculture. The agent shall have VOC loss of 350 grams/liter or less.
- B. Form Ties: Bolts and rods may be used for internal ties.
  - 1. Form ties for water-holding structures and on walls exposed to weather or earth shall have conical or spherical-type inserts and be so constructed that when the forms are removed, no metal shall be within 5/8 inch of any surface. Plastic or rubber inserts shall be used with flat bar ties for panel forms, be a minimum of 1 inch in depth, and of sufficient dimensions to permit proper grouting of the tie hole. All form ties shall provide adequate and positive spacing of the forms before and during the placing and processing of the concrete. Wire form ties will not be allowed.
  - 2. For non-water holding structures, form ties shall be metal, factory fabricated, removable or snap-off, that will leave holes no greater than 1/2 inch to 1 inch in diameter, not less than 1½ inches deep in surfaces to be exposed or painted and shall not project beyond the concrete elsewhere.

## **PART 3 - EXECUTION**

### 3.01 INSPECTION

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

### 3.02 PREPARATION

- A. Hand trim sides and bottoms of earth forms and remove any loose materials prior to placing concrete.
- B. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- C. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.
- D. Arrange forms to allow stripping without removal of principal shores, where shores are required to remain in place.

**3.03 ERECTION**

- A. All forms shall be built mortar tight and of sufficient rigidity to prevent distortion due to pressure of the concrete and other incidental construction loads, including the effects of vibration of concrete.
- B. The Contractor shall provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.
- C. The Contractor shall construct formwork to maintain tolerances in accordance with *SECTION 03300*.
- D. Provide 3/4 inch by 3/4 inch chamfer strips at all exposed edges or corners of concrete.

**3.04 APPLICATION OF FORM-RELEASE AGENT**

- A. The Contractor shall apply form-release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.
- B. Do not apply form-release agent where concrete surfaces are scheduled to receive applied coverings or special finishes which may be affected by agent. Soak contact surfaces of untreated forms with clean water and maintain in wet condition until concrete is placed.

**3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS**

- A. The Contractor shall provide formed openings where required for work embedded in or passing through concrete.
- B. The Contractor shall coordinate work of other Specifications sections in forming and setting openings, slots, recesses, chases, sleeves, plates, bolts, anchors, and other inserts.
- C. The Contractor shall install accessories in accordance with manufacturer's instructions, level and plumb, and ensure items are not disturbed during concrete placement.

**3.06 FORM REMOVAL**

- A. The Contractor shall not remove forms and shoring until concrete has sufficient strength to support its own weight and construction and design loads which may be imposed upon it. Remove load-supporting forms when concrete has attained 75 percent of required 28 day compressive strength provided construction is re-shored.
- B. The removal of forms as stipulated herein shall in no case relieve the Contractor of responsibility for the final acceptability or appearance of the work. In general, forms shall remain in place a minimum length of time as follows where average temperature is 40°F or higher:

## DIVISION 3 - CONCRETE

1. Columns, wall faces, footings, piers, and abutments where forms do not support the load of concrete: 72 hours (3 days).
  2. Crossbeams, caps, inclined walls, and columns where forms support the load of concrete: 120 hours (5 days).
  3. Side forms of footings may be removed 24 hours after concrete placement if a curing compound is applied immediately.
  4. Forms for walls not yet supporting loads may be removed 48 hours after concrete placement, immediately finished according to *SECTION 03300* and cured as required in *SECTION 03370*.
- C. Where lower temperatures or other conditions warrant, the Engineer shall decide, on the basis of post-placement conditions, the exact number of days that shall elapse before form removal.
- D. Remove formwork progressively so no unbalanced loads are imposed on structures.
- E. Any concrete surfaces damaged during form removal shall be repaired in accordance with *SECTION 03300*.
- F. All form tie holes shall be patched with a dry-pack cement mortar fill as specified in *SECTION 03300*.
- G. Forms shall not be stripped from concrete which has been placed at a temperature under 50°F without first determining if the concrete has properly set, regardless of the time element. If, in the opinion of the Engineer, stripping of forms on the basis of the specified schedule results in damage to the concrete, the schedule shall be modified to prevent such damage.

END OF SECTION 03100



**SECTION 03210  
REINFORCING STEEL**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

This section specifies reinforcing steel and accessories for concrete work.

1.02 QUALITY ASSURANCE

Contractor shall perform concrete reinforcement work in accordance with the current *ACI 318*.

1.03 SHOP DRAWINGS

- A. Contractor shall submit mill test certificates of supplied concrete reinforcing, indicating physical and chemical composition.
- B. Contractor shall indicate on the shop drawings sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, splicing, stirrup spacing, and supporting and spacing devices.

**PART 2 - PRODUCTS**

2.01 MATERIALS

- A. Uncoated-finish steel reinforcing bars shall consist of Grade 60 (unless noted otherwise) round, deformed bars. Deformed reinforcing bars for concrete reinforcement shall conform to the requirements of *ASTM A615*. Reinforcing bars requiring welding as shown on the Drawings shall conform to *ASTM A706*.
- B. Epoxy-coated reinforcing bars, when specified by the Engineer, shall be coated in accordance with *ASTM A775*. Epoxy-coated bar supports, form ties, and nylon, epoxy, or plastic-coated tie wire shall be used when epoxy-coated reinforcing bars are specified.
- C. Reinforcing steel shall be protected at all times from injury, and when placed in the formwork be free from dirt, loose mill scale, rust scale, paint, oil, or any other foreign substance.

2.02 ACCESSORY MATERIALS

- A. General: Chairs, bolsters, bar supports, and spacers shall be sized and shaped for strength and support of reinforcement during installation and placement of concrete. Materials shall be manufactured from standard bright basic wire.

B. Bar Supports:

1. Girder and slab reinforcement steel shall be supported on mortar blocks not more than 1½ inches square. The blocks shall be constructed of mortar mixed in the same proportions of sand and cement as used in the concrete.
2. Mortar blocks shall have a tie wire embedded, and the protruding ends shall be tied to the reinforcing steel to hold the mortar blocks in place. Mortar blocks with a grooved top may be used for supporting steel in slabs. If metal chair supports are used as steel supports for reinforcing bars, all surfaces of the chair support not covered by at least 1/2 inch of concrete shall be treated by one of the following methods:
  - a. Hot-dip galvanized after fabrication in accordance with *ASTM A153 Class D*.
  - b. Plastic coating, provided that the plastic is firmly bonded to the metal, has a minimum thickness of 3/32 inch at point of contact with the form and is not chemically reactive with the concrete. The plastic shall not shatter or crack at temperatures down to -5°F, nor will it deform sufficiently to expose the metal at a temperature of 200°F. Plastic coatings that have shattered, cracked, or deformed enough to expose the metal will be rejected.
  - c. Stainless steel conforming to the requirements of *ASTM A493 Type 302*.

C. Tie Wire:

1. Ties shall be made with a minimum 16 gauge, annealed-type tie wire.
2. Use epoxy-coated tie wire when using epoxy-coated reinforcement.

2.03 FABRICATION AND BENDING

- A. All bars shall be bent cold. If approved by the Engineer, welding shall be performed by certified welders in accordance with *AWS D1.4*.
- B. Unless otherwise shown on the Drawings, the Contractor shall fabricate reinforcing to provide clearances as listed under Minimum Cover.
- C. Reinforcement partially embedded in concrete shall not be field bent, except as permitted by the Engineer, or as shown on the Drawings.

2.04 HOOKS AND BENDS

Hooks and bends of steel reinforcing bars shall be bent to the inside diameters specified in *ACI 318*, as shown below.

