Set. No. _____

SPECIFICATIONS

FOR

CONSTRUCTION

OF

LOWER TWO MEDICINE WATER INTAKE
PHASE I

FOR

THE BLACKFEET TRIBE

BROWNING, MONTANA

JULY 2001

Thomas, Dean & Hoskins, Inc.
TD&H
Engineering Consultants

Job No. 01-099

CONSTRUCTION SPECIFICATIONS

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CONSTRUCTION SPECIFICATIONS

DIVISION 1
GENERAL REQUIREMENTS
SECTION 01000
SPECIAL PROCEDURES

1. GENERAL.

Work to be performed under this Phase I contract includes:

- Construction of a new water intake in Lower Two Medicine Lake complete with all associated piping, valves, pump casings, pitless units, intake screen, excavation, backfill, compaction, dewatering, shoring, concrete, and other related work.

- Construction of any temporary improvements needed to access the site.

- Site work and restoration of the work area and access route to their original condition.

The project site is on the border of Glacier National Park. The Contractor shall cooperate in every way possible with the Owner to protect the environment of the area. The Contractor's ways and means of accomplishing the work shall be compatible with all environmental considerations and restrictions in the area.

2. TIME OF COMPLETION.

The Contractor shall commence work on or before the date specified on the Notice to Proceed with Construction and complete all work within 130 calendar days of the date specified in the Notice to Proceed with Construction. Notice to Proceed will probably not be granted until mid October. Extensions of time due to weather or failure to acquire materials on time will not be granted. All work must be completed before March 1, 2002 in order to protect endangered species. If for any reason the work is not completed before March 1, 2002, all work must be discontinued until July 1, 2002 and completed after that date. Minor clean up and site grading can be completed between March 1 and July 1, 2002 if necessary. Additional construction on pipelines and the pumping facility will be under construction by October 1, 2002. The Phase I Contractor must coordinate his work carefully and cooperate in every way possible with the other Contractor to avoid interfering with their work.

3. CONSTRUCTION WAYS, MEANS, AND METHODS.

The Contractor's ways, means, and methods of installing the water intake system shall be fully compatible with environmental restrictions and all other conditions of this contract. The work must be constructed during the late fall and winter. Severe cold, deep snow, and strong winds are

common in the area, but conditions may vary. The lake will probably freeze over by early November but may stay open longer if the winter is mild. The Contractor must be prepared to work under any conditions. Excavation within the lake bed will be done in such a way as to minimize suspension of soil in the lake water. Ground water and surface water that is removed from excavations shall be treated as necessary to meet discharge permit requirements before discharge to the lake or adjacent stream.

The Contractor may elect to excavate and install the intake pipeline in a trench or utilize horizontal directional drilling techniques. The installation shall be in accordance with requirements of the drawings and specifications regardless of installation method selected. Contractors proposing to utilize horizontal drilling techniques shall meet the experience and qualifications specified.

4. ENVIRONMENTAL RESTRICTIONS

The Contractor shall abide by the following environmental restrictions:

- Work Area Boundaries. All construction activities shall be conducted within the work area boundaries indicated on the drawings and within 20 feet each side of the access road into the site. The workers and equipment shall stay within these boundaries at all times. The Contractor shall clearly mark or flag these boundaries so that workers and equipment operators clearly understand where the boundary is. All vehicles and equipment must stay on approved roads.

- Restoration of Disturbed Areas. No trees can be removed or areas disturbed without the express permission of the Owner. All areas that are disturbed shall be top soiled and seeded to native grass as specified in these documents. Trees that are removed without permission shall be replaced with the same type of tree and largest practical size to simulate the original tree. Trees removed with the Owner's permission do not have to be replaced.

- Guns. No guns of any type or size will be allowed on the project site or vicinity of the project site.

- Wildlife. Many types of animals and birds frequent the project site including grizzly bear, black bear, mountain lions, moose, deer, bald eagles, and ducks. The lake has a significant fish population. The Contractor shall use extreme care to protect and prevent disturbance of existing wildlife or fish. The Contractor shall erect barricades as necessary to prevent wildlife from falling into any excavations.

- Removal of Bear Attractants. The Contractor shall remove all bear attractants from the project site at the end of each day. This includes human waste, food, and garbage of all types.

- Camping. Workers will not be allowed to camp at the project site.

- Access. A primitive road provides the only existing access to the project site. The Contractor may widen and improve the existing road to permit access of heavy equipment, trucks, and materials. Road widening shall be kept to the minimum possible compatible with vehicle size and type and one way traffic. Passing turnouts can be provided at selected locations if desired. The improved road shall be left as constructed, but all disturbed areas off the normal driving surface shall be cleaned up, topsoiled and seeded.

5. BIDDER'S QUALIFICATIONS.

The successful bidder shall show evidence that he has the finance, organization, and equipment to perform the work with a limited number of subcontractors and in the time frame required. The bidder cannot be overdue on completion of any other public works project. The Contractor will be required to have a full time resident superintendent on the job at all times while the work is in progress. He shall be in a position to direct the work and make decisions either directly or through immediate contact with his superior. Absence or incompetence of the superintendent shall be reason for the Owner to stop all work on the project.

Any Contractor or subcontractor proposing to utilize horizontal directional drilling techniques to install the pipe shall have the following qualifications and experience:

- Have registered professional engineers qualified to design and select the materials needed for installations of this type.
- Have installed a minimum of three pipelines of similar or larger size and length beneath and/or into a river or lake.
- Have installed at least one lake or ocean intake or outfall pipe.

6. PROGRAMMING OF WORK.

Within two weeks after award of Contract, the Contractor shall furnish to the Engineer and Owner's representative a proposed progress schedule showing the order in which the Contractor proposes to prosecute the work and the rate of progress which will be maintained. The Owner and Engineer will review the schedule to determine whether or not the schedule is compatible with all contract requirements. The Contractor shall make any necessary schedule adjustments and submit a final schedule to the Engineer and Owner.

7. COST BREAKDOWN. The Contractor shall submit a detailed cost break down of the construction costs within 14 days after award of bid. The cost breakdown will be utilized as a basis for monthly progress payments. The breakdown shall as a minimum include the following items:

- General mobilization costs for bonds, insurance, general move in and site occupancy costs.
- Horizontal drilling mobilization costs (if utilized) shall be itemized separately from general mobilization costs.
- Concrete.
- Pipe of each type and size, installation outside the active lake at the time of construction

- Pipe installed within the active lake at the time of construction.
- Pump casings.
- Pitless units.
- Bedding material costs for each type of bedding material.
- Excavation costs.
- Shoring costs.
- Dewatering costs.
- Backfill and compaction costs.
- Horizontal directional drilling costs.
- Clean up and site restoration.

Each item shall be paid monthly in proportion to the amount constructed. Anticipated profit shall be distributed uniformly between all work items and not listed separately. The cost break down shall be a true representation of costs and not unfairly weighted to work items early in the project. The cost break down is subject to approval by the Owner.

8. PERMITS & FEES.

The Contractor shall procure and pay for all permits, fees, licenses and bonds necessary for the prosecution of his work and/or required by the Blackfeet Tribe and State and Federal Regulations and laws, including those that pertain to permits for transportation of materials and equipment, blasting or other operations which are not a specific requirements of these specification. The Contractor shall not be required to pay the Blackfeet Tribe's two percent (2%) TERO (Tribal Employment Rights Office) fee and the three percent (3%) construction tax. The Owner has been able to make other arrangements for settlement and payment of the fee and tax.

The Contractor shall give all notices, pay all fees, and comply with all Federal, State and Blackfeet Tribal laws, ordinances, rules and regulations and building and construction codes bearing on the conduct of the work, including the TERO requirements. All costs shall be merged and included in the Contractor's bid price for the related work.

9. BLACKFEET TRIBAL MEMBER EMPLOYMENT.

The Contractor shall meet all requirements for employment of Blackfeet Tribal members in the construction force.

10. MATERIALS AND EQUIPMENT SOURCES AND DELIVERY.

It shall be the responsibility of the Contractor to fully investigate and satisfy himself as to the availability, within the time limits specified, of all materials and equipment required under this Contract prior to submitting his bid. A time extension shall not be granted due to the Contractor's inability to obtain and install the materials within the specified contract time.

11. INSPECTION BY PUBLIC OFFICIALS.

Authorized representatives of the Owner, Indian Health Service, EPA, and other government agencies shall have access to the work wherever it is in preparation or progress. The Contractor shall provide proper facilities for such access and inspection such officials desire to make.

12. COMPLIANCE WITH STATE AND FEDERAL STATUTES AND REGULATIONS.

The Contractor and each of his subcontractors shall comply with all State and Federal Statutes and Regulations governing the work.

13. GOVERNING REQUIREMENTS.

The construction specifications and drawings shall be considered integral to the project, and that which is called for on one and not on the other shall be required. The General Conditions as modified by Special Procedures Supplementary Conditions and/or Division 1 shall govern over the construction specifications should a discrepancy exist.

14. USE OF EASEMENTS AND ADJOINING PROPERTY.

The Contractor shall contain all of his construction operations within the construction limits indicated on the drawings or within 20 feet either side of the access road unless written approval is secured from the Owner to extend the area. The Contractor shall place lath and flagging or other suitable markers at the edge of easements to show workmen the limits they must stay within.

15. PUBLIC CONVENIENCE.

The Contractor shall at all times conduct his work in a manner as to insure the least possible obstruction to traffic and inconvenience to the Owner and the general public and to insure the protection of persons and property. Temporary provisions shall be made by the Contractor in insure safe access to all buildings at all times.

16. SURVEYS.

16.1 Survey Markers and Monuments. The Contractor shall carefully protect from disturbance all survey monuments or markers. The Contractor shall use extreme care to protect and reference points during construction. Any survey marker or monument that is disturbed or destroyed by the Contractor without specific written approval of the Owner, shall be replaced by a licensed land surveyor at the Contractor's expense.

16.2 Construction Surveys. The Owner will provide two control points with coordinates and a benchmark for the Contractor’s use in laying out the work. The Contractor is responsible for furnishing all wooden stakes to be used in staking at no additional cost to the Owner. The Contractor is also responsible for preserving and protecting the installed stakes at all times during

the construction period. Any stakes obliterated, removed, or otherwise lost during construction shall be replaced by the Contractor at the Contractor's expense.

The Contractor is solely responsible for setting all construction or grade stakes necessary for construction of the pipe system.

16.3 Survey Errors. Any claim by the Contractor for extra compensation by reason of alterations or reconstruction work allegedly due to error in the Engineer's line and grade, will not be allowed unless the original control points set by the Engineer still exist, or unless other satisfactory substantiating evidence to prove the error is furnished the Engineer.

17. DISPOSAL OF WASTE MATERIALS.

The Contractor shall be responsible for disposal of all human waste, garbage, concrete, pipe, brush, rock, demolition and other materials removed during construction. Human waste, garbage, or any other material that may attract bears shall be removed from the site at the end of each working day. All materials shall be disposed of at an approved landfill site. The Contractor is responsible for locating a landfill site that will accept the material and for transporting the material to the site. If the site is on private property, the Contractor shall furnish the Owner with a letter giving the Contractor permission to use the site and another letter approving final condition of the site after disposal operations are complete. The Contractor shall merge and include all costs and fees related to transport and disposal in his contract bid price for related work. No additional measurement or payment shall be made.

18. WATER POLLUTION CONTROL.

Water originating from trench de-watering, flushing, dredging, or drilling operations shall not be discharged to surface waters without approval of the Blackfeet Tribe, the Environmental Protection Agency, and/or the U.S. Corps of Engineers where applicable. The Contractor shall obtain all necessary permits and perform all treatment required to meet the discharge permit requirements established by the various agencies. All costs related to obtaining the permits and any required treatment of the water shall be merged and included in the contract price for related work.

The project will be regulated by EPA's General Stormwater discharge permit. The Contractor shall submit a Notice of Intent form to EPA two days before construction begins. Notices are to be sent to:

Stormwater Program
EPA Region 8 – Montana Office
301 S Park Drawer 10096
Helena, MT 59626

Stormwater Notice of Intent
401 M St. SW
Washington, DC 20460

The Contractor shall develop and keep available on site a written Pollution Prevention Plan describing the construction activity and all stormwater control measures. In addition, the Blackfeet Tribe has their own ordinances affecting stormwater and water from dewatering operations. The Contractor shall contact the tribal stormwater representative at 406-338-7421 to obtain tribal requirements. All work must be done in strict conformance with these requirements. EPA and/or tribal representatives will conduct stormwater site inspections, typically unannounced. The Contractor shall comply with all directives resulting from those inspections.

A Notice of Termination must be filed with EPA on completion of the work.

19. SAFETY.

In accordance with generally accepted construction practices and the requirements of the Occupational Safety and Health Administration Standards, the Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property affected directly or indirectly by his operations during the performance of the work. This requirement will apply continuously 24 hours per day until acceptance of the work by the Owner and shall not be limited to normal working hours.

The duty of the Engineer or Owner to conduct construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on or near the construction site.

19.1 Warning Signs and Barricades. The Contractor shall provide adequate signs, barricades, and lights and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be protected at night by suitable signal lights which shall be kept burning from sunset to sunrise. Barricades shall be of substantial construction and shall be painted such as to increase their visibility at night. Suitable warning signs shall be so placed and illuminated at night as to show in advance where construction, barricades, or detours exist.

20. SANITARY PROVISIONS.

The Contractor shall provide and maintain adequate sanitary accommodations for the use of his employees and those of his subcontractors. The toilets shall be cleaned of human wastes at the end of each day to avoid attracting bears.

21. REPAIR OF DEFECTIVE JOINTS.

If the pipeline fails to meet the pressure and leakage test requirements, the pipe shall be repaired. If the gasket in a joint has "rolled" or otherwise failed, the pipe shall be removed to the nearest flexible coupling or to the current end of construction of the new pipe so that the leak can be fixed without use of repair clamps or similar devices not part of the original system design. If more than 100 feet of pipe must be removed to repair the leak, the gasket can be repaired by cutting the pipe,

replace the gasket, and connecting the cut pipe section to the main with a Rockwell 437 cast cut in repair coupling.

22. UNDERGROUND UTILITIES.

The Owner assumes no responsibility for determining the location of any existing underground utilities in the area. The Contractor is solely responsible for contacting all potential utility owner's in the area and determining the their location prior to beginning construction.
Failure of the Owner to show the existence of subsurface objects or installations on the plans shall not relieve the Contractor from his responsibility to make independent check on the ground, nor relieve him from all liability for damages resulting from his operations.