TABLE 03210 - 2.04	
<b>Stirrups and Ties:</b>	
Sizes No. 5 and Smaller	4 Bar Diameters
Sizes No. 6 through No. 8	6 Bar Diameters
Sizes No. 9 through No. 11	8 Bar Diameters
Sizes No. 14 and No. 18	10 Bar Diameters
<b>Other than for Stirrups and Ties:</b>	
Sizes No. 3 through No. 8	6 Bar Diameters
Sizes No. 9 through No. 11	8 Bar Diameters
Sizes No. 14 and No. 18	10 Bar Diameters

2.05 SPLICING

- A. General: All steel bars used for concrete reinforcement shall be furnished in the full lengths where possible. Splices that are permitted or shown on the Drawings shall be well distributed or located at points of low tensile stress. Locate reinforcing lap splices not indicated on the Drawings at points of minimum stress. Indicate location of splices on shop drawings. No splices will be permitted at points where the section is not sufficient to provide a minimum distance of 2 inches between the splice and the nearest adjacent bar or the surface of the concrete. The bars shall be rigidly clamped or wired at all splices. Bars that are lapped for splicing shall be placed in contact for the length of the splice and tied together. Splices shall be staggered where possible.
- B. Seismic: (for regions of low, moderate or high seismic risk) see the Drawings for specific seismic detailing requirements.
- C. Unless otherwise detailed on the Drawings, the minimum splice lengths shall be as follows:

TABLE 03210 - 2.05C				
BAR#	GRADE 60 PLAIN		GRADE 60 EPOXY COATED	
	Concrete Compressive Strength		Concrete Compressive Strength	
	3000 psi	4500 psi	3000 psi	4500 psi
3 & under	2'	2'	2'-3"	2'-3"
4	2'	2'	2'-3"	2'-3"
5	2'-4"	2'-4"	2'-10"	2'-10"
6	3'	2'-9"	3'-7"	3'-4"
7	4'	3'-6"	4'-11"	4'-3"
8	5'-3"	4'-7"	6'-5"	5'-7"
9	6'-8"	5'-9"	8'-1"	7'

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

**A. Placing Reinforcing Steel:**

1. Reinforcing steel shall be accurately placed in the positions shown on the Drawings and held securely during the pouring of the concrete. In general, all reinforcement shall be put in proper position and securely wired and blocked before concrete is poured in any section. Stirrups and ties shall always pass around and be securely tied to the main flexural/tension steel members. Girder and slab reinforcing steel shall be supported on mortar blocks or other approved means of support. Tack welding of reinforcing bars shall not be allowed. If approved by the Engineer, welding shall be performed by certified welders in accordance with *AWS D1.4*.
2. Before placing concrete, clean reinforcement of foreign particles, loose scale, or coatings. The Contractor shall place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.
3. At all openings in structural slabs and walls, provide a minimum of 1 No. 4 bar at each of the top and bottom of slab or faces of wall or slab at 45 degrees on all 4 corners, in addition to a minimum of 1 No. 4 bar on all sides of square or rectangular openings, and hoops at each face for each round opening, unless otherwise shown on the Drawings.
4. The Contractor shall notify the Engineer when reinforcing is in place for inspection of reinforcement prior to placement of concrete. No concrete shall be placed until the Engineer or his representative has inspected the placing of the reinforcing steel and has given permission to pour concrete. All concrete placed in violation of this provision may be rejected and removal required.

**B. Minimum Cover:**

1. The minimum clear space between reinforcing bars shall be as follows (unless otherwise shown on the Drawings):

<b>TABLE 03210 - 3.01 - B1</b>	
Between parallel bars in a layer	Bar Diameter (1 inch minimum)
Between adjacent layers	1 inch

2. Except as otherwise shown on the Drawings, the minimum thickness of concrete cover over reinforcing bars shall be as shown in the following tables:

<b>TABLE 03210 - 3.01 - B2 CAST IN PLACE CONCRETE (NON-PRESTRESSED)</b>	
Concrete cast against and permanently exposed to earth	3 inches
Concrete exposed to earth or weather: No. 6 through No. 18 bar No. 5 bar, W31 or D31 wire, and smaller	2 inches 1½ inches
Concrete not exposed to weather or in contact with ground: Slabs, walls, joists: No. 11 bar and smaller Beams, columns: Primary reinforcement, ties, stirrups, spirals Shells, folded plate members: No. 6 bar and larger No. 5 bar, W31 or D31 wire, and smaller	¾ inch  1½ inches  ¾ inch ½ inch

<b>TABLE 03210 - 3.01 – B3 CAST-IN-PLACE CONCRETE (PRESTRESSED CONCRETE) <i>Minimum Cover 1”</i></b>	
Concrete cast against and permanently exposed to earth	3 inches
Concrete exposed to earth or weather: Walls, panels, slabs, joists Other members	1 inch 1½ inches
Concrete not exposed to weather or in contact with ground: Slabs, walls, joists Beams, columns: Primary reinforcement Ties, stirrups, spirals Shells, folded plate members: No. 5 bar, W31 or D31 wire, and smaller Other reinforcement	¾ inch  1½ inches 1 inch ¾ inch $d_b$ , but not less than ¾ inch

<b>TABLE 03210 - 3.01 – B4 PRECAST CONCRETE (Manufactured under plant control conditions)</b>	
Concrete exposed to earth or weather: <u>Wall panels:</u> No. 14 and No. 18 bars, pre-stressing tendons larger than 1½ inch diameter  No. 11 bar and smaller, pre-stressing tendons 1½ inch diameter and smaller W31 and D31 wire and smaller	  1½  ¾

<u>Other members:</u>	
No. 14 and No. 18 bars, pre-stressing tendons larger than 1½ inch diameter	2
No. 6 through No. 11 bars, pre-stressing tendons larger than 5/8 inch diameter through 1½ inch diameter	1½
No. 5 bar and smaller, pre-stressing tendons 5/8 inch diameter and smaller, W31 and D31 wire, and smaller	1¼
<u>Concrete not exposed to weather or in contact with ground:</u>	
<u>Slabs, Walls, Joists:</u>	
No. 14 and No. 18 bars, pre-stressing tendons larger than 1½ inch diameter	1¼
Pre-stressing tendons 1½ inch diameter and smaller	3/4
No. 11 bar and smaller, W31 or D31 wire, and smaller	5/8
<u>Beams, columns:</u>	
Primary reinforcement $d_b$ but not less than 5/8 and need no exceed	1½
Ties, stirrups, spirals	3/8
<u>Shells, folded plate members:</u>	
Pre-stressing tendons	3/4
No. 6 bar and larger	5/8
No. 5 bar and smaller, W31 or D31 wire, and smaller	3/8

C. Bar Placement Tolerances:

1. Between bars: 1/4 inch, plus or minus
2. Vertical position of bars in slabs and beams:
  - a. Members 8 inches deep or less: 3/8 inch, plus or minus
  - b. Members over 8 inches deep: 1/2 inch, plus or minus
3. Bars may be moved to avoid interference with other reinforcing steel, conduits, or embedded items. If moved more than 1 bar diameter or stipulated tolerances, consult with the Engineer to determine final placement.

## DIVISION 3 - CONCRETE

- D. Tie Wire: At a minimum, 50 percent of reinforcing steel intersections shall be connected with tie wire.
- E. Welding: Welding of reinforcing shall be prohibited unless explicitly allowed by the Engineer in writing or as shown on the Drawings. If approved by the Engineer, welding shall be performed by certified welders in accordance with *AWS D1.4*.

END OF SECTION 03210

**SECTION 03300  
CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

Cast-in-place concrete slabs, walls, footings, grade beams, columns, beams, and piers.

1.02 QUALITY ASSURANCE

- A. Perform work in accordance with *ACI 301*.
- B. Obtain materials from same source throughout the work.

1.03 REGULATORY REQUIREMENTS

Conform to the *IBC*, *WSDOT Standard Specifications* and *ACI*.

1.04 TESTING

- A. Testing and analysis of concrete shall be performed by the Contractor under provisions of *ACI 301* and/or *WSDOT Standard Specifications*. Concrete testing and analysis shall include, at a minimum, compressive strength cylinders, temperature, slump, and air entrainment. Contractor's testing agency shall remain on site and observe the entirety of the concrete placement.
- B. Concrete materials and operations may be tested and/or inspected by the Engineer's representative in accordance with the above standards. Failure to detect defective work or material early will not prevent rejection if a defect is discovered later nor shall it obligate the Engineer for final acceptance. The cost of test conducted by the State shall be paid by the State. Additional testing costs resulting from substandard materials and operations as indicated by the State's tests shall be paid by the Contractor at no additional cost to the State.
- C. Sampling and testing will be performed before concrete placement from the first load. Concrete shall not be placed until all tests have been completed by the Contractor's testing agency and the results indicate that the concrete is within acceptable limits.
  - 1. If the concrete is not within acceptable limits, sampling and testing will continue for each load until one load meets all of the applicable acceptance requirements. After one test indicates that the concrete is within specified limits, the concrete may be placed, and sampling testing frequency may decrease to one every 100 cubic yards.
  - 2. Random samples shall be selected in accordance with *WSDOT T 716*. After the first acceptable load of concrete, up to 1/2 cubic yard of concrete may be placed from subsequent loads to be tested prior to testing for acceptance.



## DIVISION 3 – CONCRETE

3. When the results for any subsequent accepted test indicates that the concrete as delivered and approved by the Contractor for placement does not conform to the specific limits, the sampling and testing will be resumed for each load. Whenever one subsequent test indicates that the concrete meets the specified limits, the random sampling and testing frequency of one for every 100 cubic yards may resume.
  4. Sampling and testing for a placement of one class of concrete consisting of 50 cubic yards or less will be as listed above, except that after one set of tests indicate that the concrete is within specified limits, the remaining concrete to be placed may be accepted by visual inspection.
- D. Two cylinders shall be tested for strength at the end of 28 days in accordance with *ASTM C39* or *WSDOT Standard Test Methods* as set forth in the *WSDOT Materials Manual*. Additional cylinders may be taken in sets of two (2), to verify concrete strength prior to 28 days at the contractor's discretion and cost.
1. When temperatures are expected to fall below 41° F within seven days of concrete placement, one additional test cylinder will be taken and cured at the site under the same conditions as the concrete pour from which it was taken.
  2. When temperatures are expected to rise above 89° F within seven days of concrete placement, one additional test cylinder will be taken and cured at the site under the same conditions as the concrete pour from which it was taken
- E. Concrete not conforming to the Specifications, concrete damaged from any cause, or concrete found to be defective for any reason shall be replaced by the Contractor with acceptable concrete at no additional cost to the State. Any concrete test that shows concrete in place that is below the specified requirements shall be reason for removal of the entire pour, and any subsequent concrete deposited will also be jeopardized. The concrete shall be removed and replaced by the Contractor at no additional cost to the State.

### 1.05 SUBMITTALS

- A. Manufacturer's Data - Concrete Work: Submit manufacturer's data with application and installation instructions for proprietary materials and items, including admixtures, patching compounds, water stops, joint systems, grout, and others as requested by the Engineer.
- B. Placement Schedule: Prepare a placement schedule that clearly identifies and labels each location to receive concrete and submit it for review a minimum of 2 weeks prior to the start of concrete placement operations.
- C. Delivery Tickets: Furnish copies of delivery tickets for each load of concrete delivered to the site. Provide items of information to the Engineer as specified under *ASTM C94 - Certification*.

- D. Submit proposed mix design to the Engineer for review and acceptance a minimum of 2 weeks prior to commencement of work.
- E. Furnish results of tests certifying conformance made by a recognized testing laboratory acceptable to the Engineer as the test information becomes available.

**PART 2 - PRODUCTS**

**2.01 CONCRETE MATERIALS**

A. Cement:

- 1. Cement shall be classified as Portland Cement or blended hydraulic cement and shall meet the requirements of the latest version of WSDOT Standards Specification 9-01.
- 2. Portland Cement shall conform to *ASTM C150 Type I or II (low alkali)*, gray color.
- 3. Blended hydraulic cement shall conform to *AASHTO M240 or ASTM C595*, Type IP(X)(MS) or Type IS(X)(MS).
  - a. For Type IP(X)(MS), X shall be a maximum 35% fly ash.
  - b. For Type IS(X)(MS), X shall be a maximum of 50% ground granulated blast furnace slag.
- 4. All cement used in this work shall be taken from stock bins at the place of manufacture.
- 5. Cement delivered to the site of the work shall at all times be suitably stored or protected from exposure to the atmosphere. If the cement shows signs of deterioration, it shall be removed from the work site unless additional tests show that it conforms to the requirements stated above.

B. Fine and Coarse Aggregates:

- 1. Fine Aggregate: Fine aggregate shall conform to *WSDOT Standard 9-03.1(2)B* and shall consist of sand or other inert materials or combinations thereof having hard, strong, durable particles free from adherent coating. Fine aggregate shall be washed thoroughly to remove clay, loam, alkali, organic matter, or other deleterious matter.
- 2. Coarse Aggregate: Coarse aggregate shall conform to *WSDOT Standard 9-03.1(4)C* , *AASHTO Grading No. 67 or 57* and shall consist of gravel, crushed stone, or other inert material or combinations thereof having hard, strong, durable pieces free from adherent coatings. It shall be washed thoroughly to remove clay, silt, bark, sticks, alkali, organic matter, or other deleterious material. Use of pit or bank-run gravel is not permitted.

3. Combined Aggregate Gradation: As an option to using coarse and fine graded aggregates, aggregate gradation may consist of a combined gradation with a nominal maximum size of 1 inch or 3/4 inch per *WSDOT Standard 9-03.1(5)B*.
  4. Approved aggregates shall be so stored as to prevent deterioration, segregation, or intrusion of foreign matter. Improper storage will be considered a reason for rejection of affected aggregate.
- C. Water: Water shall be any potable water, clean and free of injurious amounts of oil, acid, alkali, and organic material. Water containing 2 percent or more common salt shall not be used.

## 2.02 ADMIXTURES

- A. Air Entrainment: An air-entraining admixture meeting *ASTM C260* shall be used when specified in *PARAGRAPH 2.05 - CONCRETE MIX*.
- B. Chemical Admixture: Water-reducing, retarding, and/or accelerating admixtures shall be used when specified in *PARAGRAPH 2.05 - CONCRETE MIX*, meeting *ASTM C494* or as approved by the Engineer.
- C. Calcium chloride shall not be used.

## 2.03 GROUT

- A. Nonshrink grout shall consist of a hydraulic cementitious system conforming to *ASTM C 1107 (Grade C)*, specially graded and composed of processed natural fine aggregate and additives as required. The material shall meet all of the following requirements:
  1. 28 day compressive strength:  $f'_c = 7500$  psi.
  2. Nonmetallic.
  3. Free of gas-producing or releasing agents.
  4. Free of oxidizing catalysts.
  5. Free of inorganic accelerators, including chlorides.
  6. SikaGrout 212, or Engineer approved equal.
- B. Epoxy grout for embedding rebar, brick ties, and bolts shall be a 2-component mixture conforming to IBC seismic requirements, Hilti HIT-RE 500-V or Engineer approved equal. Application of all epoxy grout shall be in accordance with the manufacturer's specifications or instructions.

**DIVISION 3 – CONCRETE**

- C. General-purpose grout for grout fills shall consist of 1 part Portland Cement, 1 part fine aggregate, and 2 parts coarse aggregate by volume. The aggregate in the nominal mix may be varied slightly to give the most workable mix, but in no case shall the volume of the coarse material be less than 1½ times the volume of the fine. No more than 5 gallons of mixing water, including moisture in the aggregate, shall be used for each sack of Portland cement. The consistency shall be the driest consistency possible.
- D. Grout used for anchoring reinforcing bars into rock shall be cementitious with *Sika Intraplast-N* grouting aid as an expansion/fluidifying water-reducing admixture, or Engineer approved equal. The grout mix design shall be in accordance with the admixture manufacturer’s recommendations for the intended use. Contractor shall submit mix design for Engineer’s approval.