The Contractor shall protect from damage private and public utilities, including telephone lines, power lines, and appurtenances.

23. SURFACE WATER, GROUNDWATER AND UNSTABLE SOILS.

Prior to submitting a bid, the Contractor shall become thoroughly familiar with all surface water, groundwater and soil conditions on the construction site and include in the bid price the cost of all labor, materials, equipment, and miscellaneous items necessary to remove all surface water and groundwater that affects construction in any way and to remove and replace or stabilize soils as necessary to complete the entire work.

The pumping facility site is saturated with water at times. A small stream and/or springs discharge water into the area. Both surface water and ground water will have to be controlled to stabilize the area and permit construction. The Contractor shall include all costs for control of ground water and surface waters in his contract price for the work.

Three exploratory holes were drilled at the new pump station site as part of a subsurface soils investigation. No exploratory holes were drilled in the lake bed. Results of this investigation are included in the Appendix of the contract documents. These results may or may not be typical or representative of all soils and groundwater in the construction area. Sands and silts in the area are very unstable under certain groundwater conditions and special construction procedures and techniques will be required. The Contractor should conduct any additional investigations or tests he deems necessary prior to submitting a bid.

The Contractor is solely responsible for designing and providing all groundwater removal and soil stabilization techniques required to make construction of the work possible. Groundwater shall be removed to the greatest degree possible using multiple well points and/or other suitable means necessary to remove groundwater and surface water to the depths required for stable construction. The Contractor shall utilize all appropriate techniques necessary to stabilize the soils for excavation and construction including sheet piling and concrete plugs to prevent heaving of soils on the bottom of excavations.

24. ROCK.

Rock was not encountered in any of the three holes drilled, but rock may be encountered at deeper depths or at locations away from the exploratory holes. Irregularities in the bed rock surface may be present. In addition, large isolated boulders may be present although not encountered in the drill holes. The Contractor shall be prepared to remove any rock that is encountered and have the equipment and skills to do so.

25. LAKE WATER LEVEL.

The Owner will attempt to have the lake water level drawn down to elevation 4866.1 by November 1, 2001. Depending on the weather and ice conditions it may not be possible to get to this elevation or maintain it through the winter. The level will be maintained as low as reasonably possible with the existing structures during the construction period.

26. TOPOGRAPHIC SURVEY ACCURACY.

The lake bed topography was established using sonar type technology and may not be precisely accurate. The Contractor shall anticipate variations in lake bed elevations up to one foot when preparing his bid. Immediately after award of contract, the Contractor shall verify the lake bed elevation at the intake screen elevation. The intake screen must be set at the elevation given on the drawings. It may be necessary to change the intake screen location if ground elevations are higher than anticipated at this point. If the intake line must be extended, the contract price will be adjusted upward by an amount equal to the manufacturer's invoice price of the additional pipe plus $150 per foot of additional pipe installed for mark up and installation costs. No additional payment will be made for the increased pipe installation.

27. BRIDGE WEIGHT RESTRICTIONS.

Access to the site is gained by utilizing an existing bridge over the Two Medicine River. This bridge has a weight limit of 20 tons. The Contractor shall be aware of this restriction and arrange his equipment and material deliveries to be compatible. If higher loads are needed, the Contractor shall modify the bridge as recommended by a registered professional engineer, or provide an alternate temporary method of crossing the stream. Alternate methods are subject to the approval of the Blackfeet Tribe.

28. TEMPORARY ELECTRICAL POWER AND TELEPHONE.

The Contractor shall provide electrical power generators as necessary for temporary power needs during construction. There is no existing utility power service in the immediate vicinity of the work. The Contractor shall also provide his own telephone or other communication equipment or service. There is no existing telephone service.

29. SOILS INVESTIGATION.

Three drill holes were made on shore in the vicinity of the pumping facility casings. The results of this investigation are attached in the Appendix for general information purposes only. No engineering characteristics or the extent and types of soils are implied or suggested. The groundwater table is only indicative of the water level on the day the holes were drilled and can be expected to vary. The Contractor shall conduct any soils investigation he deems necessary for his construction purposes prior to submitting a bid.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS
SECTION 01010
MEASUREMENT AND PAYMENT

1. GENERAL.

The following items shall constitute pay items for the work to be done under these specifications. Payment for these items shall be full compensation for the completed item of work and the cost of any incidental work or materials required to complete the item, even though not specifically mentioned herein, shall be merged with and become a part of the applicable pay items.

The cost of all the work described on the drawings or in each individual section of the specifications shall be merged and included in the lump sum pay items listed herein. Costs shall be distributed to each pay item as appropriate and reflect a true and accurate distribution of actual costs for the work. Profit and overhead shall be distributed to each pay item in proportion to the cost of each pay item.

2. SPECIFIC ITEMS.

2.1 Mobilization. No separate measurement will be made for the items included in this work. Payment shall be at the contract lump sum price for "Mobilization". All costs related to purchase of bonds and insurance, mobilization and demobilization of men and equipment, on-site equipment storage and administration facilities, sanitary facilities, and other similar costs shall be merged and included in the contract lump sum price for "Mobilization". The contract price for "Mobilization" shall not exceed five percent of the total base bid. If the bid price submitted exceeds five percent of the total base bid, the bid price for "Mobilization" and the total base bid shall be reduced accordingly such that the price for "Mobilization" does not exceed five percent.

2.2 Water Intake. No separate measurement of items required in this work will be made. Payment shall be made at the contract lump sum price for "Water Intake". All costs related to construction of the water intake system shall be merged and included in the contract lump sum price for "Water Intake". The contract price shall include the cost of the stainless steeel intake screen, water intake line, air flushing line, fittings, weights, valves, inner and outer pump casings, pitless units, discharge piping and valves, and all dewatering, water treatment, sheeting, shoring, soil stabilization, excavation, bedding, backfill, compaction, and site grading as shown on the drawings; plus transport and disposal of excess excavated materials, topsoiling, seeding, site access improvements, site and access restoration, clean-up, fees, taxes, permits, and all other work necessary for a complete and operable installation.

2.3 Rock Excavation. Rock excavation and backfill shall be measured by the cubic yard of excavated rock material in its original form and condition prior to removal. Excavation shall only

be considered rock excavation if it meets the definition in Section 02201-4.2.16. The volume of rock excavation and backfill shall be computed in the following manner:

1. The length of trench shall be determined by measuring along the centerline of the pipe.

2. The depth of the rock excavation shall be determined by measuring from the top of the material defined as rock excavation down to the flowline of the pipe or the bottom of the rock material, whichever is least. Measurement to the flowline of the pipe shall be increased by 0.5 feet to allow for bedding material and pipe wall thickness. All measurements shall be to the nearest 0.1 feet.

3. The width of the trench shall be considered as 5.5 feet for the full depth of the trench rock excavation regardless of the actual trench width or shape actually constructed.

The measured number of cubic yards of rock trench excavation will be paid for at the contract unit price per cubic yard for "Rock Excavation" as shown on the bid proposal form. The contract bid price shall include the cost of all excavating, blasting, special rock removal equipment and techniques to protect structures and utility lines, safety procedures, seismic recording, extra pipe bedding, shoring, bracing, dewatering, disposal of unusable materials, furnishing and importing of acceptable backfill materials, compaction and all other items necessary or incidental to the complete work except as otherwise provided in these specifications.

The quantity estimated in the Bid Form is not exact, the actual quantity may vary from zero to a quantity equaling the entire excavation required for the project. Payment will be based on the unit bid price in the bid proposal multiplied by the actual quantity, measured as defined in this section. No adjustments to the unit bid price will be allowed, regardless of the actual quantity.

END OF SECTION

CONSTRUCTION SPECIFICATION

DIVISION 2 – SITE WORK
SECTION 02150
CLEARING AND GRUBBING

1. GENERAL.

This work shall consist of clearing, grubbing, removing, burying, chipping, and otherwise disposing of vegetation and debris from areas that must be disturbed within the construction limits except for such objects as are designated to remain or are to be removed in accordance with other sections of these specifications. This work shall also include the preservation from injury of vegetation and objects designated to remain. Clearing and grubbing shall be limited to that area that must be disturbed for construction purposes. All other areas shall not be disturbed. All disturbed areas shall be topsoiled and seeded.

The work shall be classified as follows:

Clearing: Clearing shall consist of the felling of trees and disposal of stumps, brush, windfalls, logs, limbs, sticks, piles of sawdust, rubbish, debris, vegetation and other objectionable matter existing within the clearing limits, as hereinafter defined, or that interfere with excavation or embankment, or the designated clear-vision areas.

Grubbing: Grubbing shall consist of the removal from the ground and the disposal of roots, stumps, stubs, together with duff, matted roots, and debris from the grubbing limits, as hereinafter defined.

Method of Disposal: Methods of disposal shall consist of removing all material from the project site and disposing of it off Blackfeet Tribal land at an approved site. The Contractor may sell any merchantable timber removed with permission of the Owner and keep the proceeds, if any.

2. APPLICABLE PUBLICATIONS.

Not used.

3. MATERIALS.

Not used.

4. CONSTRUCTION.

4.1 General. Clearing and grubbing shall be done at such times and in such manner that the surrounding vegetation, adjacent property, and anything designated to remain within the construction limits shall not be damaged. Dragging, piling, disposing of debris, and other work that may be injurious to vegetation shall be confined to areas that carry no vegetation or that will be covered by embankments or disturbed by excavations.

The Owner will designate trees, shrubs, plants, or other objects that are to remain. The Contractor shall preserve all objects so designated.

The Contractor shall avoid injury to trees, shrubbery, vines, plants, grasses, and other vegetation growing on areas outside of the slope limits of excavation and embankment. The Contractor shall paint, as required, cut or scarred surfaces of trees or shrubs selected for retention. The paint shall be an approved asphaltum base paint prepared especially for tree surgery.

The Contractor's pioneer roads or work trails shall be located no less than 20 feet inside of the actual clearing limits in order to prevent undercutting of live root systems supporting vegetation adjacent to but outside of the designated clearing limits.

Anticipated potential hazards, such as "widow makers", leaning trees (alive or dead), snags, and the like, within the right-of-way shall be close-cut and removed.

Grubbing shall be confined to the area over which excavation or surface disturbance is to be actively prosecuted within approximately 30 days following clearing operations. Depressions resulting from grubbing operations shall be made free-draining by backfilling with suitable material or grading to drain. Where scour is likely to occur, temporary erosion control settling basins shall be constructed prior to any scour occurring.

Not less than 15 days prior to disposing of material, the Contactor shall submit to the Owner a proposal describing the proposed disposal sites and written permission by the landowner. Materials from clearing and grubbing operations shall not be disposed of until the proposal and written permission are submitted.

4.2 Clearing. Clearing shall be within the construction limits, with a tolerance not to exceed five (5) feet outside these limits and limited to areas that must be disturbed for construction.

Trees, stumps, brush, shrubs, and other vegetation shall be cut off within six inches of the ground. Where feasible, trees shall be felled toward the center of the area to be cleared so they will not injure other trees or objects designated to remain. Stumps shall ultimately be removed.

The Contractor shall remove dead vegetation, logs, stumps, limbs, sticks, piles of sawdust, rubbish or debris, and other undesirable matter existing on areas where live shrubbery, brush, or trees occur. Designated vegetation is to be left in place.

Timber having commercial value shall be cut into logs in accordance with established logging practice. Unless otherwise specified, logs may be stacked in convenient places along the roadway or other locations that are convenient for loading. Logs shall be the property of the Contractor.

4.3 Grubbing. Grubbing shall be within the construction limits with a tolerance not to exceed five feet outside these limits.

All stumps, roots, logs, or other timber and all brush, matted roots, and other debris within the area disturbed for construction shall be pulled or otherwise removed to a depth of not less than 12 inches below the original ground surface.

4.4 Methods of Disposal. All brush, stumps, windfalls, slash, timber having no commercial value, and all other debris resulting from clearing and grubbing operations shall be disposed at a sanitary landfill or at a private landfill with written permission of the Owner.

4.4.1 Burying. The disposal of refuse from clearing and grubbing areas by burying shall be accomplished in a manner that will prevent water pollution, unsightliness, or other deleterious effects. The material shall be disposed off site. The Contractor shall obtain a written permit from the property owner on whose property the disposal is to be made. The permit, or a certified copy thereof, together with a written release from the property owner absolving the Owner from any and all responsibility in connection with the disposal of material on the property shall be filed with the Owner. Disposal shall be in a manner acceptable to the land owner.

4.4.2 Chipping Slash. Chipping slash to provide for disposal of debris from the project clearing operations is permitted provided ultimate disposal is off site.

Chips, when stored, shall be placed in stockpiles. The stockpiles shall be located out of the construction area where they will not interfere with equipment. They shall be located on well-drained sites above the high waterline of adjacent drainages.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 2 - SITE WORK
SECTION 02201
TRENCH EXCAVATION AND BACKFILL FOR
PIPELINES AND APPURTENANT STRUCTURES

1. GENERAL.

1.1 Description. This section of the specifications covers excavation, trenching and backfilling for pipelines and appurtenances within the lake and on shore. This work shall consist of all necessary clearing, grubbing, and site preparation; removal of all material of whatever description that may be encountered; removal and disposal of debris; handling and storage of materials to be used for fill and backfill; all necessary bracing; shoring and protection; pumping and dewatering as necessary; treatment of water discharged by dewatering operations, all backfill, preparation of subgrades, and final grading, dressing and cleanup of the site.

Dredge type excavation will be permitted in the lake where indicated on the drawings, but material removed cannot be discharged back to the lake.

The Owner will arrange to have the lake level lowered as far as physically possible with the existing dam. Weather conditions will also determine the water level that can be achieved.

1.2 Trench Maintenance. The Contractor shall, for a period of one year after completion and final acceptance of the work, maintain and repair any trench settlement which may occur and shall make repairs to any structures or roads which become damaged as a result of backfill settlement.

If the Contractor elects to perform such maintenance and repairs by force account with the Owner or subcontract with others, he shall furnish the Owner and the Engineer a copy of such subcontract, authorization or evidence of his faithful intention to perform the work.

In any case, the Contractor shall furnish a written statement of the method of maintenance he proposes to use. Final acceptance and payment will not be made without such statement.

1.3 Contractor's Safety Responsibilities. Whether utilizing Type 1 or Type 2 trench excavation, the Contractor shall be responsible for enforcing safety and maintaining safe working conditions in all trenching, shoring, and blasting operations to conform to OSHA regulations.

The Contractor shall employ qualified, properly trained personnel to design shoring, perform safety inspections of the trenches, and supervise the handling of explosives, and other operations involving safety procedures, as specified by OSHA.

1.4 Traffic Control and Warning Devices. The Contractor shall pursue construction of the project in such a manner as to minimize the interruption of the use of local roads including primitive roads in the project area.

For the protection of the public, the Contractor shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the "Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations", published by U.S. Department of Transportation, Federal Highway Administration (ANSI D6.1-1978). The Contractor shall take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. The Contractor shall station such guards or flagmen as necessary and shall conform to such special safety regulations relating to traffic control as may be required by the Blackfeet Tribal authorities. All signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.

1.5 Protection of Existing Properties and Utilities.

1.5.1. General. Prior to beginning construction, the Contractor must contact (in writing) all utility companies and/or public utilities having underground installations - telephone, electric, gas, etc., that may be encountered during the excavation. The Contractor must locate any underground installations and shall preserve intact any underground pipes or other utilities encountered during construction (except as hereinafter permitted) provided their location is such that they do not interfere with new pipelines or structures being installed. In case such utilities or other structures are accidentally broken, they shall be immediately replaced (at the Contractor's expense) in a condition conforming to the standard repair practice of the utility.

1.5.2 Privately Owned Utilities. Underground, electrical and telephone cables, telephone poles, light poles, etc., required to be moved to make way for new construction will be moved by the utility company.

1.5.3 Maintenance of Flows. Adequate provisions shall be made for maintaining the flow of drains, ditches, and water courses encountered during construction.

1.5.4 Structures. The Contractor shall exercise precaution to prevent damage to existing bridges, culverts, ditches, fences, or other structures in the vicinity of the work. In the event such damages occur, he shall repair them to the satisfaction of the Owner of the damaged structure and at no cost to the Owner.

1.5.5 Overhead Utilities. The Contractor shall use caution to avoid a conflict, contact or damage to overhead utilities, such as power lines, street lights, telephone lines, television lines, poles or other appurtenances during the course of construction of this project.

1.5.6 Survey Markers and Monuments. The Contractor shall use care and precaution to protect and not disturb any survey marker or monuments, such as those that might be located at a lot or block corners, property pins, intersection of street monuments or additional line demarcation. Such protection shall include marking with flagged high lath and close supervision. No monuments shall be disturbed without prior approval of the Owner or Engineer. Any survey marker or monument that is disturbed or destroyed by the Contractor without approval during the construction of this project shall be replaced by a licensed land surveyor at no cost to the Owner.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Association of State Highway and Transportation Officials (AASHTO) Publications.

AASHTO T-88	Particle Size Analysis of Soils
AASHTO T-89	Determining the Liquid Limit of Soils
AASHTO T-90	Determining the Plastic Limit and Plasticity Index of Soils
AASHTO T-96	Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine
AASHTO T-180	Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-inch Drop
AASHTO T-238	Density of Soil and Soil Aggregate In-Place by Nuclear Methods (Shallow Depth)
AASHTO T-239	Moisture Content of Soil and Soil Aggregate In-Place by Nuclear Methods (Shallow Depth)

2.2 Department of Labor, Safety and Health Regulations for Construction (OSHA) Publications.

OSHA 29 CFR 1926	Excavations; Final Rule October 31, 1989

2.3 Department of Transportation Uniform Traffic Control Devices for Streets and Highways.

3. MATERIALS.

3.1 Type 1-A Bedding Material. This bedding material shall be utilized for all HDPE pipe and shall consist of crushed well-graded clean aggregates conforming to the following gradations:

U.S. Standard (Sieve Size)	Percent Passing
1 inch	100
0.5 inch	70 - 90
No. 4	40 - 55
No. 10	30 - 45
No. 40	10 - 25
No. 200	0 - 5

That portion passing the No. 40 sieve shall have a maximum plasticity index of 6 and a liquid limit of not more than 35 when tested in accordance with AASHTO Methods T-89 and T-90. Crushed gravel shall have a percentage of wear of not more than 30 percent when tested in accordance with ASSHTO T-96.

3.2 Type 1-B Bedding Material. This bedding material shall only be utilized for ductile iron pipe and shall consist of well-graded clean gravel aggregates conforming to the following gradations:

U.S. Standard (Sieve Size)	Percent Passing
1 1/2 inch	100
0.5 inch	60 - 90
No. 4	40 - 60
No. 10	30 - 50
No. 40	10 - 30
No. 200	0 - 10

That portion passing the No. 40 sieve shall have a maximum plasticity index of 6 and a liquid limit of not more than 35 when tested in accordance with AASHTO Methods T-89 and T-90.

3.3 Type 2 Bedding Material. Type 2 bedding material shall consist of suitable granular material conforming to the following gradations:

U.S. Standard (Sieve Size)	Percent Passing
3"	100
1-1/2"	70 - 85
No. 4	25 - 50
No. 200	0 - 12

The material passing the No. 200 sieve shall have a maximum plasticity index of 6 when tested in accordance with AASHTO Methods T-89 and T-90.

3.4 Type 3 Bedding Material. Type 3 bedding shall only be utilized where specifically called out on the drawings. Type 3 bedding material shall consist of suitable durable granular material conforming to the following gradations:

U.S. Standard (Sieve Size)	Percent Passing
1"	100
No. 4	0 - 10

3.5 Plastic Marking Tape. The tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum overall thickness of 5.0 mils and shall include a solid aluminum core. Tape color shall be as specified in Table 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1 TAPE COLOR

Red	Electric
Yellow	Gas, Oil, Dangerous Materials
Orange	Telephone, Telegraph, Television, Police and Fire Communications
Blue	Water Systems
Green	Sewer Systems

4. CONSTRUCTION AND/OR INSTALLATION.

4.1 Stripping. When crossing existing grass surfaces, the Contractor shall remove the vegetation and then strip the cover material to full depth of the topsoil or to a maximum depth of 12 inches, whichever is less. Topsoil shall be stockpiled and utilized to restore the site prior to seeding.

4.2 Trench Excavation.

4.2.1 General. All excavation, trenching and shoring, and the like, under this contract shall be performed in a manner that meets with the requirements of OSHA Manual. All ground water shall be removed sufficiently below the bottom of the trench to provide a stable bottom.

The Contractor shall excavate as necessary at the locations shown on the drawings, staked in the field or otherwise specified for the installation of pipelines. Excavations shall be made at each location by one of the two methods specified herein - either Type 1 or as Type 2 Trench Excavation. Type 1 Trench Excavation may be used in most open areas in the lake bed. Type 2 will be used for all excavations within 100 feet of the well casings or when space limitations or other conditions dictate. Areas of Type 1 and Type 2 Trench Excavation that are designated on the drawings shall be excavated as indicated.

Whether trench excavation is classified as Type 1 or Type 2, the Contractor shall take precautions and protect all adjoining property and facilities, including underground and overhead utilities, structures, and fences. Any disturbed or damaged facilities shall be restored or replaced at no cost to the Owner.

All trench excavation shall be made by open cut methods.

During excavation, materials suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Excavated material shall be piled on one side of the trench only, to permit ready access to the trench. Surface drainage of adjoining areas shall be unobstructed.

All excavated materials not required or suitable for backfill shall be removed from the site and wasted at sites designated by the Owner or furnished by the Contractor.

Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any other water accumulating in the area shall be promptly removed. No water shall be permitted to rise in non backfilled trenches until after the pipe has been placed, tested and covered with backfill for a depth of at least five feet unless the pipe is filled with water, in which case at least two feet of cover is required. Any pipe having its alignment or grade changed as a result of a flooded trench shall be removed and re-laid after the trench is regraded at no additional cost to the Owner.

The bottom of the trenches shall be accurately graded to the line and grade shown on the drawings. Bedding material shall provide uniform bearing and support for each section of the pipe at every point along its entire length. Unauthorized over-excavation shall be backfilled with pipe bedding material at the Contractor's expense.

There will be no differentiation of materials in trench excavation with the exception of consolidated rock as defined in section 4.2.16. Excavation shall include the removal and subsequent handling of all earth, gravel, rock, or other material encountered regardless of the type, character, composition or condition of the material.

When rock is encountered, the Contractor shall excavate the rock to a depth of at least six inches below the bottom of the pipe.

The Contractor will be required to conduct his work so that trenches will remain open a minimum possible time. No trench excavating shall begin until approved compaction equipment is at the site where the excavating is to take place.

4.2.2 Type 1 Trench Excavation. Excavation performed as Type 1 will not be shored or sheeted. The sides of all trenches shall be sloped back to preclude collapse, in accordance with OSHA Regulations.

4.2.3 Type 2 Trench Excavation. Excavation performed as Type 2 shall be adequately shored and sheeted in accordance with the minimum requirements of OSHA Regulations.

Portable trench boxes or sliding trench shields may be used for performing Type 2 Excavation in lieu of a shoring system if they are designed, constructed, and maintained in a manner which will provide protection equal to or greater than the sheathing or shoring required for the trench.

4.2.4 Trench Dimensions. Trench dimensions shall be as specified below.

4.2.4.1 Width. The width at the bottom of the trench shall be such to provide adequate working room for men to install and join the pipe in the specified manner. The width of that portion of the trench from the existing ground surface to the bottom of the trench for Type 2 Trench Excavation or from the bottom of the trench to a maximum of five feet above the bottom of the trench for Type 1 Trench Excavation, shall be as follows:

> For pipe sizes 12 inch diameter and smaller, a minimum width of 3.5 feet and a maximum width of 4.5 feet.
>
> For pipe sizes larger than 12 inch diameter, a minimum width of 2 feet plus the outside diameter of the pipe and a maximum of 3.5 feet plus the outside diameter of the pipe.

For Type 2 Excavation, the width of the trench at the surface shall not exceed the bottom trench width by more than 4 feet.

4.2.4.2 Depth of Trench. Trench depth shall be as required for the pipe grade or pipe cover shown on the plans or as specified elsewhere, plus an additional 4 inches for Type 1 pipe bedding. Type 3 bedding shall only be utilized under water in dredged trenches where needed to make a uniform grade.

Care shall be taken not to excavate below the required depth. In areas with rock subgrade, the Type 1 pipe bedding depth shall be a minimum of 6 inches.

When soft or unstable material is encountered at subgrade which will not uniformly support the pipe, such material shall be excavated to an additional depth as specified by the Engineer, and backfilled with Type 2 bedding material to provide a firm foundation for the pipe.

4.2.5 Blasting. Blasting for excavation will only be permitted in trenches that are not underwater. The Contractor shall use utmost care to protect life and property. All explosives shall be safely and securely stored in compliance with local laws and ordinances, and all such storage places shall be clearly marked "Dangerous Explosives". No explosives shall be left unprotected where they could endanger persons or property.

When blasting rock in trenches, the Contractor shall cover the area to be shot with earth backfill or blasting mats that will prevent the scattering of rock fragments outside the excavation. Prior to blasting, the Contractor shall station men and provide signals of danger in suitable places to warn people and stop vehicles. The Contractor will be responsible for all damage to property and injury to persons resulting from blasting or accidental explosions that may occur in connection with his use of explosives.

The Contractor shall furnish the following information to the Owner and Engineer prior to commencing blasting operations: Proof of insurance covering liability for such operations and planned procedures for protecting the public, fish, and wildlife.

The Contractor's blasting procedures shall conform to Federal, State and local ordinances. The Contractor shall acquire all required permits prior to the start of blasting.

4.2.6 Equipment. Trenching machinery will be used except in places where its operation will cause damage to existing structures or features, in which case hand methods shall be employed.

4.2.7 Dewatering. Where ground water or surface water is encountered in excavation, it shall be removed to avoid interfering with pipe laying and other construction operations. Groundwater shall not be permitted to directly enter surface waters without provisions for erosion control and treatment including sedimentation and filtration where required by the discharge permit. The Contractor shall obtain a discharge permit from the Blackfeet Tribe prior to beginning construction.

4.2.8 Drainage. The Contractor shall control the grading in the vicinity of trenches and structures as much as possible so that the ground surface is properly sloped to prevent water from running into excavated areas. Water which has accumulated in the excavation from rainfall and/or surface runoff, or from any other cause, shall be removed by the Contractor at his expense, and the subgrade shall be restored to proper bearing capacity. The Contractor shall not divert drainage water to other existing channels without the permission of the Owner.

4.2.9 Erosion Control. The Contractor shall prepare an erosion control plan suitable to obtain a stormwater discharge permit from the Blackfeet Tribe. The Contractor shall utilize best management practices and provide treatment of the water as required to meet the conditions of the discharge permit.

4.2.10 Surface and Groundwater Disposal. The Contractor shall obtain a temporary discharge permit from the Montana Department of Environmental Sciences for discharge of surface water and ground water to the lake or other surface waters in the area. In general, water containing silt, oil, or other matter shall be diverted into a treatment system that will produce an effluent meeting the requirements of discharge permit prior to discharge to a surface water. Any operation not meeting these requirements shall be subject to shutdown of the project.

4.2.11 Shoring, Sheeting, and Bracing. The Contractor shall do all shoring, bracing and tight sheeting required to prevent caving and to protect his workmen, in accordance with Occupational Safety and Health Regulation Requirements, and to protect adjacent property and structures. If surface cracking occurs in the vicinity of the trench, sloughing of the trench wall or horizontal deflection of shoring occurs, the Contractor shall stop excavation operations and shall provide shoring or additional shoring to protect the project, workmen and adjoining property.

4.2.12 Tight Sheeting Ordered Left in Place. In areas where quicksand or other unstable material is encountered which requires the driving of tight sheeting to protect the work and workmen, the sheeting may be required to be left in place. If the withdrawal of the sheeting would result in damage to the work or any surrounding property, it shall be left in place. In the event that removal of tight sheeting should result in personal injury or property damage of any kind, the fact that the sheeting was not ordered to be left in place shall in no way relieve the Contractor of his responsibility for protecting the work as described in the General Conditions of these specifications. This does not include intermittent shoring and bracing which shall be removed. No additional payment will be made for shoring left in place.

4.2.13 Excavation for Appurtenances. Excavations for structures and other appurtenances shall be sufficient to leave 18 inch minimum clearance on all sides. The depth, provisions for removing water, and other applicable portions of these specifications shall apply to excavation for appurtenances.