**2.04 CONCRETE REPAIR MATERIAL**

- A. Repair material for vertical and overhead concrete surfaces shall be either prepackaged or a Contractor recommended blend of Portland cement Type I/II and fine aggregate conforming to *WSDOT Standard SECTION 9-20.4(1)*.
- B. Repair material for holes greater than 3/4 inch shall conform to *WSDOT Standard SECTION 9-20.4(2)* at a 1:2 cement/aggregate ratio.
- C. Repair material for holes less than 3/4 inch shall conform to *WSDOT Standard SECTION 9-20.4(2)* at a 1:1 cement aggregate ratio.
- D. Repair material for horizontal concrete repairs up to 4 inches in thickness shall be Rapid Set Cement All Multi-Purpose Construction Material, or Engineer approved equal.

**2.05 CONCRETE MIX**

- A. Mix concrete in accordance with *ASTM C94*. The specified compressive strength at 28 days are listed below. The Contractor shall ensure that the water/cement ratio does not exceed the specified amount. Refer to *PARAGRAPH 3.03.G* for slump requirements.

**FOR THIS PROJECT, USE MIX # 2**

<b>TABLE 03300 - 2.05A</b>				
	<b>Mix Design</b>			
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Specified Compressive Strength at 28 days, minimum psi.	4500	4500	3000	3000
Air Entrainment	None <sup>1</sup>	4.5-7.5%	None <sup>1</sup>	4.5-7.5%
Cementitious, pounds per cubic yard, minimum pounds	564	564	540	540

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Water/cement by weight, maximum	0.44 0.38 <sup>2</sup>	0.44 0.38 <sup>2</sup>	0.50 0.45 <sup>2</sup>	0.50 0.45 <sup>2</sup>
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<sup>1</sup>No entrained-air content entrapped air only.

<sup>2</sup>Reduced water/cement ratio applies to concrete for underwater placement (4000W) or low-shrink concrete (LS) requirements. Use of a water-reducing admixture is mandatory for these applications. Increase coarse and fine aggregate weights to adjust the yield.

<sup>3</sup>Aggregate weights listed are based on a specific gravity of 2.67. The concrete plant shall adjust aggregate proportions for the specific gravity of the aggregates used and note the changes on the Submittal.

- B. Use accelerating admixtures in cold weather only when reviewed and accepted by the Engineer. Use of admixtures will not relax cold weather placement requirements.
- C. Use set-retarding admixtures during hot weather only when reviewed and accepted by the Engineer.
- D. Use water-reducing admixtures as reviewed and accepted by the Engineer.
- E. Contractor may use flyash or ground granulated blast furnace slag (GGBFS) as a constituent of the concrete. A mix design shall be provided for Engineer's approval before usage.
- F. Failure of any concrete to meet the specified 28 day strength in place as determined by test cylinders shall be reason for removal of the entire pour, and any subsequently placed concrete will be thereby jeopardized. All work necessary for correction will be at the Contractor's expense.
- G. Should the concrete not meet the 28 day test strength, the Contractor may at his option and expense make test corings and tests to the satisfaction of the Engineer.

### 2.06 BONDING AGENT

- A. Bonding agent for bonding new concrete to hardened concrete shall conform to *ASTM-C-881*.
- B. Bonding agent shall be Dayton Superior Sure Bond J58, or Engineer approved equal.

### 2.07 WATER STOP

Water stop shall be 4 inches wide, PVC, 4 inch x 3/16 inch Ribbed Center Bulb, manufactured by Sika/Greenstreak Group, Inc. – Model Number 702 – Type CH2M Hill; or Engineer approved equal. All mitered intersections shall be factory manufactured, filed straight butt splices shall be in accordance with manufacturer's requirements. Installation shall be in accordance with manufacturer's requirements and recommendations.

### 2.08 EXPANSION JOINT MATERIAL

- A. Pre-formed rubber expansion joint material shall conform to *ASTM D1752, Type 1*, and be full depth of the joint, less expansion joint sealant and backer rod, 1/2 inch thick. A.P.S., Rubber Expansion Joint Filler or Engineer approved equal.

- B. Pre-formed asphalt expansion joint material shall conform to *ASTM D994*, full depth of joint, 1/2 inch thick. A.P.S. Fiber Board or Engineer approved equal.

#### 2.09 EXPANSION JOINT SEALANT

Sealant shall be one part cold applied, non-sagging silicone. Color shall be gray. Movement capability shall be +100% / -50% per *ASTM C719*. *DOWSIL NS Parking Structure Sealant* or Engineer approved equal. Depth of sealant shall be 1/2 the joint width, utilizing closed-cell foam back rod under the sealant.

### **PART 3 - EXECUTION**

#### 3.01 INSPECTION

Verify anchors, seats, plates, reinforcements, waterstop, and other items to be cast into concrete are accurately placed, held securely, and will not be detrimental in placing concrete.

#### 3.02 EMBEDMENTS

- A. Embedded items shall be installed where shown on the Drawings or as described in these Specifications. Expansion anchors shall not be acceptable substitution for anchor bolts.
- B. Any embedded items shall be accurately positioned prior to concrete placement and firmly held in place until concrete has set.
- C. Waterstops shall be installed in required joints as close to the center of the joint as possible, on the water side of the reinforcing. Flexible-type waterstop should be firmly tied and/or fixed in position to prevent movement during placement of concrete. Install waterstop in accordance with manufacturer's recommended forming procedures.
- D. All waterstops shall be heat-welded at all joints.

#### 3.03 BATCHING AND MIXING

- A. Except for hand-mixed concrete, all concrete shall be batched in a prequalified manual, semi-automatic, or automatic plant. The prequalification shall consist of a current, annual certification inspection by WSDOT or as approved by the Engineer. If the plant has not been prequalified, the Contractor shall provide written notification to the Engineer 2 weeks prior to the anticipated use of the batch plant to allow for the necessary prequalification. The Engineer is not responsible for any delays to the Contractor due to problems in getting the plant certified.
- B. The Contractor has the option to site mix, transit mix, or plant mix the concrete. In all cases, concrete shall be mixed until a uniform distribution of the materials produces a homogeneous batch.
- C. Site-mixed concrete operations larger than 5 cubic yards total shall be subject to the prior approval of the Engineer.

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- D. Transit-mixed concrete may be used provided it complies with these Specifications and *ASTM C94* or *WSDOT Standard Specifications*. The concrete supplier shall have adequate equipment to ensure weight and quality control.
- E. Concrete shall only be mixed in the quantities required for immediate use. The concrete shall be used while fresh before initial set has taken place. Any concrete that has developed initial set shall not be used. Partially hardened concrete shall not be retempered or remixed. One batch of mixed concrete shall be entirely discharged before the following batch is charged.
- F. Temperature and Time for placement
1. Concrete temperature shall remain between 55° F and 89° F while it is being placed.
  2. From the time cement is added to the concrete mixture, the batch shall be discharged within the following time periods:

Condition	Maximum Allowed Time
Concrete being place is 75° F or grater.	1½ Hours (90 Min)
Concrete being placed is less than 75° F	1¾ Hours (105 Min)
Concrete being placed is less than 75° F with Engineer's approved.	2 Hours (120 Min)

- G. The maximum slump for vibrated concrete shall be 4½ inches. When a high range water reducer is used, the slump may be increased an additional 2 inches. Minimum slump is that required for proper placement and compaction. The maximum slump for non-vibrated concrete shall be 7 inches.

H. Conformance to Mix Design

Weights of the mix components shall be within the following tolerances of the mix design:

Cement; +5%, -1%

Fly Ash, Ground Granulated Blast Furnace Slag; +5%, -5%

Aggregates; +5%, -1% for batch volumes greater than 4 cubic yards

Aggregates; +10%, -2% for batch volumes equal to or less than 4 cubic yards

Water; +0%

3.04 CONCRETE JOINTS

A. Waterstop shall be installed in all joints for walls of ponds, raceways, and other water-holding or containing structures.

B. Expansion Joints:

1. Expansion (isolation) joints shall be placed and constructed as shown on the Drawings.
2. The length of a joint material shall match the required length in the Drawings without splicing or stretching.
3. Open joints shall be formed with a template made of wood, metal, or other suitable material. Insertion and removal of the template shall be done without chipping or breaking the edges, or otherwise injuring the concrete.
4. Any part of an expansion joint running parallel to the direction of expansion shall provide a clearance of at least 1/2 inch (produced by inserting and removing a spacer strip) between the 2 surfaces. The Contractor shall ensure that the surfaces are precisely parallel to prevent any wedging from expansion and contraction.