4.2.14 Structural Excavation. Excavation for structures shall extend a sufficient distance from walls and footings to provide for forming except where concrete for footings is authorized to be deposited directly against excavated surfaces. Avoid excavating below the depths indicated on the drawings. Over-excavation shall be restored to proper elevation by filling with granular bedding material at the Contractor's expense and compacted to 95% of maximum dry density as determined by AASHTO T-180.

4.2.15 Dredging. Dredging will be allowed in specific areas within the flooded lake bed as indicated on the drawings. Material removed by dredging shall not be discharged back to the lake, but may be disposed on the exposed dry lake bed by spreading it out so that the existing lake bed elevation is not raised more than 6 inches. The Contractor shall utilize berms or other satisfactory methods to prevent water in the dredged material from flowing back to the lake without treatment meeting the requirements of the discharge permit. After the material is drained it can be spread out.

The dredged trench bottom must be true to the grade shown on the drawings and not undulate up and down. The finished installation shall not vary by more than ±0.2 feet along its length from the grade and elevations shown on the drawings. The Contractor may elect to construct a single dip in the pipeline below the indicated grade (see drawings) such that the pipe slopes positively upward in either direction from the dip rather than follow one uniform grade. The pipe must meet the required elevations at each end within the lake and slope positively upward to those elevations without undulating up and down. Backfill of the pipe will not be required in the dredged area.

4.2.16 Rock Excavation. Material shall be considered rock if it is sufficiently tough and hard that a Caterpillar Model 235 or equal backhoe in new operating condition and equipped with a rock bucket and skilled operator cannot excavate the material without drilling and blasting. Rock excavation requiring drilling and blasting shall be paid for separately. Acceptable backfill material shall be brought in as necessary to complete trench backfill as specified in Section 02201. Disposal of unacceptable soil or rock backfill is the responsibility of the contract. The Contractor shall utilize all appropriate safety measures and procedures while blasting.

The Contractor shall attain written approval from the Bureau of Indian Affairs prior to commencing blasting activities. The Contractor shall make seismic recordings of each blast such that a permanent record of ground movement is maintained.

The Contractor shall utilize alternative methods of rock cutting and breaking where blasting may damage dams, structures, existing water, sewer or other utility lines. The Contractor is solely responsible for the selection of the method of rock removal and is solely responsible for all damage. Whenever rock removal is to occur near existing water, sewer, or other utility lines, the Contractor shall have suitable materials on hand for making immediate repairs to the damaged line. Any structures or utility lines, or other items damaged during construction shall be repaired by the Contractor to the satisfaction of the Owner of the utility or structure at no additional cost to the Owner.

4.3 Trench Backfill.

4.3.1 General. All trenches except for portions of the trench within the lake as indicated on the drawings shall be backfilled immediately after grade, alignment and jointing of the pipe has been inspected and approved by the Engineer. Leakage tests, pressure tests or tests for alignment and grade shall be performed after backfill. If any test fails, the Contractor shall be responsible for work required to correct the defects at no additional cost to the Owner. Backfill density shall be determined in accordance with AASHTO T-238 and T-239 methods.

4.3.2 Pipe Bedding Material.

4.3.2.1 Type 1 Pipe Bedding. Type 1-A or 1-B pipe bedding material (depending on pipe material) shall be placed to a minimum depth of four (4) inches under the pipe except in trenches cut in rock requires six (6) inches under the pipe for the full width of the trench. The material shall be placed up to the centerline of ductile iron pipe and to a point 12 inches above the pipe for polyethylene pipe for the full width of the trench. Bell holes and depressions for joints shall be dug after the trench bedding has been graded and compacted. The holes shall be only of such length, depth and width as is required for properly making the particular type joint.

4.3.2.2 Type 2 Pipe Bedding. Type 2 bedding material shall be used to replace soft, spongy, or other unsuitable material encountered in trench bottom below the Type 1 pipe bedding material level, to the depth necessary to support the pipe as determined by the Engineer.

4.3.2.3 Type 3 Pipe Bedding. Type 3 bedding material shall only be utilized in dredged trenches to achieve a uniform pipe grade at specific locations indicated on the drawings that are within the existing lake.

4.3.2.4 Bedding Compaction. The pipe bedding material shall be placed in lifts not exceeding six (6) inches in depth and compacted to 90% of maximum dry density as determined by AASHTO T-180.

4.3.3 Backfill.

4.3.3.1 General. The fill material above the bedding material and to a minimum depth of 12 inches above the pipe shall be a select backfill material meeting the following requirements:

1. The select material shall be free of clods, lumps of frozen material, or stones larger than one inch in their maximum dimension.

2. The select material for polyethylene pipe shall be Type 1A bedding material.

3. The select material for rigid pipe such as ductile iron or steel shall have a maximum liquid limit of 40 and a maximum plasticity index of 15 based on that fraction of the material passing the No. 40 sieve. All material shall be inorganic. Type 1B bedding material may be utilized for select material at the Contractor's option.

Where suitable material is available in the material excavated from the trench, the Contractor may procure the select material by screening, sifting, or manually sorting the material removed from the trench. The particle size, liquid limit, and plastic limit shall be determined in accordance with AASHTO T-88, AASHTO T-89 and AASHTO T-90.

After the pipe bedding and select backfill material has been placed and compacted as specified above, the remainder of the trench backfilling shall be done. All backfill material shall be free from cinders, ashes, refuse, organic and frozen material, boulders, or other materials that are unsuitable. From 12 inches above the top of pipe to six inches below the ground surface, material containing stones up to six inches in the greatest dimension may be used. Stones shall be placed so that each piece is completely surrounded with material compacted to the density hereinafter specified. No frozen materials or ice clods will be permitted in areas that are not within the exposed dry lake bed. Some frozen materials and clods may be utilized for Type B backfill above the select material within the dry lake bed provided the frozen materials and clods do not constitute more than 40 percent of the total backfill depth.

Trench backfill compaction is separated into two classifications. Type A trench backfill compaction is required for backfill in areas above the normal high water operating level or other selected areas as designated on the drawings. Type B backfill compaction may be utilized in the dry lake bed below the normal high water operating level where Type A backfill compaction is not required. Locations of the types of backfill required shall be as shown on the drawings.

Compaction by flooding will not be permitted. Wherever the trenches have not been properly filled, or if settlement occurs, they shall be re-opened to the depth required for proper compaction and refilled and recomputed. Settlement within the dry lake bed area up to one foot is permissible without correction.

The Contractor shall provide excavation equipment and dig compaction test holes through each layer of backfill at approximately 100 foot intervals as selected by the Engineer, where the layers exceed one foot in depth or where backfill was placed without the Engineer being present. The compaction test holes shall be dug by the Contractor at no additional cost to the Owner. Should the tests fail, the Contractor shall excavate the trench to the required depth for recompaction and shall recompact the backfill material at no additional expense to the Owner.

Pipelines will be checked to determine whether any displacement or other damage has occurred after the trench has been backfilled approximately two feet above the pipe. If the pipelines show

poor alignment, breakage, excessive leakage or any other defects, the deficiencies shall be corrected by the Contractor at his expense.

4.3.3.2 Backfill Compaction.

4.3.3.2.1 Select Backfill Zone. The bedding and select material under, around and twelve inches above the top of the pipe shall be placed by hand in maximum layers of six inches and carefully compacted in a manner which will not displace the pipe. Special care shall be taken to assure complete compaction under the haunches of the pipe. Backfill material shall be placed in the trench for its full width on each side simultaneously. Compaction of the select backfill shall be not less than 90% of the maximum density as determined by AASHTO T-180.

Water settling will not be allowed, and the addition of water shall be limited to that required for optimum moisture for maximum compaction of the material.

4.3.3.2.2 Type A Trench Backfill Compaction. Materials used for backfill shall be carefully deposited in layers not to exceed 6 inches in depth and suitable to the equipment used for compaction, wetted to optimum moisture content, and compacted to at least 85% of maximum Standard Proctor Density, as determined by AASHTO T-180.

4.3.3.2.3 Type B Trench Backfill. Backfill to at least twelve inches above the pipe shall meet the requirements for bedding material and Select Backfill. Materials used for Type B Trench Backfill shall be compacted in layers to a density of at least 75% of maximum Standard Proctor Density, as determined by AASHTO T-180.

In grass areas, the stripped topsoil shall be placed to a uniform depth over the backfilled trench. The topsoil shall not require compaction, but shall be graded to provide a smooth surface.

4.3.4 Backfilling for Appurtenances and Structures. Backfill around appurtenances and structures shall be deposited in a manner that does not disturb the appurtenances or structure from its proper alignment, and compacted to the finished grade. Backfill material, compaction and backfill procedures shall conform Type A backfill.

4.3.5 Plastic Marking Tape. Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade in areas above the low water elevation of the lake unless otherwise shown.

4.3.6 Disposal of Excess Material. Excess materials, including rock, broken concrete, debris or other materials not suitable for backfill shall be removed and disposed off the site. Excess silt and sand material may be wasted in the dry lake bed that is at least 8 feet below high lake level and in an area designated by the Owner. The material shall be spread out to a maximum depth six inches above the original ground and in a disposal areas designated by the Owner. When disposal sites are not designated by the Owner, the Contractor shall provide the site. The site must meet regulatory provision for waste disposal. The disposal sites meeting regulatory requirements may be used provided written permission is obtained from the Owner of the property upon which the material is to be deposited. The Contractor shall provide the Owner with a copy of the written permission.

After all waste material has been placed in the disposal site, the Contractor shall grade the site to leave the surface in uniform and free draining condition.

4.3.7 Testing. Field density tests of the compacted fill will be run at all levels. These tests will be performed by the Owner's representative.

4.4 Cleanup. As work progresses, that portion of the work completed shall be cleared of debris and brought to the finished grade with a minimum of 8 inches of topsoil. Upon completion of the work, the entire site shall be cleared of all debris and ground surfaces shall be finished smooth with uniform slopes and shall present a neat and workmanlike appearance. All rocks brought to the ground surface by excavation or backfilling operations shall be removed. All disturbed areas shall be seeded.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 2 - SITE WORK
SECTION 02210
HORIZONTAL DIRECTIONAL DRILLING

1. GENERAL.

1.1 Construction Alternative. Horizontal directional drilling rather than open cut construction of the intake pipeline is an acceptable alternative means of construction provided the Contractor meets the requirements herein and provides an acceptable drilling and installation proposal.

1.2 Experience Requirements. The Contractor or his subcontractor must meet the horizontal directional drilling qualification and experience requirements:

- Have registered professional engineers qualified to design and select the materials needed for installations of this type.
- Have installed a minimum of three pipelines of similar or larger size and length beneath a river or lake.
- Have installed at least one ocean or lake intake or outfall pipe.

A summary of experience must be provided with the proposed drilling plan within two weeks after the bid opening. Contractors not having the required qualifications and directional drilling experience and an acceptable drilling plan will be rejected and bid award made to the next qualified bidder.

1.3 Drilling Plan. The Contractor shall submit a complete drilling plan within two weeks after the bid opening if horizontal directional drilling is proposed. The drilling plan shall have as a minimum the following information:

- Proposed profile of installed pipeline.
- Carrier pipe must be high density polyethylene. Pipe manufacturer and wall thickness along with design calculations by a registered professional engineer showing pipe is adequate for stresses that will be applied to it during installation and long term operation.
- If a casing is needed, provide casing pipe information along with design calculations by a registered professional engineer showing the casing is adequate for the stresses applied during installation and long term operation. Casing material is the Contractor's option.
- Show scale drawing layout of the proposed drilling operation, mud pit, assembly area and equipment and material laydown area. Operations must be conducted within limits and requirements described in these specifications.
- Mud pits must be located on the exposed dry lake bed.
- Area disturbance beyond the exposed dry lake bed must be within limits described in these specifications.

- Provide a proposed schedule for completion of the work.

The drilling plan is subject to approval by the Owner. Failure to produce an acceptable drilling plan is cause for rejection of the bid and award to the next qualified experts.

1.3.1 Acceptance of Drilling Plan. The Owner reserves the right to review the proposed drilling plan and make discretionary judgment to the adequacy of the plan. The Owner has the right to approve any plan, reject any plan, request clarifications of any plan, and negotiate modifications to any plan.

1.4 Soils Investigation A specific soils investigation of the lake bed area has not been conducted. Limited soils information on the pumping facility site on shore is available and is enclosed in the Appendix of this specification. This data is provided for general information only and no engineering characteristics or the extent of the soils and types of soils found are implied or suggested. The Owner makes no assertion as to the type of soils, rock, and groundwater systems or their characteristics that will be encountered along the route. The Contractor shall conduct the drilling operation solely at his own risk. No additional payment will be made for unforeseen conditions. The Contractor should satisfy himself as to subsurface conditions before submitting a bid.

2. APPLICABLE PUBLICATIONS.

Not applicable.

3. MATERIALS.

3.1 Carrier Pipe. The carrier pipe shall be high density polyethylene pipe as specified in the section for pipelines. If the pipe wall thickness must be increased to meet the stresses that will be applied to it, then a larger pipe with a minimum inside diameter of 18.0 inches shall be provided and installed at no extra cost.

3.2 Casing Pipe. A casing pipe if needed will be selected and sized by the contractor to meet the requirements of the installation. Steel casing is acceptable.

3.3 Drilling Fluids. Fluids required for drilling, removal of cuttings, and installation of the pipe shall be non-toxic, compatible with potable water installations, and pose no environmental threat to the lake fishery, birds, and other wildlife in the area that may come in contact with it. Fluids shall be approvable by regulatory authorities and the Blackfeet Tribe.

4. CONSTRUCTION.

4.1 General. The Contractor shall determine his own methods and means of construction subject to the approval of the Owner and regulatory authorities. Drilling operations shall be contained within the construction limits established by the Owner. Muds and cutting shall not be discharged

to the lake. Mud pits shall be erected on the exposed dry lake bed. Upon completion of work, the mud pits shall be removed and the residue spread uniformly over the dry lake bed to a depth not to exceed 6 inches and shall not be closer than 50 feet to the lake high water line.

4.2 Completed Installation. The completed pipe installation shall be as shown on the drawings with the exception that the pipe can be installed at a deeper depth in the middle than indicated on the drawings such that the pipe slopes upward continuously in each direction without undulations. Both ends must be terminated at the elevations indicated on the drawings. Any special connections required are subject to the approval of the Owner.

At all locations, the intake pipe shall be provided either with adequate anchoring or cover material such that flotation will not occur, assuming the pipeline contains 10% of its volume as air once in operation and 100% of its volume as air during construction. If the intake pipe is filled with water during installation, the air volume requirement can be reduced accordingly.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 2 - SITE WORK
SECTION 02662
PIPELINES

1. GENERAL.

1.1 Description. This section of the specifications covers construction of underground and underwater pipelines, including fittings, and other appurtenances normally used for underground water supply pipeline systems and underground compressed air systems. This work shall consist of furnishing and installing pipe and fittings, construction of weights, thrust blocking, testing, cleaning, and other related work. Special considerations will be detailed on the drawings.

1.2 Certification. The Contractor shall furnish certification that all materials conform to the specifications.

All pipe shall be clearly marked with type, class, and or, thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

1.3 Responsibility for Material. The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found to be defective or damaged. This shall include the furnishing of all materials and labor required for the replacement of installed material discovered to be damaged or defective prior to the final acceptance of the work, or during the guarantee period.

The Contractor shall be responsible for the safe and proper storage of material used on the project. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times.

1.4 Fusion Welding Qualifications for Polyethylene Pipe. The Contractor shall only utilize special fusion welding equipment specifically approved for that purpose by the pipe manufacturer under the conditions that will occur on the project site. Personnel or subcontractors making the fusion welds shall be specifically trained and qualified for the work and have a minimum of five years of experience with fusion welding of polyethylene pipe of similar size or larger. Proof of such experience and skills shall be provided the Owner before beginning of construction. The Owner has the right to reject personnel or subcontractors that do not meet the experience and skill requirements.

The pipe manufacturer shall have a representative on site to supervise the fusion welding process for a minimum of 10 joints. Joints and welding procedures utilized by the Contractor shall be approved by the pipe manufacturer's representative and written certification of that approval shall be provided to the Owner before continuing fabrication.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Society of Testing and Materials (ASTM).

ASTM D-2837	Specification for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D-3035	Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside
ASTM D-3261	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Pipe and Tubing
ASTM D-3350	Specification for Plastics for Pipe and Fittings
ASTM F-593	Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
ASTM F-594	Specification for Stainless Steel Nuts

2.2 American Water Works Association (AWWA).

AWWA C-104	Cement-Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water
AWWA C-105	Polyethylene Encasement for Gray and Ductile Cast Iron Pipe for Water and Other Liquids
AWWA C-110	Gray Iron and Ductile Iron Fittings, 3-In. through 48-In. for Water and Other Liquids
AWWA C-111	Rubber-Gasket Joints for Ductile Iron and Gray Iron Pipe and Fittings
AWWA C-115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
AWWA C-151	Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water and Other Liquids

AWWA C-153	Ductile Iron Compact Fittings, 3 In. through 24 In. through 64 In. for Water
AWWA C-906	Polyethylene (PE) Pressure Pipe and Fittings 4-In. Through 63 Inch, For Water Transmission and Distribution

3. MATERIAL.

3.1 Polyethylene Pipe for Compressed Air Piping. Polyethylene plastic pipe for compressed air pipelines shall be extruded thermoplastic pipe conforming in all respects to ASTM D-3035, DR 13.5, IPS size with a 256 psi pressure rating. Pipe material having a hydrostatic design basis of 1600 psi as defined by ASTM D 2837 and meet or exceed cell class PE 3408 requirements defined in ASTM D 3350. All pipe shall be homogenous throughout and free from cuts, cracks, holes, blisters, voids, foreign inclusions or other injurious defects visible to the naked eye or that may affect wall integrity. The pipe shall be as uniform as practicable in color, opacity, lengths, minimum density and other physical properties. The pipe shall be furnished in standard 50 feet or greater lengths. The pipe joints shall be thermal butt fusion welded.

3.1.1 Polyethylene Pipe Fittings. Polyethylene pipe fittings for compressed air pipelines shall be of the same material as the pipe and have the same or greater wall thickness and pressure ratings. Fittings shall be butt heat fusion type and shall conform to the requirements of ASTM D 3261.

3.2 High Density Polyethylene Pipe for Water Piping. High density polyethylene plastic pipe for water pipelines shall be extruded thermoplastic pipe conforming in all respects to AWWA C-906, DR 17, IPS size with a minimum working pressure rating of 100 psi. Pipe material shall have a minimum hydrostatic design basis of 1600 psi as defined by ASTM D 2837 and meet or exceed cell class PE 3408 requirements defined in ASTM D3350. Pipe shall be homogenous throughout and free from cuts, cracks, holes, blisters, voids, foreign inclusions or other injurious defects visible to the naked eye or that may affect wall integrity. The pipe shall be as uniform as practicable in color, opacity, density and other physical properties. The pipe shall be furnished in standard lengths of 50 feet. The pipe joints shall be thermal butt fusion welded.

3.2.1 Joints. Joints between polyethylene pipe segments shall be butt heat fusion welded in accordance with the requirements of AWWA C-906. Joints connecting polyethylene pipe to ductile iron pipe shall be flanged. A ductile iron or Type 304 stainless steel back up flange shall be slipped on the pipe and a polyethylene stub end flanged adapter shall be butt fusion welded to the polyethylene pipe. The ductile iron flange shall meet the requirements of AWWA C-115 with a minimum thickness of specified in that standard and ANSI B16.1, Class 125 drilling. Solid thickness flanges are required. Hollow back flanges are not acceptable. Bolts and nuts for flanged connections shall be stainless steel, Type 303, 304, or 305 conforming to ASTM F-594 and have

the diameter specified in AWWA C-115 for the respective size. Flange gaskets shall be full face synthetic rubber gaskets, minimum 1/8 inch thickness

Stainless steel bolts and nuts shall be assembled utilizing anti-seize lubricants equal to John Crane "Thread Gard Nickel", Never-Seez "Pure Nickel Special", or Permatex "Nickel Anti-Seize Lubricant". Dielectric sleeves and pads shall be placed between the stainless steel bolts and nuts and ductile iron flanges such that there is no metal to metal contact. Dielectric material can be synthetic rubber, 30 mil Hypalon, or equal approved material.

3.3 Type 1 Restrained Joint Ductile Iron Pipe. Type 1 restrained joint ductile iron pipe shall conform to the requirements of AWWA C-151, minimum Class 56 with boltless ball and socket joints equal to Ball Joint Pipe as manufactured by American Cast Iron Co., USIFLEX Pipe as manufactured by U.S. Pipe Co., or Snap Lok River Crossing Pipe as manufactured by Griffin Pipe Co. Joints utilizing bolts as part of the permanent locking system are not acceptable. Joints shall permit a maximum deflection of 15 degrees without leakage. Joints shall also permit a safe end pull of 100 tons. Pipe interior shall be cement mortar lined in accordance with AWWA C-104. Joints shall be push on with rubber gaskets conforming to AWWA C-111 unless otherwise specified.

3.4 Type 2 Restrained Joint Ductile Iron Pipe. Type 2 restrained joint ductile iron pipe shall conform to the requirements of AWWA C-151, Class 52 with locking ring joints equal to Flex-Ring joints as manufactured by American Cast Iron Co., TR Flex as manufactured by U.S. Pipe Co., or Snap Lok FC joints as manufactured by Griffin Pipe Co. Joints utilizing bolts as part of the permanent locking system are not acceptable. Pipe interior shall be cement mortar lined in accordance with AWWA C-104. Joints shall be push on with rubber gaskets conforming to AWWA C-111 unless otherwise specified.

3.5 Type 3 Restrained Joint Ductile Iron Pipe. Type 3 restrained joint ductile iron pipe shall conform to the requirements of AWWA C-151, Class 52 with locking type gasket joints equal to Fast-Grip gasket joints as manufactured by American Cast Iron Co., Field-Lok gaskets as manufactured by U.S. Pipe Co. and by Griffin Pipe Co. Joints utilizing bolts as part of the permanent locking system are not acceptable. Pipe interior shall be cement mortar lined in accordance with AWWA C-104. Joints shall be push on with rubber gaskets conforming to AWWA C-111 unless otherwise specified.

3.6 Flanged Ductile Iron. All flanged ductile iron pipe shall conform to the requirements of AWWA C-115, Class 53. Pipe interior shall be cement mortar lined in accordance with AWWA C-104. Gaskets shall be full face rubber gaskets. Bolts shall be stainless steel, Type 304 conforming to ASTM 594 with a diameter and length as specified in AWWA C-115. Anti-seize compound such as Nickel Anti-Seize Lubricant shall be utilized on all bolts and nuts.

3.7 Cast and Ductile Iron Fittings. Cast iron fittings shall conform to the materials and dimension requirements of AWWA C-110 with a 250 psi rating or shall be ductile iron conforming to AWWA

C-153 rated at 350 psi. The fittings shall have cement lining conforming to AWWA C-104. Fittings shall have push-on joints unless otherwise specified on the drawings. Special fittings for piping under the structure shall have Mega-Lug returning glands.

3.8 Sanitary System and Floor Drain Piping. Not used.

3.9 Polyethylene Encasement. Polyethylene encasement shall conform to the requirements of AWWA C-105.

3.10 Concrete. Portland cement concrete shall conform to the requirements of the section for Portland Cement Concrete and the section for Placing and Finishing Concrete.

3.11 Flexible or Sleeve Couplings. Flexible or sleeve couplings shall have ductile iron sleeves and ductile iron followers on all pipe sizes 16 inches in diameter and smaller and shall be equal to Smith Blair 441. Transition or adapter type couplings shall be used as required. Couplings above ground shall have low alloy steel bolts. Underground couplings shall have stainless steel bolts.

4. CONSTRUCTION.

4.1 Trench Excavation and Backfill for Pipelines. Trench excavation and backfill shall include all excavation, backfilling, disposal of surplus and unsuitable material, and all other work incidental to the construction of trenches. Excavation required for valves, fittings, thrust blocks, or other structures forming a part of the pipeline system shall be classified as "Trench Excavation".

Work performed under this section shall be in conformance with construction specifications for Section 02201, "Trench Excavation and Backfill for Pipelines and Appurtenant Structures".

Where water is encountered in the trench, it shall be removed as specified and maintained until the ends of the pipe are sealed and provisions are made to prevent floating of the pipe. Trench water shall not be allowed to enter the pipe at any time.

4.2 Underground Pipe Installation.

4.2.1 General. Pipe shall be installed in accordance with the manufacturer's recommendations and instructions. The Contractor shall provide all tools and equipment including any special tools designed for installing of pipe. Water lines shall have a minimum cover of 7.0 feet unless specific elevations are given on the drawings. The pipe shall be laid on a straight uniform grade between elevation points as noted on the drawings.

4.2.2 Handling of Pipe. All pipe shall be delivered and distributed at the site by the Contractor. Pipe, fittings, specials, valves and accessories shall be loaded and unloaded in a manner to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe shall not be

skidded or rolled against pipe already on the ground. Pipe shall be handled in a manner to prevent damage to the coating and lining. Pipe which is damaged shall be rejected.

4.2.3 Laying of Pipe. Before installation, the pipe shall be inspected for defects. Bare cables, chains, hooks or metal bars shall not be permitted to come in contact with the pipe. If belt slings are used for lowering the pipe into the trench, care shall be taken, when the slings are removed to prevent damage to the pipe or coatings. Prior to placing in the ground or in the lake all ductile iron pipe, except Type 1 restrained joint pipe and ductile or cast iron fittings shall be wrapped in a double layer of polyethylene encasement to provide a complete covering over the entire length of the pipe or fittings. The covering shall be free of holes or openings. No metal shall be allowed to touch the soil. The encasement shall overlap and be secured in place.

Polyethylene pipe shall be carefully bedded in Type I-A pipe bedding material and ductile iron pipe shall be carefully bedded in Type 1-A or Type 1-B bedding material at the Contractor's option. The prepared foundation shall be shaped to conform to the lower quadrant of the pipe. Bell or coupling holes shall be carefully formed so as to not destroy more than 9 inches of pipe bearing. The trench bottom shall be over-excavated 4 inches and brought to grade with bedding materials. Type I –A or 1-B bedding materials shall be installed the full width of the trench to a depth of 4 inches under and up to the midpoint of the pipe for ductile iron pipe – or 12 inches above the pipe as shown on the drawings for polyethylene pipe. Trench bedding and backfill shall be placed in layers and each layer shall be wetted and compacted to the density specified in Section 02201.

The first and second layers shall be compacted on each side of the pipe in a manner that will avoid shifting or displacing the pipe. The third layers, and remaining layers, shall be tamped uniformly across the full width of the backfill.

All pipe shall be laid and maintained to the required lines and grades shown on the drawings or at such depth as is required in order to connect the new pipe to the existing mains. Fittings and valves shall be placed at locations required with the centerlines conforming to the pipe centerline and valve stems set plumb. The minimum cover over the top of the pipe shall be 7 feet unless noted otherwise on the drawings.

Wherever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the plan is required, the Engineer shall have the authority to change the plans and order a deviation from the line and grade. Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings and valves shall be carefully lowered in the trench in a manner to prevent damage to pipe. Under no circumstances shall materials be dropped or dumped in the trench.

Precaution shall be taken to prevent foreign material from entering the pipe while it is being placed. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means to ensure absolute cleanliness inside the pipe.

Long radius curves, either horizontal or vertical, may be laid by pipe deflections at the joints. If the pipe is shown curved on the plans and no special fittings are shown, the Contractor can assume the curves can be made by deflection of the joints with standard length of pipe. If shorter lengths are required, the plan will indicate maximum lengths that can be used.

Where field conditions require deflection or curves not anticipated by the plans, the Engineer will determine the methods to be used. No additional payment will be made for laying pipe on curves as shown on the plans, nor for field changes involving standard lengths of pipe deflected at the joints.

Maximum deflection at pipe joints shall not exceed the applicable material and joint specifications of AWWA nor shall they exceed the recommendations of the pipe manufacturer. When rubber gasketed pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. Trenches shall be made wide on curves for this purpose.

Concrete reaction or thrust blocking shall be applied at all tees, plugs, valves, reducers, caps and at bends deflecting 11-1/4 degrees or more. Reaction blocks shall be concrete having a compressive strength of not less than 3,000 pounds per square inch at 28 days. Blocking shall be placed between solid ground and the fitting. The area of bearing on the pipe and on the ground shall be as shown on the drawings. The blocking shall be so placed that the pipe and fitting joints will be accessible for repair. All fittings shall be wrapped in polyethylene.

The cutting of pipe for installation of valves, fittings or closure pieces shall be done in a neat and workmanlike manner with standard pipe cutting tools without damage to the pipe and providing a smooth end at right angles to the axis of the pipe.