C. Crack-Control Joints:

1. Crack-control joints are intended to have cracking occur in the joints to prevent uncontrolled traverse cracks from occurring in walls and slabs.
2. Crack-control joints shall be installed as shown on the construction Drawings, when not designated in the construction Drawings refer to the table below:

Concrete Thickness	Joint Spacing
12 Inches and Greater	15 Feet
Less than 12 Inches	8 Feet

3. Crack-control joints shall be straight and true. Crack-control joints shall have a formed crack depth of 1/4 of the concrete thickness and not less than 1 inch (for walls, half from each side of the section) and may be formed using a plastic strip anchored to the forming material or other method approved by the Engineer. Slab saw cut joints shall be completed when the concrete has hardened sufficiently to prevent dislodgement of aggregates and no later than 12 hours after placement. When a wall or other obstacle prevents the required depth of cut a smaller diameter saw shall be used to complete the cut. Contractor shall inform the Engineer of the cutting schedule.

All re-entrant corners shall have a crack-control joint installed to the corner in both directions. The Contractor may use a construction (stop pour) joint in place of the crack-control joint when approved by the Engineer.



**D. Construction Joints:**

1. Construction joints are stopping places in the process of concrete placement and shall be made only where shown on the Drawings, when not designated in the construction drawings, construction joints shall be provided at a 25 foot maximum spacing, or as approved by the Engineer.
2. Vertical construction joints in walls shall follow the location of the construction joints established in the slab or footing below the wall.
3. All construction joints shall be neatly formed as shown on the Drawings. Irregular or undulating joint lines shall not be allowed. All construction joints shall be either horizontal or vertical, or if the main reinforcement is inclined, the joints shall be normal to the direction of the main reinforcement.
4. When the Drawings call for a construction joint with roughened surface, the surface shall be struck off to leave surface irregularities approximately 1/2 inch wide and 1/4 inch deep. Surface irregularities shall not exceed 1/2 inch in depth. If the desired roughness is not obtained by the initial strike-off, the surface shall be roughened prior to the concrete reaching its initial set in such a manner as to leave grooves approximately 1/4 inch deep at 1/2 to 1 inch centers in both transverse and longitudinal directions. The rough surface shall be clean and free of laitance and loose material. Shear keys are required where shown on the Drawings.
5. Waterstops shall be installed in all walls and slab construction joints in ponds, raceways, and other water-holding or containing structures, or where shown in the construction drawings.

**3.05 PLACING CONCRETE - GENERAL**

- A. Notify the Engineer a minimum of 48 hours prior to commencement of concreting operations. Forms, waterstop, reinforcing bar, inserts, and embeds shall be inspected and approved by the WDFW Engineer or representative a minimum of 24 hours prior to concrete placement.
- B. All building slabs, floor slabs, and pond floor slabs shall be placed over a 6-mil clear polyethylene vapor barrier (unless noted otherwise). A 4 inch layer of fill placed over poly vapor barrier will improve finish quality of the concrete slab.
- C. Concrete shall be placed as soon as possible after mixing and shall be plastic and readily workable when placed in the forms. See *DIVISION 03300 3.03F*. The method and manner of placing concrete shall avoid segregation of the aggregates or displacement of reinforcement.
- D. When placing new concrete intended to bond to existing concrete, immediately before concrete placement against existing hardened concrete, bonding agent shall be applied to existing clean concrete surface. New concrete shall be placed while agent is still tacky.
- E. Concrete shall not be placed if other work in the area, such as driving piles or sheets, causes vibrations that adversely affect the initial set or strength of the concrete.

- F. Aluminum conduits shall not be used in the pumping or placing of concrete.
- G. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- H. Place grooved crack-control joints prior to initial set.
- I. Excessive honeycomb or embedded debris in concrete is not acceptable.

**3.06 PLACING CONCRETE INTO FORMS**

- A. Before placement of concrete, forms shall be cleaned and free of all debris and ice. The foundations and forms shall be dampened prior to placing concrete. Care must be taken to see there is no standing water on the foundation or in the forms when the concrete is placed. Where possible, all foundation excavations shall be pumped dry and concrete deposited in the dry. If it is not possible to proceed in this manner, a seal of concrete of sufficient thickness to resist any possible uplift shall be deposited underwater in accordance with the requirements specified in *PARAGRAPH 3.08 - PLACING CONCRETE IN WATER*.
- B. Deposit concrete in forms in continuous horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Insert vibrator into previous layer to ensure homogeneous concrete placement.
- C. Remove temporary spreaders in forms when concrete being placed has reached the elevation of such spreaders.
- D. To avoid material segregation, concrete shall not be dropped more than 3 feet. When placing operations would involve dropping the concrete more than 3 feet, it shall be deposited through sheet metal or another approved conduit. In sloping forms where concrete, if dropped, will tend to slide down one side of the form as it is placed, the concrete shall be placed through approved conduit without dropping. After initial set of the concrete, the forms shall not be jarred, and no strain shall be placed on the ends of the projecting reinforcement bars.
- E. The method of depositing and consolidating concrete shall be conducted so as to form a compact, dense, and impervious concrete that will show smooth faces on exposed surfaces. If any section of concrete is found to be defective, it shall be removed by the Contractor at no additional expense to the State. Plastering will not be permitted.

**3.07 PLACING CONCRETE SLABS**

- A. Deposit and consolidate concrete slabs in a continuous operation within the limits of construction joints until the placing of a panel or section is completed. When concrete in place has sufficiently set up (at least 24 hours), an alternate section shall be placed. The edges of all sections shall be tooled with a minimum radius as shown on the construction Drawings, if not indicated, edges shall be tooled to a 3/4 inch radius.
- B. Slope all exterior concrete slabs and interior slabs with floor drains in a manner to prevent the collection of water.

- C. Bring slab surfaces to the correct level with a straightedge and strike off. Use bullfloats or derbies to smooth the surface, leaving it free from humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.
- D. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

**3.08 PLACING CONCRETE IN WATER**

- A. In no case shall concrete be placed in running water. Whenever permission is given to place concrete underwater, it shall be so placed within the confines of a watertight compartment such as a cofferdam, tube, or caisson.
- B. Concrete placed underwater shall include a water-reducing admixture within the manufacturer's recommended dose range as approved by the Engineer. Concrete placed in still water inside an open crib or cofferdam shall be placed by means of a tremie. The width of section of footing being poured shall not exceed 18 feet for each tremie or bucket used.
- C. When the concrete is to be placed by a tremie, the methods of construction shall comply with the following requirements:
  - 1. All tremies shall consist of a tube having a diameter not less than 10 inches and a hopper adequate to perform the work, or a method using a straight tremie tube on the end of a concrete pumper hose may be developed provided prior approval of the proposed method and procedure is obtained from the Engineer.
  - 2. A satisfactory method of expelling the water and first filling the tremie shall be used.
  - 3. The end of the tremie tube shall be kept deep enough into the seal concrete, and the concrete maintained in the tube at the elevation required to prevent water from entering the tremie tube at any time during the concrete placement. In placing concrete through a tremie, 2 distinct handling devices shall be used: one to raise, lower, and place the tremie, and the other to deliver concrete to the tremie. When a batch is dumped into the hopper at the top, the tremie shall be raised slightly (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper or the top of the tremie tube. The flow shall then be stopped by lowering the tremie.
  - 4. The seal shall be completed by placing full thickness as the seal advances from one end of the placement to the other, keeping the finished surface of the concrete as level as possible.
  - 5. The concrete shall be placed continuously until the required seal is placed. If for any unavoidable reason it becomes necessary to discontinue the placing before the required seal is completed, the Contractor may be required to remove all concrete placed in the seal at no cost to the State.

- D. When concrete is placed underwater, the Contractor may use methods whereby the aggregates are preplaced within the cofferdam before the introduction of the cement grout, provided prior approval of the proposed method and procedure is obtained from the Engineer.

**3.09 PLACING CONCRETE IN HOT WEATHER**

- A. When ambient temperatures will exceed 77° during the placement, the Contractor shall place and cure concrete in accordance with ACI 305R. Concrete shall not be placed without Engineer approval when anticipated 24 hour range will exceed 89°F. Contractor shall submit a hot weather plan to the Engineer for review and approval no less than 7 days prior to the proposed hot weather concreting..
- B. The temperature of the concrete equipment and ingredients shall be maintained at such a level that the temperature of the concrete at the time it is placed shall not exceed 85°F.
- C. Water-reducing admixtures shall be used so that the maximum amount of water or slump shall not be exceeded. The mixing of the concrete and the time between mixing and placing shall be kept to a minimum. Mixer trucks shall not be exposed to the sun while waiting to be unloaded. Chutes, conveyors, and pump lines shall be shaded. To keep the forms and reinforcing steel cool prior to placing the concrete, the top layer of reinforcing steel shall be completely covered with clean, wet burlap and the forms and reinforcing steel shall be sprinkled with cool water immediately prior to placing the concrete or as ordered by the Engineer. The concrete shall be finished without delays. Equipment for applying a water-fog spray shall be available in case it is needed to prevent plastic cracks.
- D. When the combination of air temperature, humidity, temperature of the surface of the concrete, and the wind velocity produces an evaporation of 0.2 or more pounds per hour per square foot of surface as determined by the Engineer, the Contractor shall provide a windbreaker enclosure to protect the concrete from winds blowing over the surface of the concrete until the curing compound is applied.

**3.10 PLACING CONCRETE IN COLD WEATHER**

- A. When air temperature is expected to fall below 37°F during placement or within 7 days thereafter, the Contractor shall place and cure concrete in accordance with *ACI 306R*. Contractor shall submit a cold weather concreting plan to the Engineer for review and approval no less than 7 days prior to the proposed cold weather concreting.
- B. The following provisions shall govern cold weather concreting:
  - 1. Concrete shall not be mixed or placed while the atmospheric temperature is below 37°F without Engineer approval.
  - 2. Concrete shall not be placed on frozen ground or against frozen forms.
  - 3. Concrete shall be effectively protected from atmospheric temperatures below 37°F for a period of 7 days after placement.
  - 4. The Contractor proposed concrete temperature monitoring shall be approved by the Engineer prior to concreting operations.

- C. Frozen concrete shall be immediately removed when Contractor is directed to do so by the Engineer and replaced with new work at no cost to the State.

**3.11 VIBRATION OF CONCRETE**

- A. The Contractor shall provide suitable internal vibrating tampers for use in placing and compacting all concrete except that which is placed underwater. The vibrators shall be of the type designed to be placed directly in the concrete, and the vibrator's frequency of vibration shall be not less than 7,000 impulses per minute when in actual operation. The type of vibrator and its method of use shall be subject to the approval of the Engineer.
- B. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine (between 2 to 3 feet). Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary for consolidation around reinforcement and other embedded items without causing segregation of the mix. Generally, this will be from 5 to 15 seconds in accordance with *ACI 301*. Do not use vibrators to transport concrete inside of forms.
- C. Vibrators shall not be applied directly to steel that extends into partially hardened concrete.
- D. Vibration shall not continue in any one spot to the extent that pools of grout are formed. When vibrating and finishing top surfaces that are exposed to weather or wear, extreme care shall be exercised to avoid drawing water or laitance to the surface. For relatively high lifts, the top layer shall be comparatively shallow, and the concrete mix shall be as stiff as can be effectively vibrated into place and properly finished.
- E. The Contractor shall supply a sufficient number of vibrating tampers to effectively vibrate all of the concrete placed. Hand tamping shall be required wherever necessary to secure a smooth and dense concrete on the all surfaces.
- F. Vibration of forms and reinforcing will not be allowed.

**3.12 FINISHING CONCRETE SURFACES - GENERAL**

- A. All concrete shall show a smooth, dense face. Any concrete that is porous shall be removed by the Contractor at no additional cost to the State.
- B. Curing compound shall be immediately applied to exposed faces after finishing or when forms are removed before the concrete cure period is complete. Contractor shall apply two coats that total at least 1 gallon per 150 square feet and shall fully cover the surface of the concrete. If curing compound spills on waterstop or reinforcing steel, Contractor shall remove the cure prior to the next concrete placement.
- C. At the discretion of the Engineer, cracks in concrete work not covered by *PARAGRAPH 3.16 - DEFECTIVE CONCRETE AND REPAIR OF CONCRETE* and 0.050 inch and greater shall be repaired at the Contractor's expense by an *ACI*-recommended method as approved by the Engineer. Criteria for an acceptable method of repair will be based on the following elements:

1. Structural or nonstructural crack.
  2. Exposure level/conditions of structures.
  3. Appearance.
  4. Cause of cracking.
- D. Except for surfaces covered by backfill to achieve finish grade, stains and discoloration caused by the Contractor's operations, equipment, or materials shall be removed and properly finished prior to final acceptance.

### 3.13 FINISH OF SLABS

- A. Screed all slabs.
- B. Trowel by hand or machine to hard, dense, and mark-free surface. Do not absorb wet spots with neat cement or mixture of cement and sand. Wait until surfaces are dry enough for proper troweling. Chemical dryers not permitted.
- C. Interior concrete slabs to receive flooring materials, carpet, or coatings shall be steel troweled. Slabs receiving epoxy coating shall be prepared and finished in accordance with *SECTION 09900 - PAINTING* and as shown on the Drawings.
- D. Slabs in hatchery trough rooms and slabs not receiving flooring materials shall receive a light broom finish perpendicular to the floor slope to achieve a non-slip surface.
- E. Exterior slabs and slabs in contact with water, shall receive a light-broom finish perpendicular to the floor slope to achieve a non-slip surface.

### 3.14 FINISH OF FORMED SURFACES

- A. Finish of formed surfaces shall be as shown in the Drawings, if not indicated, finish shall be surface finish Type "A". No other methods or finishes will be accepted without approval in writing by the Engineer.
- B. Top of walls shall be steel troweled, chamfered, and receive a light broom.
- C. Surface Finish Type "A"

Within 5 days following the removal of forms, the following finishing operations shall be performed to produce a uniform texture and fill all pits and air holes

1. Grind smooth all projections and offsets. Open all paste and air holes and completely remove all curing compound and dust.
2. Saturate form tie holes with water and fill voids with patching mortar conforming to SECTION 2.04 and a 1:2 cement/aggregate ratio mixed with a bonding agent admixture per the manufacturer's requirements.

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3. All patching shall be to sound substrate, cut out and remove all loose or otherwise deleterious material prior to repair operations.
4. All damaged areas due to spalling, voids, rock pockets and bug holes 3/4 inch in depth and larger shall have edges ground square to the surface and back beveled. Patching mortar conforming to SECTION 2.04 and a 1:2 cement/aggregate ratio shall be installed over an epoxy bonding agent per the manufacturer's requirements.
5. All other damaged areas less than 3/4 inch to 1/4 inch in depth shall be repair with mortar conforming to SECTION 2.04 and a 1:2 cement/aggregate ratio mixed with a bonding agent admixture per the manufacturer's requirements.
6. Finish patched areas flush with adjoining surfaces.
7. Small air holes may be considered those which would be covered over by sacking and do not need to be repaired. Air holes larger than this shall be considered voids.
8. Prior to installation of drilled anchors and other attachments all formed surfaces shall be rubbed with cement of a consistent color and burlap and/or with brick and water to eliminate pockets and produce reasonable smooth surface. A reasonable smooth surface shall be defined as a surface with no projections, recesses, or form marks greater than 1/16 of an inch after finishing. Chamfers and fillets shall be made straight, true, and uniform.
9. On surfaces to receive backfill the finish shall extent 12 inches below finish grade.
10. Finished surfaces shall be cured in accordance with SECTION 03370 Concrete Curing.

### D. Surface Finish Type "B"

Within 5 days following the removal of forms, the following finishing operations shall be performed.