4.2.4 Setting Fittings and Valves. Fittings and valves shall be installed at required locations and as detailed on the drawings. Concrete supports are required for all valve installations. Cast iron valve boxes shall be firmly supported, centered, and set plumb over the wrench nut of the valve, with the box cover flush with the surface of the existing ground or pavement. The fittings, valve and valve box shall be wrapped with polyethylene.

4.3 Under Water Pipe Installation

Pipe installed under water in the lake shall be Type 1 restrained joint ductile iron pipe or thermal butt fusion welded polyethylene pipe. The pipe shall be installed true to the line, grade, and elevations indicated on the drawings. Trenching is required beneath the lake to install the pipe. In order to prevent air from being trapped in pockets in the pipe, the pipe shall not be allowed to undulate up and down. Maximum undulation permitted is 0.2 feet plus or minus from the grade shown on the drawings. The Contractor may elect to install the pipe with a single sag as shown on the drawings in order to maintain a positive grade in either direction from the bottom of the sag. This method is an acceptable alternative potentially easier method of installing the pipe without undulations.

In general, bedding material is not required for pipe installation where Type 1 restrained joint pipe is indicated on the drawings. Type 3 bedding can be utilized to help maintain grade and prevent undulations if the Contractor chooses to do so.

The Contractor is solely responsible for selecting the means and methods of pipe installation. Concrete anchors must be installed on polyethylene water and air pipelines at intervals indicated on the drawings. Anchors shall be as detailed on the drawings. Concrete shall conform with the requirements of Sections 02810 and 02811. Bolted connections for the weights shall be Type 304 stainless steel. Anti-seize thread compound will be utilized on all stainless steel bolted connections.

Ductile iron pipe does not require permanent weights, but the pipe may float unless filled with water. Polyethylene wrap is not required on Type 1 restrained joint ductile iron pipe. The iron pipe can be pulled into place. A concrete weight is required on the ductile iron pipe at the intake screen as shown on the drawings.

Trenching in the lake below the low water lake level underwater can be done in coffer dams in dry condition or by dredging without dewatering at the Contractor's option. The finished pipe installation, however, must not undulate up and down and it must not be above the elevations shown on the drawings. Soil removed by trenching or dredging cannot be discharged directly back to the lake. The soil/water mixture may be transported to the dry exposed lake bed and stock piled in a contained area for dewatering. Temporary berms around the contained area are required to prevent water from running directly back into the lake from the soil pile. Once the drainage water meets discharge permit requirements it can be discharged back to the lake. The dewatered stockpile can then be spread out on the existing exposed bottom to a depth not to exceed 6 inches.

4.4 Pipe Jointing.

4.4.1 Rubber Gasket "Push-on" Joints. Jointing of pipe, valves and fittings with a rubber gasket "push-on" joint shall be as recommended by the manufacturer. The rubber gasket and gasket seat inside the bell shall be wiped clean with a cloth. A thin film of lubricant, furnished by the manufacturer shall be applied to the inside surface of the gasket. The plain end of the adjoining pipe shall be wiped clean and inserted into the bell a sufficient distance to make contact with the gasket. The plain end shall then be forced "home" by the use of a wood blocking, crow bar, fork tool, or jack assembly so that no metal comes in contact with the pipe. Gaskets and pipe shall be heated if necessary as recommended by the manufacturer to assemble joints properly.

4.4.2 Restrained Joint Pipe. Restrained joint pipe systems shall be assembled in strict accordance with the manufacturer's instructions. Gaskets and pipe shall be heated if necessary as recommended by the manufacturer to assemble joints properly.

4.4.3 Polyethylene Pipe. Polyethylene pipe shall be thermal butt fusion welded in strict compliance with the instructions of the pipe manufacturer. Personnel doing the fusion work and equipment utilized shall meet all of the qualification requirements specified in Paragraph 1.4 and pipe manufacturer requirements. Heating facilities will be provided as necessary to bring the pipe to the proper temperature before beginning the thermal fusion process.

4.5 Testing.

4.5.1 Pressure System Hydrostatic Tests. Both the new water intake line and the compressed air supply line shall be flushed and pressure tested. The intake water pipe and the air pipe shall be subjected to hydrostatic pressure tests of 50 psi. The duration of the test shall be at least two hours. The pressure shall not vary by more than 5 psi±. Before applying the specified test pressure, all air shall be expelled from the pipe by flushing with water
In order, to conduct a test, the contractor shall install a temporary flange on the intake screen end of the pipe and temporary plugs at the pump well casing connections.

A leakage test shall be conducted concurrent to the pressure test. The Contractor shall furnish the pump, pipe, connections and all other necessary apparatus, and shall furnish all necessary assistance to conduct the test. The duration of each leakage test shall be two hours, and during the test, the main shall be subjected to a pressure as specified above.

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified test pressure after the pipe has been filled with water.

No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

in which L equals the allowable leakage in gallons per hour; S is the length of pipe tested in feet; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

Pipe leakage shall not exceed the applicable limit listed in the following table:

ALLOWABLE LEAKAGE PER 1000 FEET OF PIPELINE
(gallons per hour)

Avg. Test Pressure psi (Bar)	Nominal Pipe Diameter-in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
300 (21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275 (19)	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250 (17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225 (16)	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200 (14)	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175 (12)	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150 (10)	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125 (9)	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100 (7)	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

If testing against a gate valve, the gate valve shall not leak and no leakage allowance will be made for the valve.

All exposed pipes, fittings, valves and joints will be carefully examined. Any cracked or defective pipes, fittings, and valves discovered in the course of this test shall be removed and replaced by the Contractor, at his expense with sound material and the test shall be repeated until satisfactory.

Should any test of pipe laid disclose leakage greater than that specified above, the Contractor shall, at his own expense, locate and repair the defects until the leakage is within the specified allowance.

The Contractor may use an air compressor to develop the required test pressure after it is assured that the pipe line being tested is completely filled with water.

4.6 Cleaning.

4.6.1 Cleaning Pipelines. All pipelines shall be flushed thoroughly after the pressure test and leakage test are completed.

Flushing is only intended to remove lighter solids and cannot be relied upon to remove heavy material such as rocks allowed to get into the main during laying. Heavier material must be physically removed prior to flushing. The flushing velocity in the pipeline shall not be less than 2.5 feet per second. The Contractor shall provide all pumps and piping necessary to flush the lines. Temporary pumps shall be installed in the pump casings and pump water from the screen through the pipeline to the pumps and then discharge back to the lake. Temporary discharge piping shall be provided as necessary to discharge the water back to the lake. The Contractor shall install all necessary piping and fittings necessary to supply water to the pipelines being flushed and transport the water safely away to avoid damage to structures or erosion of the land surface.

4.7 Cleanup. As work progresses, that portion of the work completed shall be cleared of debris and brought to finished grade as specified in Paragraph 4.4, Cleanup of Section 02201.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 2 - SITE WORK
SECTION 02671
RESILIENT-SEATED GATE VALVES

1. GENERAL.

This section of the specifications covers resilient-seated gate valves, together with related appurtenances. Resilient seated gate valves shall be utilized on underground water lines 4 inches to 16 inches in diameter.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Water Works Association (AWWA).

AWWA C-105	Polyethylene Encasement for Gray and Ductile Iron for Water and Other Liquids
AWWA C-509	Resilient-Seated Gate Valves 3-In. through 48-In. for Water and Sewage Systems

3. MATERIALS.

3.1 Resilient-Seated Gate Valves and Boxes. Resilient-seated gate valves shall meet or exceed the requirements of AWWA C-509. They shall be of the non-rising stem pattern and shall offer no resistance to the flow of water when open. All ferrous metal internal surfaces shall have an epoxy or polymer coating. The valves shall have external breakoff capability and a positive mechanical stop to prevent over-compression of the seat material. The disc or disc logs shall travel in machined guides on either side of the valve body to prevent excessive vibration or displacement of the disc either in the upstream or downstream direction due to high velocities and pressure differentials across the disc as the disc closes. They shall be designed for 200 psi water working pressure and tested to 400 psi pressure on one side of the valve and zero pressure on the other side. They shall open by turning to the left, or counterclockwise. A two inch square operating nut shall be provided on the main stem. Main line valves shall be hub end. Bolts for flanged connections and mechanical joint connections, where permitted, shall be stainless steel.

A cast iron valve box and cover shall be furnished and set with each valve. The adjustable valve boxes shall be of the screw type. They shall have not less than 5-1/4 inches inside diameter. The

cover shall be of the deep socket bolt down type with a locking lid utilizing a five point bolt and shall be marked "WATER". Valve box bases shall be a No. 6 Oval for up to 8 inch valves and No. 160 Oval for larger than 8 inch.

3.2 Polyethylene Wrap. Polyethylene encasement shall conform to the requirements of AWWA C-105. Flat sheets shall be furnished for wrapping all valves and valve boxes.

3.3 Concrete. Portland cement concrete shall conform to the requirements of the sections for Portland Cement Concrete and Placing and Finishing Concrete.

4. CONSTRUCTION.

4.1 Excavation. Trench excavation and backfill shall conform to the requirements of Section 02201, Trench Excavation and Backfill for Pipelines and Appurtenant Structures. Type of excavation and backfill shall be the same as required for water main construction as shown on the drawings.

4.2 Gate Valves and Valve Boxes Installation. Gate valves shall be set and jointed to the pipe in the manner specified for pipe laying and jointing. Valves shall be set with operating stem vertical. Valve boxes shall be centered and plumb over the operating nut and shall be set so that no shock or stress will be transmitted to the valve. Tops of valve boxes shall be set flush with the concrete slab that shall be poured around the valve box top.

All valves shall be installed with thrust or support blocks and anchor rods as detailed on the plans.

4.3 Polyethylene Wrap. Polyethylene encasement shall be used on all valves and valve boxes below the ground surface.

4.4 Restoration, Finishing and Cleanup. The Contractor shall restore and/or place all paved surfaces, curbing, sidewalks, or other disturbed surfaces to their original condition in such manner as to meet the requirements of applicable sections. All surplus material and temporary structures, as well as all excess excavation shall be removed and the entire site of Contractor operations shall be left in a neat and clean condition.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 2 - SITE WORK
SECTION 02810
PORTLAND CEMENT CONCRETE
(PAVING AND UTILITY IMPROVEMENTS)

1. GENERAL.

Portland cement concrete shall be composed of portland cement, Type II or IIA, water, fine aggregate and coarse aggregate. All concrete shall be air-entrained.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Association of State Highway and Transportation Officials (AASHTO).

AASHTO T-26	Quality of Water to be Used in Concrete

2.2 American Society of Testing and Materials (ASTM).

ASTM C-33	Specification for Concrete Aggregates
ASTM C-39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C-94	Specification for Ready-Mixed Concrete
ASTM C-143	Test Method for Slump of Portland Cement Concrete
ASTM C-150	Specification for Portland Cement
ASTM C-231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

3. CONCRETE MATERIALS.

3.1 Cement.

3.1.1 Regular Portland Cement. Regular portland cement shall conform to all the requirements of ASTM C-150 for Type II.

3.1.2 Air-Entraining Portland Cement. Air-entraining portland cement shall conform to all the requirements of ASTM C-150 for Type IIA.

3.2 Concrete Aggregate. Concrete aggregate shall conform to the ASTM C-33. The maximum size of the aggregate shall be ¾-inch for curb and gutter, driveway, aprons, sidewalks, raised islands and retaining wall, and 1½-inch for other work.

3.3 Water for Concrete. The water shall be free from objectionable amounts of oil, acid, alkali, organic matter or other deleterious materials and shall not be used until the source of supply has been approved. If at any time the water from an approved source becomes an unsatisfactory quality or insufficient quantity, the Contractor will be required to provide satisfactory water from another source

The quality of the mixing water may be determined by AASHTO T-26.

When comparative tests are made of the water proposed for use with water of known satisfactory quality by making standard soundness, time of set and 1:3 mortar strength tests, any indication of unsoundness, marked change in time of set, or a reduction of more than 10% in mortar strength, shall be sufficient cause for rejection of the water under test.

3.4 Air-Entraining Admixture. The Contractor may elect to use a regular portland cement type with the addition of an air-entraining admixture. Air-entraining admixtures to be used with Type II cement shall be Darex AEA, Neutralized Vinsol Resin Portex or equal. The air-entraining characteristics of the admixture shall be such that the resulting concrete will have a satisfactory workability and the total air content shall be three percent to six percent. The air content of the concrete shall be determined by ASTM Specification C-231 or by an air meter.

4. MIXTURE PREPARATION.

4.1 Testing of Materials. All tests which are necessary to determine compliance of the concrete materials with these specifications will be performed by a qualified testing laboratory, and paid for by the Contractor.

Cement may be accepted on the basis of mill tests and the manufacturer's certification of compliance with the specifications provided the cement is the product of a mill with a record for production of high quality cement. Certificates of compliance shall be furnished the Engineer by the Contractor for each lot of cement furnished prior to use of ready-mixed, or transit-mixed concrete. Cement proposed for use where no certificate of compliance is furnished or where the cement furnished under the certificate of compliance may have become damaged in transit, or deteriorated because of age or improper storage, will be sampled at the mixing site and tested for conformance to the specifications.

Cement will be approved for use if it satisfactorily passes the fineness, soundness and time of set test requirements specified, provided the general run of materials has been satisfactorily meeting the 7 and 28 day strength requirements. Any approved cement failing to pass the 7 and 28 day strength requirements shall be rejected. Other lots of shipments from the same mill may be held for the results of tests before being used.

If cement is supplied from a new source or from a source of unknown quality, it may be held for the results of a strength test before being approved.

4.2 Storage of Materials. Cement and aggregates shall be stored at the site in such a manner as to prevent deterioration of intrusion of foreign matter. Any material which has deteriorated or which has been damaged shall not be used for concrete.

4.3 Concrete Mixture Requirements. The concrete shall meet the following requirements:

TABLE OF REQUIREMENTS

PROPERTY		MIN.	MAX
Cement Factor (Sacks per Cu. Yd.)			
Class A Installation *		6.5	---
Class B Installation **		5.5	---
Water-Cement Ratio (Gal. per sack)		---	6.0
Entrained Air (Percent)		3.0	6.0
Slump (inches)		1	4
Maximum size of aggregate			¾"
Minimum Compressive Strength			
Class A Installation *	7 day (psi)	2000	
	28 day (psi)	3500	
Class B Installation **	7 day (psi)	1800	
	28 day (psi)	3000	

* Class A Installation: Construction of sidewalks, curb and gutter, alley aprons, inlet aprons, valley gutters, structural members and other items as noted on the drawings.

** Class B Installation: Construction of manhole bases, thrust blocks and miscellaneous work as noted on the drawings.

If it is found impossible to produce concrete having the required air content with the materials and mixing procedures that are being used, the Contractor shall make such changes in the materials or mixing procedures, or both, as may be necessary to insure full compliance with the requirements of air content in concrete.

The total weight of aggregates per sack of cement and the relative proportions of coarse and fine aggregates shall be determined by yield tests made during the progress of the work.

Any combination of aggregates which requires the use of more than six gallons of water per sack of cement to produce a workable mixture with the brand of cement used, will be considered as being unsatisfactory and all such combinations of aggregates will be rejected.

Coarse aggregate having moisture absorption of more than 1.0 percent (as computed from over-dry to saturated surface-dry basis) shall be saturated with water before it is used. The wetting shall be performed sufficiently in advance to permit complete filling of the open pores of the particles of aggregate.

Concrete shall be uniformly plastic, cohesive, and workable. Workable concrete is defined as concrete which can be placed without honeycomb and without voids in the surface. Workability shall be obtained without producing a condition such that free water appears on the surface when finished. The consistency of the mixture shall be that required for the specific conditions and methods of placement; however, the previously determined maximum water-cement ratio shall not be exceeded.

The Contractor shall provide a concrete mixture design that complies with these specifications. Modifications will be made in the material proportions as are necessary to provide satisfactory concrete. The properties of the concrete will be determined according to ASTM C-231 for air content, ASTM C-39 for compressive strength and ASTM C-143 for slump.

4.4 Proportioning of Materials. All materials shall be separately and accurately measured by weight and each batch shall be uniform. The coarse and fine aggregates shall be weighed separately. A sack of cement shall weigh 94 pounds. When bulk cement is used, 94 pounds shall be considered as one sack. The Contractor shall furnish and use weighing devices which will supply the exact quantity of materials for the class of concrete. The method of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked at any time during the work. Measurement of materials for ready-mixed concrete shall conform to ASTM C-94. The cement shall not remain in contact with the aggregate more than forty-five (45) minutes before being deposited into the mixer.

4.5 Mixing Concrete.

4.5.1 Consistency. The quantity of water to be used shall not be varied. The Contractor shall furnish and use with the mixer an adjustable water measuring device which will prevent excess water flowing into the mixer, in order that all batches may be of the same consistency.

In general, the minimum amount of water shall be used which will produce the required workability. The mortar shall cling to the coarse aggregate and shall show no free water when removed from the mixer.

4.5.2 Mixing. The mixing machine used shall be of a type known as a batch mixer, and of a design having a device attached for automatically measuring the proper amount of water accurately to one percent and for automatically timing each batch of concrete so that all materials will be easily regulated and controlled to meet the variable conditions encountered. If the timing device becomes broken or fails to operate, the Contractor will be permitted to continue the balance of the day without the timing device, while the device is being repaired, provided that each batch of concrete is mixed for two minutes.

The mixing time for each batch shall be one minute, and the measuring of this period shall begin after all the materials are in the drum. During this mixing period, the drum shall revolve at the speed for which the mixer is designed, but shall make not less than 14 nor more than 20 revolutions per minute.

No materials for a batch of concrete shall be placed in the drum of the mixer until all of the previous batch has been discharged therefrom. The discharge of water into the drum shall commence with the flow of the aggregates, but shall not be started before the entrance into the drum of part of the aggregates. The discharge of all the mixing water for any batch shall be completed within ten seconds after all of the aggregates are in the drum. The inside of the drum shall be kept free from hardened concrete.

Ready-mixed concrete from a central mixing plant delivered at the work ready for use, will be permitted provided the mixture is transported to the job site in an agitating truck having the concrete contained in a revolving drum and provided there is no segregation of the mixture at the point of placing. Ready-mixed concrete from a central batching plant and mixed in transit will be permitted. Any ready-mixed concrete shall comply with all of the requirements of these specifications. The concrete must be of workable consistency when placed. No mixer which has a capacity of less than a two-sack batch shall be used. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements set forth in ASTM C-94. Hand-mixing will not be permitted.

In the event that the Contractor elects to use an air-entraining admixture with Type 1 portland cement for air-entraining concrete, the mixture shall be equipped with a suitable automatic dispensing device which will proportion the air-entraining admixture accurately to each batch of concrete. The device shall be calibrated and adjusted to deliver to each batch of concrete the quality of admixture required to produce the specified air content of the concrete.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 2 - SITE WORK
SECTION 02811
PLACING AND FINISHING CONCRETE
(PAVING AND UTILITY IMPROVEMENTS)

1. GENERAL.

The placing and finishing of concrete for paving improvements, as described in this article, shall include all forming, placing, reinforcing, finishing and curing.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Association of State Highway and Transportation Officials (AASHTO).

AASHTO M-213	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
AASHTO T-141	Standard Method of Sampling Fresh Concrete

2.2 American Society of Testing and Materials (ASTM) Publications.

ASTM A-185	Welded Steel Wire Fabric for Concrete Reinforcement
ASTM A-615	Deformed Billet Steel Bar Reinforcement Grade 40
ASTM C-31	Method of Making and Curing Concrete Test Specimens in the Field
ASTM C-39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C-309	Specifications for Liquid Membrane- Forming Compounds for Curing Concrete

3. MATERIAL.

3.1 Concrete. Concrete for curbs, inlet aprons, alley aprons, valley gutter, sidewalks, and driveways shall conform to the requirements of Section 02810 for Portland Cement Concrete, Class A Installation. Concrete for manhole bases, inlet bases and minor structures shall conform to Class B Installation unless otherwise noted on the drawings.

3.2 Reinforcement Bars. Reinforcing bars shall conform to ASTM A-615.

3.3 Weld Wire Fabric (W.W.F.) Welded wire fabric shall be electrically welded wire fabric of cold-drawn wire of gauge and mesh size shown on the plans and shall conform to ASTM A-185.

3.4 Expansion Joint Material. Expansion joint material shall be preformed from strips of clean, suitable fibers securely bound together and then uniformly saturated with asphalts, conforming to AASHTO M-213, ½ inch thick.

3.5 Curing Compound. Curing compound shall conform to ASTM C-309, Type II.

4. CONSTRUCTION.

4.1 Equipment. Before curbing and other concrete placing operations are started, the Contractor shall have at the site and on the project, equipment necessary for proper placing, finishing and curing, and tools necessary for performing all parts of the work. The equipment shall be checked for mechanical condition, adjustment, design and shall have the capacity and mechanical condition capable to do the project within the timetable of the contract.

4.1.1 Forms. Side forms shall be metal unless otherwise specified. Metal forms shall be of sufficient weight and strength to resist the pressure of the concrete and of a design that can be rigidly held to proper line and grade.

Flexible or curved forms of proper radii shall be used for curves of one hundred feet radius or less. Side forms shall be heavy enough to support mechanical finishing machines, mechanical subgrader or similar heavy equipment. They shall be equipped with a device for holding abutting sections firmly in alignment, and shall permit adjustment for horizontal and vertical curves.

Forms shall have a depth at least equal to the prescribed edge thickness of the concrete. They shall be equipped with a minimum of three staking points for back forms and two staking points for front forms, for each ten feet of length with means of securely locking the form to each stake. Flange braces and staking pockets shall extend outward from the form and shall not be less than two thirds of the height of the form.

The use of wooden forms will not be permitted except by written approval for special cases. When used, side forms of wood shall conform to the requirements for steel forms as to line, grade and height.

4.1.2 Slip-Form Paver. A slip-form paver for curb and gutter construction may be used, in lieu of forms, provided the equipment is given prior approval subject to the following modifications:

1. The Contractor shall provide such equipment as required to prepare, finish, grade, and compact the subbase course as subgrade.

2. The slip-form paver shall be equipped with a vibrator and/or tamping bar extending over the full width of the surface.

4.2 Freezing Weather. No concrete work shall be done if the air temperature is below 40°F., or if the weather forecast predicts freezing weather before the final set of the concrete, unless special means of heating and protecting the work are used.

When the concrete is placed at temperatures lower than those described above, the aggregate and mixing water shall be heated to at least 80°F. before mixing and adequate measures shall be employed to protect the concrete from freezing for a period of 72 hours after it is poured.

Concrete slabs and curbing laid on the ground, or other similar concrete construction, may be protected against freezing by insulation with a thick layer of straw or other acceptable material. No concrete shall be poured against frozen ground.

The use of salt or other compounds to prevent concrete from freezing will not be permitted. Any work which has been injured by freezing shall be removed and replaced, at the Contractor's expense.

4.3 Field Test Specimen.

4.3.1 Sampling of Concrete. Samples of concrete for test specimens shall be taken in accordance with AASHTO T-141. The location in the work of the batch of concrete sampled shall be noted for further reference.

The sampling of concrete shall be in accordance with AASHTO T-141 and making and curing of cylinders in accordance with ASTM C-31.

4.3.2 Curing Specimen. Test specimens made to check the adequacy of the field mixture and materials used for testing the strength of the concrete shall be removed from the molds at the end of 24 hours and stored in a moist condition at a temperature within the range of 65°F. to 75°F. until the time of test. Specimens shall not be exposed to a stream of running water. If storage in water is desired, a saturated lime solution shall be used.

Test specimens for determining when a structure may be put into service, or for determining the adequacy of field curing and temperature control, shall be removed from the molds at the end of 24 hours and stored as near to the point of sampling as possible and shall receive, insofar as practicable, the same protection from the elements as is given to the portions of the structure which they represent. Field control specimens shall be protected from injury while on the job site. For 28 day tests, the specimens shall be sent to the laboratory not more than 7 days prior to the time of test. For other periods of test, the specimens shall be kept in the field for at least three-fourths of the test period. While in the laboratory, the specimens shall be kept at laboratory temperature until 24 to 48 hours before testing during which final period they shall be immersed in water or stored in a moist condition in such a manner that free water is maintained on the surface of the specimen at all times at laboratory temperature.

4.3.3 Cylinder Tests. Concrete test cylinders will be made by the Engineer. The Contractor shall provide cylinder molds and shall have the cylinders tested by an approved laboratory. The Contractor shall bear all costs of such testing. The Contractor shall be responsible for protecting the cylinders during field curing period. The Contractor will not be allowed to pour concrete until cylinder molds are provided to the Engineer.

The cylinder shall be tested in accordance with ASTM C-39.

Tests may be required for each day's run or according to the following schedule:

TOTAL CUBIC YARDS Concrete Placed	MINIMUM NUMBER OF TESTS 2 Cylinders Each
0 - 100	One for each 50 cu. yds.
100 - 1000	One for each 125 cu. yds.
1000 - 2000	One for each 175 cu. yds.
2000 - and over	One for each 250 cu. yds.

4.3.4 Compressive Strength Requirements. The compressive strength of specimen cylinders, made in the field from the various classes of concrete, shall be tested in accordance with ASTM C-39 as required in Section 02810.

4.4 Preparation of Subgrade, Subbase or Base Course. After the subgrade, subbase or base has been compacted in conformity with the requirements of the appropriate sections of these specifications, the subgrade, subbase or base course shall be trimmed, shaped and compacted to the lines, grades and cross-sections shown on the plans or staked by the Engineer, prior to setting the forms or placing of the curb with a slip from curb machine.

After the forms have been set and approved, the disturbed subgrade, subbase or base course shall be reshaped and recompacted by accepted rollers or compactors before the curb pouring operation commences.

The subgrade, subbase or base course shall be in a moist but not muddy condition at the time of placing the concrete. If required, it shall be wetted the previous night or not less than six hours previous to placing of concrete. If it subsequently becomes dry, the subgrade or foundation course shall be sprinkled, but the method of sprinkling shall not be such as will form mud or pools of water.

4.5 Form Setting. The forms shall show no variation greater than one-fourth (¼) inch from the true plane of the face or top of the forms. The forms shall be free from warp, bends, or kinks.

The subgrade, subbase, or the base course, under the forms, shall be hard and cut true to grade so that the form, when set upon it, will be firmly in contact for its entire length at the desired grade.

Any subbase or base course which, at the form line is found below the established grade shall be filled to grade with ½-inch minus uniformly graded gravel and thoroughly compacted to the specified density. Imperfections and variations above grade shall be corrected by compacting before or after the form is set. No settlement or springing of forms under finishing machines will be tolerated.

Conformity of the alignment and grade elevation of the forms with the alignment and grade elevation shown on the plans will be checked, and necessary corrections made by the Contractor immediately prior to placing the concrete. Where any form has been disturbed or any foundation course thereunder has become unstable, the form shall be reset and rechecked.

Forms shall be set not less than 400 feet in advance of the point where the concrete is being placed to insure proper construction and inspection of the foundation course. Forms shall remain in place at least four (4) hours minimum after the concrete has been placed against them. Forms shall be cleaned and oiled each time they are used. The Contractor shall exercise care in removing forms to avoid any damage to the concrete edges.

4.6 Placing Concrete.

4.6.1 Placing Concrete by Form Methods. The concrete shall be distributed to such depth above the grade that, when consolidated and finished, the thickness required by the drawings will be obtained at all points and the surface will not be below the grade specified for the finished surface.

Concrete shall be placed on a prepared subbase or base course, or subgrade, which has been approved. Concrete shall not be placed on a frozen base or subbase course, or subgrade. At all times during the placing of concrete, enough grading for one day's run of concrete shall have been prepared ahead of the pouring operation. No concrete shall be placed around manholes or other structures until they have been brought up to the required grade and alignment.

The concrete shall be deposited on the subbase or base course, or subgrade, in a manner requiring as little rehandling as possible. Concrete along the forms shall be consolidated by vibration. Vibrators attached to the rear of the spreader or operated by hand from outside the forms will be permitted. Care shall be taken to insure that the concrete is not excessively vibrated. Placing of concrete shall be continuous between transverse joints without the use of intermediate bulkheads.

Whenever it becomes necessary to stop pouring, a transverse construction joint shall be constructed as hereinafter specified.

Subbase and base material shall be placed under all sidewalks, driveways, inlet aprons, alley aprons, and valley gutters as shown on the drawings and construction standards.

4.7 Finish.

4.7.1 General. All exposed concrete surfaces, exclusive of any surfaces below the line of backfill and vertical sides of curbs and walks, will be given the following surface finish. Any concrete which has a honeycombed texture shall be rejected. Grout sealing shall not be permitted.