1. Grind smooth all projections and offsets. Open all paste and air holes and completely remove all curing compound and dust.
2. Saturate form tie holes with water and fill voids with patching mortar conforming to SECTION 2.04 and a 1:2 cement/aggregate ratio mixed with a bonding agent admixture per the manufacturer's requirements.
3. All patching shall be to sound substrate, cut out and remove all loose or otherwise deleterious material prior to repair operations.

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4. All damaged areas due to spalling, voids, rock pockets and bug holes 3/4 inch in depth and larger shall have edges ground square to the surface and back beveled. Patching mortar conforming to SECTION 2.04 and a 1:2 cement/aggregate ratio shall be installed over an epoxy bonding agent per the manufacturer's requirements.
5. All other damaged areas less than 3/4 inch to 1/4 inch in depth shall be repair with mortar conforming to SECTION 2.04 and a 1:2 cement/aggregate ratio mixed with a bonding agent admixture per the manufacturer's requirements.
6. Finish patched areas flush with adjoining surfaces.
7. On surfaces to receive backfill the finish shall extent 12 inches below finish grade.
8. Finished surfaces shall be cured in accordance with SECTION 03370 Concrete Curing.

E. Surface Finish Type "C"

Following the removal of forms, the following finishing operations shall be performed:

1. Remove all cure from and around tie holes.
2. Saturate form tie holes with water and fill voids with mortar of the same mix as concrete (less coarse aggregate) mixed with a bonding agent admixture per the manufacturer's requirements.
3. Finish patched areas flush with adjoining surfaces and cure.
4. Finish surfaces shall be cured in accordance with SECTION 03370 Concrete Curing.

3.15 FINISHED CONCRETE TOLERANCES

A. Formed concrete tolerances shall conform to the following requirements:

<b>TABLE 03300 - 3.15A</b>	
1. Variation from plumb: <ol style="list-style-type: none"> <li>a. In lines and surfaces of columns, piers, walls:</li> <li>b. For exposed corner columns, crack control joint grooves, and other conspicuous lines:</li> </ol>	<ol style="list-style-type: none"> <li>1/8 inch in any 10 feet</li> <li>1/2 inch maximum for the entire length/height</li> <li>1/4 inch in any 20 foot length</li> <li>1/2 inch maximum for the entire length</li> </ol>



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<p>2. Variation from the level or the grades:</p> <p>a. In slabs and beams soffits:</p> <p>b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:</p>	<p><math>\frac{1}{4}</math> inch in any 10 foot length  <math>\frac{3}{8}</math> inch in any bay or in any 20 foot length  <math>\frac{3}{4}</math> inch maximum for the entire length</p> <p><math>\frac{1}{4}</math> inch in any bay or in any 20 foot length  <math>\frac{1}{2}</math> inch maximum for the entire length</p>
<p>3. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions:</p>	<p><math>\frac{1}{2}</math> inch in any bay  <math>\frac{1}{2}</math> inch in any 20 foot length  1 inch maximum for the entire length</p>
<p>4. Variation in the sizes and location of sleeves, floor openings, and wall openings:</p>	<p><math>\frac{1}{4}</math> inch plus or minus</p>
<p>5. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:</p>	<p><math>\frac{1}{4}</math> inch minus  <math>\frac{1}{2}</math> inch plus</p>
<p>6. Footings:</p> <p>a. Variation in dimension in plan:</p> <p>b. Misplacement or eccentricity:</p> <p>c. Thickness:</p> <p>1. Decrease in specified thickness:</p> <p>2. Increase in specified thickness:</p>	<p><math>\frac{1}{2}</math> inch minus  2 inches plus</p> <p>2 percent of the footing width in the direction of misplacement, 2 inches maximum</p> <p>5 percent</p> <p>No limit</p>
<p>7. Variation in steps:</p> <p>a. In a flight of stairs:</p> <p>1. Rise:</p> <p>2. Tread:</p> <p>b. In consecutive steps:</p> <p>1. Rise:</p> <p>2. Tread:</p>	<p><math>\frac{1}{8}</math> inch plus or minus</p> <p><math>\frac{1}{4}</math> inch plus or minus</p> <p><math>\frac{1}{16}</math> inch plus or minus</p> <p><math>\frac{1}{8}</math> inch plus or minus</p>

B. Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

3.16 DEFECTIVE CONCRETE AND REPAIR OF CONCRETE

- A. Concrete that is not formed as shown on the Drawings, or for any reason is out of alignment, level, tolerances, or shows a defective surface shall be removed from the job at the Contractor's expense, unless the Engineer grants permission to patch the defective area. Permission to patch in such an area shall not be considered a waiver of the Engineer's right to require complete removal of defective work if patching does not, in his opinion, satisfactorily restore quality and appearance of the surface.
- B. Repair or replace concrete not properly placed with the material specified.
- C. All pour joints, rough sections, cracks, and honeycombed areas shall be repaired by cutting back to solid concrete. Apply cement mortar fill after coating surface with bonding agent.
- D. Fill all tie holes and small imperfections with specified material in accordance with SECTION 3.14.

3.17 PLACING ANCHOR BOLTS AND EMBEDDED METALWORK

- A. Cast-in-place anchor bolts and embedded metalwork shall be accurately placed as shown on the Drawings.
- B. The Contractor shall secure the cast-in-place anchor bolts and metalwork to the forms or reinforcing steel prevent misalignment of these items while placing the concrete. Embedded metalwork designed to align with a visible concrete face shall be flush with the face of the concrete when cast-in-place.
- C. Conduits, pipes, and other fabrications made of aluminum shall not be embedded in concrete unless effectively coated or covered to prevent aluminum-concrete reaction (see *DIVISION 9 - FINISHES*).

3.18 WATER-HOLDING STRUCTURE TEST

- A. Description: All concrete structures that are designed to hold, treat, or pass water or wastewater shall be constructed to be watertight. All structures shall be hydraulically tested for pressure and leakage after concrete has cured and obtained design strength. Leakage testing shall be performed at the expense of the Contractor prior to backfilling the structure.
- B. Testing Procedure: Water holding structures shall have each water holding unit tested individually. The unit shall be filled with water to the normal operating static level and maintained at that level for 7 days to allow for absorption and stabilized. For testing purposes, all inlets and outlets shall be closed or plugged. At the end of the 7 day period, the change in the volume shall be measured after 24 hours without any water flowing into or out of the unit. For acceptance, the unit shall meet both of the following criteria:
  - 1. No visible leakage or visibly damp areas.

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2. A leakage rate no greater than .001 of total tank volume in a 24 hour period.

Failure to meet these criteria will require repairs of the structure at the Contractor's expense by a method approved by the Engineer. The structure shall be tested after repairs. This process will be repeated until the leakage volume criteria are met.

END OF SECTION 03300

**SECTION 03370  
CONCRETE CURING**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

Concrete curing materials and methods.

1.02 ENVIRONMENTAL CONDITIONS

When the air temperature is expected to fall below 37°F during the 7 day initial cure period, the Contractor shall submit a written cold weather concreting plan conforming with *ACI 306R* to the Engineer for approval prior to the commencement of any concrete work.

1.03 QUALITY ASSURANCE

Contractor shall conform to requirements of *ACI 301*.

**PART 2 - PRODUCTS**

2.01 MATERIALS

- A. Water shall be clean, potable and not detrimental to concrete.
- B. Absorptive mat shall be burlap-polyethylene, 8 ounces per square yard, bonded to prevent separation during use.
- C. Concrete curing compound shall be of a standard and uniform quality, ready for use as shipped by the manufacturer. Contractor shall verify curing compound compatibility with required concrete surface finishes as specified in *SECTION 03300 - CAST-IN-PLACE CONCRETE* and as noted on the Drawings. The curing compound shall conform to *ASTM C309, Type 1, Class A or B*, and shall be clear with no discoloring. Curing compounds shall be certified nontoxic to fish or approved by the engineer.
- D. Curing compound for interior slabs and interior walls shall be WR Meadows 1300 Clear or Engineer approved equal.
- E. Polyethylene Film shall conform to *ASTM D2103* and shall be 6 millimeter thick and white in color.

**PART 3 - EXECUTION**

3.01 CURING METHODS

- A. All concrete surfaces shall be cured by one of the following methods for not less than 7 days after the concrete is placed.

B. Using one of the methods listed below, the Contractor shall determine the best method for the project, as approved by the Engineer:

1. Walls:

- a. General: Where walls are to receive coating, painting, cementitious material, or other similar finishes or where curing compound is not permitted, do not use curing compounds. Use only water-curing procedures.
- b. Method 1: Leave concrete forms in place and keep entire exposed surfaces wet at all times.
- c. Method 2: Apply curing compound as specified, where allowed, immediately after finishing of surfaces. Concrete shall be kept moist while finishing is accomplished.
- d. Method 3: Continuously sprinkle 100 percent of all exposed surfaces.
- e. Method 4: Leave concrete forms in place and apply curing compound to top of wall.

2. Slabs and Curbs:

- a. Method 1: Cover surface by water ponding.
- b. Method 2: Cover with absorptive mats and keep continuously wet.
- c. Method 3: Continuously sprinkle exposed surface.
- d. Method 4: Apply specified curing compound to exposed surfaces.
- e. Other agreed upon method that will provide moisture to be present and uniform at all times on all surface of slabs.

C. Onset of Curing:

- 1. Slabs-on-Grade: Apply curing compound, if used, as soon as free water has disappeared from concrete surface after placing and finishing.
- 2. Formed Concrete: Remove forms as specified in *SECTION 03100*, and patch and finish immediately. Apply curing method immediately to finished sections of the work.

**3.02 MEMBRANE CURING COMPOUND**

- A. Apply immediately after finishing of slabs and walls, etc. in accordance with manufacturer's instructions.
- B. Surfaces that have their forms removed after concrete has reached two-thirds of its design strength by test will not require curing compound applied.

**3.03 ABSORPTIVE MAT**

Contractor shall saturate burlap side of absorptive mat, place over slab areas burlap side down, lap edges and ends 12 inches, and maintain in place for duration of curing period.

**3.04 POLYETHYLENE FILM**

- A. Contractor shall spread polyethylene film over slab areas, lap edges and ends 3 inches, and seal with pressure-sensitive polyester tape.
- B. Contractor shall maintain polyethylene film in place with plywood sheets for duration of curing period.

END OF SECTION 03370

**SECTION 03400  
PRECAST STRUCTURAL CONCRETE**

**PART 1 - GENERAL**

1.01 DESCRIPTION OF WORK

The work includes furnishing of all necessary material, labor, and equipment for providing the precast concrete flow meter vaults shown on the Drawings, including design, manufacture, transportation, and other related work as required for a complete fabrication and delivery.

1.02 QUALITY ASSURANCE

A. A company specializing in providing precast concrete products and services normally associated with the industry for at least 5 years. Written evidence shall be submitted to the State to show experience, qualifications, and adequacy of plant capability and facilities for performance of contract requirements, including proof of current plant certification by the Precast Concrete Institute (PCI). Upon request by the State, the manufacturing facility shall be made available for inspection.

B. TESTING:

In general, comply with applicable provisions of Pre-stressed Concrete Institute MNL-116, Manual for Quality Control for Plants and Production of Precast Pre-stressed Concrete Products.

C. INSPECTION:

All precast units may be inspected by the Owner at the casting yard. All damaged and/or otherwise defective products shall be rejected.

1.03 REFERENCE STANDARDS

A. *ACI 318*, Building Code Requirements for Reinforced Concrete.

B. *ACI 301*, Specifications for Structural Concrete for Buildings.

1.04 SUBMITTALS

A. Submit complete plant quality control (QC) plan and proof of PCI Certification. The plan shall include the names and qualifications of individuals having responsibility for product quality control and shall include specific reference standards used for quality control.

B. Submit complete design calculations and drawings for the precast concrete flow meter vault. Design shall be in accordance with *ACI 318*, Chapters 16 and 18 for the criteria and components shown on the Drawings. Design calculations shall be completed under the responsible charge of a licensed Structural Engineer in the State of Washington and shall be stamped and sealed accordingly.

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- C. Submit complete shop drawings indicating all shop and erection details, including position and quantities of reinforcing steel, anchors, inserts, etc. Design of all lifting loops or embedded hardware required for construction shall be the responsibility of the Contractor. All calculations shall be completed under the responsible charge of a licensed Structural Engineer in the State of Washington and shall be stamped and sealed accordingly. Drawings shall also indicate the concrete compressive strength, and sequence at various stages of manufacture, handling, and erection.
- D. Submit mill certificates indicating specification compliance regarding strength and metallurgy of reinforcing steel to be furnished.
- E. Fabrication shall not be started until the shop drawings and other submitted data are reviewed by the State and returned to Contractor.
- F. Submit test reports indicating specification compliance for concrete materials and strengths.
- G. Submit test reports indicating specification compliance for concrete admixtures.
- H. Submit concrete curing methods and records of concrete curing temperatures for all accelerated curing.
- I. Repair procedures, including materials to be incorporated into the repairs, for minor repairs associated with normal construction practice.

## PART 2 - PRODUCTS

### 2.01 CONCRETE REINFORCEMENT

See *SECTION - 03210 of these specifications.*

### 2.02 STEEL COMPONENTS

See *DIVISION 5 of these specifications.*

### 2.03 FLOOD HOLE SCREEN

Provide opening for screen. The screen will be provided and installed onsite by others.

### 2.04 CONCRETE MIXES AND STRENGTHS

Concrete for the precast flow meter vault shall develop a minimum design compression strength of 4000 psi at 28 days. The minimum cement content of the concrete mix shall be 611 lbs/cy, and the maximum water/cement ratio shall be 0.40. Air entrainment shall be 5% to 8%.

### 2.05 MANHOLE STEPS

Provide corrosion-resistant manhole steps where shown on the Drawings. Steps shall be polypropylene-encased steel and shall comply with WISHA standards.



2.06 JOINT-SEALANT-STANDARD MANHOLE SEALANT

Joints shall be watertight. Provide rubber gaskets conforming to *ASTM C443*.

2.07 FABRICATION

General: Manufacturing procedures shall be in general compliance with *PCI MNL-116*.

2.08 MANUFACTURERS

Granite Precasting & Concrete, Inc., Bellingham, WA

Hanson Concrete Products, Inc., Tacoma, WA

Oldcastle/AMCOR Precast, Nampa, ID

Or equal approved by Engineer

**PART 3 - EXECUTION**

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. DELIVERY AND HANDLING:

1. Precast concrete members shall be lifted and supported during manufacturing, stockpiling, transporting, and erection operations only at the lifting or supporting points, or both, as shown on the shop drawings, and with approved lifting devices.
2. Transportation, site handling, and erection shall be performed by qualified personnel using equipment and methods capable of suspending and supporting precast structural concrete members without overstress.
3. Extreme care shall be exercised during all handling operations. The Contractor shall repair all damaged units at no cost to the State. Units damaged beyond repair shall be removed and replaced at no additional cost to the State.

B. STORAGE:

1. Support all units to prevent overstress.
2. Store all units off ground.
3. Place stored units so that identification marks are discernible.
4. Separate stacked members by battens across full width of each bearing area.
5. Stack so that lifting devices are accessible and undamaged.
6. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

3.02 ERECTION BY OTHERS SHALL INCLUDE:

- A. Precast units shall not be erected until the concrete has attained the minimum specified design strength and only after a minimum of 14 days after pouring.
- B. Provide true, level bearing surfaces on all field-placed supporting members.
- C. Installation: Members shall be lifted by means of suitable lifting devices at points provided by the manufacturer. Set members as indicated on the Drawings. Provide necessary temporary shoring and bracing, where required, to keep members plumb and stable. Align and level members as required.
- D. Fastening: Fasten members only where indicated on the Drawings.
- E. Patching: Cut off lifting devices and fill voids with an approved epoxy grout.

END OF SECTION 03400