4.7.1.1 Exposed Form Surfaces. As soon as the concrete has set sufficiently to permit rubbing, the surface shall be thoroughly wetted with a brush and rubbed with a No. 16 carborundum stone, or an abrasive of equal quality, bringing the surface to a paste. The rubbing shall be continued sufficiently to remove all form marks and projections, producing a smooth dense surface without pits or irregularities. The material which has been ground to a paste shall be carefully spread or brushed uniformly over the entire rubbed surface and permitted to reset. The final finish shall be obtained by a thorough rubbing with a No. 30 carborundum stone or an abrasive of equal quality. The rubbing shall continue until the entire surface has a smooth texture and is uniform in color.

4.8 Curing. Fresh concrete shall be adequately protected from heavy rains and mechanical injury. Rapid evaporation of water, with resultant drying out of surfaces, shall be prevented. The curing process shall be commenced as soon after pouring of the concrete as can be done without injury to the concrete surface. Where ponding or spraying methods of curing are used, the exposed concrete surfaces shall be protected with wet burlap until the concrete surface has set sufficiently to prevent damage from the direct application of water. The burlap shall be applied as soon after the placing of concrete as possible without marring the surface of the concrete. All concrete shall be kept wet for a period of seven days by ponding with water, application of a water-saturated covering or by other approved methods which will keep all surfaces continuously wet. Wood forms left in place during curing shall be kept wet.

The use of impervious membrane coatings for curing of concrete curb, aprons, and similar exposed surfaces will be permitted, but membrane coatings shall not be used on surfaces where discoloration

is objectionable on surfaces which are to be painted, or on concrete base which is to be overlaid with an asphaltic surface course.

The Contractor shall be held responsible for the adequate curing of all concrete during the entire curing period. Concrete, which shows conclusive evidence of improper and inadequate curing, may be rejected.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 2 - SITE WORK
SECTION 02893
INTAKE SCREEN

1. GENERAL.

Intake screen construction includes the installation of the intake screen and related supports in the lake.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Society for Testing and Materials (ASTM)

ASTM A-276	Specification for Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A-167	Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip

2.2 American Water Works Association (AWWA).

AWWA C-207	Steel Pipe Flanges for Waterworks Services – Sizes 4 In. Through 144 In.

3. MATERIALS.

3.1 Intake Screen One intake screen shall be furnished and installed. The intake screen shall be of all stainless steel construction and shall be a US Filter T-24 tee type intake screen with flanged connection for connection to the 3” HDPE air line. The screen shall include internal components of the Air-Burst cleaning system. The screen shall be suitable for mounting in the lake as shown on the drawings.

3.1.1 Size and Flow Rating. The screen assembly shall have a minimum flow rating of 3,000 gpm at a maximum water velocity through the slots of 0.5 feet per second. The corresponding average slot velocity shall be 90% or more of the maximum velocity. At this flow the corresponding pressure drop through the screen shall not exceed 0.1 psi. Pressure drop through the entire screen assembly shall not exceed 1.0 feet of water at 3,000 gpm. Screen inflow velocity shall be determined using inviscid flow field modeling. The screen manufacturer shall provide information

verifying that they have performed physical tests using models of at least 1/6 scale to confirm the results of the mathematical model. All information shall be submitted with screen shop drawings.

3.1.2 Screen Strength. The screen shall be capable of withstanding a hydrostatic collapse pressure in excess of 15 psi. Design stress used for determining strength of assembly shall be no more than 90% of the published yield strength of the material used. Certification of strength shall be provided with the shop drawings prior to receiving approval. The screen shall be designed for mounting as shown on the drawings.

3.1.3 Screen Slot Size. The screen slot size shall be 0.125 inches. The slot size shall be controlled and continuously monitored during manufacture. Slot size tolerance shall be +/- 0.003 inches.

3.1.4 Construction. The screen inlet slots shall widen inwardly from the screen surface so as to minimize the chance of debris entrapment in the screen openings. All materials utilized in construction shall be stainless steel, Type 304 or Type 316, conforming to ASTM A-167 or A-276 as appropriate. The surface wire shall be Johnson Vee wire No. 69. Wire face width shall vary no more than +/- 0.001 inches. The surface wire, support beam and stiffener structure shall be an all welded matrix designed to provide the specified strength with minimal interference with the screen flow pattern. End plates and tee body shall be a minimum of 3/16 inch thick. All structural butt welds shall be full penetration. Structural fillet weld size shall be the thickness of the thinner component. The screen shall have at least one cone shaped end to act as a deflector for debris. The other end may be flat. Each screen shall be T-shaped with an 18 inch diameter flanged outlet. The flange on the outlet shall conform to AWWA C-207, minimum thickness is Class D, standard ANSI 150 lb. drilling. Flange thickness shall be designed for the loads imposed. The screen shall be structurally designed for mounting as shown on the drawings.

3.1.5 Cleaning System. Each screen shall be constructed with an internal air operated surface cleaning system equal to the Johnson Hydro-Burst internal system. The system shall utilize compressed air to remove debris from the screen surface. The screen shall be equipped with a 3 inch flanged outlet (150 lb. ANSI drilling) for air supply to the screen.

3.2 Stainless Steel Stabilizer System.. A stainless steel stability support system shall be fabricated as shown on the drawings. Structural shapes shall conform to ASTM A-276, Type 304 stainless steel and flat plates shall conform with ASTM A – 167, Type 304 stainless steel. Welding shall be done with suitable stainless rod.

4. GENERAL.

4.1 Inlet Screen. The inlet screen shall be installed as recommended by the manufacturer and shown on the drawings. The piping and screen shall be adequately supported as shown on the drawings with additional supports provided as necessary if recommended by the screen manufacturer. The air supply and water pipeline shall be connected with flanged connections.

If the screen is installed with divers, the divers shall be certified and qualified to do underwater flanged pipe assembly. The Contractor shall utilize extreme care to protect all workmen above and below water. Related OSHA safety regulations shall be rigorously followed.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 2 - SITE WORK
SECTION 02895
PUMP CASING FACILITY

1. GENERAL.

The pump casing facility construction includes the inner and outer pump casings, the pitless units, and related piping and appurtenances.

2. APPLICABLE PUBLICATIONS.

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

2.1 American Society for Testing and Materials (ASTM)

ASTM A-36	Specification for Structural Steel
ASTM A-53	Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless
ASTM A-276	Specification for Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A-167	Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip
ASTM F-593	Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
ASTM F-594	Specification for Stainless Steel Nuts

2.2 American Water Works Association.

AWWA C-206	Field Welding of Steel Water Pipe
AWWA C-207	Steel Pipe Flanges for Waterworks Service – Sizes 4 In. Through 144 In.

2.3 American Association of State Highway and Transportation Officials (AASHTO).

AASHTO T-180	Moisture-Density Relations of Soils Using a 10-ob. Rammer and an 18-In. Drop

3. MATERIALS.

3.1 Outer Pump Casing. The outer pump casing shall be 20.0 inch outside diameter black steel pipe, weight class XS (Schedule 30), with a wall thickness of 0.5 inches conforming with ASTM A-53. Bottom steel plate thickness shall be 0.5 inches thick. Top steel plate thickness shall be 1.0 inches. Plates shall conform with ASTM A-36.

3.2 Inner Pump Casing. The inner pump casing shall be 14.0 inch outside diameter black steel pipe, weight class Standard, Schedule 30, with a wall thickness of 0.375 inches conforming with ASTM A-53.

3.3 Flanged Inlet. The flanged inlet connection shall be fabricated with steel pipe and flanges. Flanges shall conform to AWWA C-207, Class E, minimum 1.375 inch thickness. Flanges shall be solid steel standard steel hub flanges. Hollow back flanges are not acceptable. Drilling shall conform with ANSI 16.5, Class 150. Pipe segment shall be 14 inch outside diameter black steel pipe, weight class XS, with a wall thickness of 0.5 inches conforming with ASTM A-53.

3.3.1 Flange Bolts and Gaskets. Bolts for flanged connections shall be stainless steel bolts, Type 303, 304, or 305 conforming with ASTM F-593 and ASTM F-594. Bolts shall be the diameter specified in AWWA C-207. Gaskets shall be synthetic rubber gaskets, full flange face, conforming with the requirements of AWWA C 207. Anti-seize lubricant such as Permatex “Nickel Anti-Seize Lubricant” or equal shall be used on all threaded bolts and nuts.

3.4 Pitless Units. The pitless unit shall be suitable for underground installation of submersible pumps and shall be equal to Baker Monitor Model Monitor PS for 14 inch wells as manufactured by the Baker Manufacturing Company, Evansville, Wisconsin. The units shall be designed for installation and bury depth as indicated on the drawings.

The unit shall have the following specifications:

1. Pitless unit to well casing connection - chamfered for weld connection

2. Pitless unit black steel upper case 0.375 inch wall – minimum 17¼ inch I.D. Iron body acceptable Provide corrosion resistant coating on steel case. The upper casing must provide a watertight connection from the discharge body to the well cap.

3. Discharge body minimum 14 inch I.D.

4. Hold-down mechanism and locator to lock spool into place, prevent uplift and turning during pump startup

5. Lift-out - 5 inch I.P.S. with lift-out bail

6. Lift-out bail - lift-out pipe and bail assembly designed for a 140,000 lb. load. Two adjustable hooks on lift out pipe shall hook into the side of the pitless case

7. Seal cap watertight with 2 inch and 1-inch F.I.P. tapping and vent on top

8. Screwed well vent with 24 mesh corrosion resistant screen - screw into 2-½ inch F.I.P. tapping on top of seal cap

9. Conduit tappings - 2 inch F.I.P. with sealed conduit connections

10. Depth tester block tappings - ¼ inch F.I.P.

11. Motor and control cable passage through discharge spool – 3½ - inch ±

12. Distance from ground surface to top of pitless case - 29 inches

13. Spool to drop pipe connection - 8 inch, threaded

15. Discharge connection - 8 inch, threaded FIP or flanged A.S.A. Std. 150 lb.

16. Bury Depth of 7 feet

Unit Component Materials:

1. Well Vent - cast iron - enamel finish

2. Cap - cast iron - enamel finish

3. Conduit box - steel - corrosion resistant coating

4. Conduit connector - cast iron

5. Hold-down and lift-out mechanism galvanized steel

6. Discharge body lead free galvanized cast iron

4. INSTALLATION

4.1 Exterior Casing The exterior casings shall be installed utilizing drilling methods for that portion of the casing below the inlet opening. Disturbance of the natural ground below this opening must be minimized. Open cut methods may be utilized above the inlet opening if desired. Open cut excavation absolutely cannot be utilized more than 4 inches below the inlet piping. A conductor pipe to hold the hole open while drilling will be utilized if necessary and then removed. The annular space between the casing and the earth shall be filled with clean sand. The space should not exceed 6 inches.

The casing shall be fabricated from a single continuous length of pipe without welding segments together. The exterior casing shall be set true and plumb to the elevations indicated on the drawing. Once each of the casings are set and secured in place, the inlet holes can be accurately located and field cut but must accurately match the 14 inch pipe inside diameter and be reasonably smooth and uniform. Opening edge shall be ground and beveled appropriately for welding as required by AWWA C-206. The casing shall be removed and replaced with a new casing if the hold is not properly cut. The inlet pipe connection shall then be welded to the casing with a full penetration continuous weld. The inlet pipe shall be cut to accurately and tightly fit the casing exterior wall prior to welding. No gaps greater than 0.02 inches will be permitted prior to welding. The completed weld shall be watertight and as strong as the original casing. The completed weld shall be coated with a coal tar epoxy. Welds on the top and bottom plates on the casing shall also be coated. Welds shall be in conformance with the requirements for AWWA C–206. Steel restraint clips and angles shall be welded to the casings and a concrete collar will be placed around the casings as shown on the drawings to prevent long term movement of the casings when backfilled.

4.2 Interior Casing. The interior casing shall be fabricated from a single continuous piece of pipe without welds. Guides shall be welded on the casing exterior as indicated on the drawings such that the casing is kept accurately centered inside the exterior casing and plumb. Holes shall be cut in the interior casing to the diameter, location, and number indicated on the drawings. The interior casing shall be slipped into the exterior casing and welded to the top support plate with a continuous full penetration weld. Welding shall be in conformance with the requirements of AWWA C-206. The top of the interior casing shall be properly beveled and prepared for welding to the pitless unit.

4.3 Pitless Units. Pitless units shall be installed as recommended by the manufacturer. The units shall be welded to the casing in conformance with requirements of AWWA C-206. If the pitless unit is furnished with a threaded discharge outlet, a suitable flanged by threaded steel pipe spool piece approximately 12 inches long shall be connected to the threaded opening. The spool

piece shall be Schedule 40 steel pipe conforming with ASTM A-53. Ductile iron fittings and piping shall then be connected to the discharge connection as shown on the drawings. All piping shall be properly bedded.

4.4 Excavation and Backfill. The excavation for the installation of the casings and piping shall be thoroughly dewatered to provide a safe and stable work area. The water table shall be drawn at least 2 feet below the bottom work area. Shoring and bracing shall be installed to insure worker safety. Pipes shall be bedded and backfilled as specified in Section 02201. All backfill shall be compacted to a minimum of 90% of the maximum dry density as determined by AASHTO T-180. All backfill on the discharge piping side of the casings shall be Type 1-A bedding material as defined in Section 02201 from the original ground surface at the bottom of the excavation to a point 6 inches above the discharge piping. Type 2 bedding can be utilized in place of Type 1 from the bottom of the excavation to 4 inches below the discharge pipe. Backfill shall be done in maximum 6 inch lifts and compacted to 90% of the maximum dry density as defined by AASHTO T-180. No rocks, clumps, or frozen material shall be included in the backfill.

END OF SECTION

CONSTRUCTION SPECIFICATIONS

DIVISION 2 - SITE WORK
SECTION 02910
SEEDING AND FERTILIZING

1. GENERAL.

The work described in this section shall consist of providing all labor, services, fertilizer, seed and equipment to seed, fertilize and establish grasses as per these specifications.

The Contractor shall be or shall employ an expert plantsman who will be present during all seeding operations and direct the work.

All areas disturbed prior to and during trenching and construction operations (excluding the lake bed below high water level) shall be topsoiled and seeded to native grass. The Contractor shall be responsible for estimating prior to bidding the amount of area to be seeded.

2. APPLICABLE PUBLICATIONS.

Not used.

3. MATERIAL.

3.1 Grass Seed. Grass seed will be provided by the Contractor. All seed shall be properly stored by the Contractor and any seed damaged during such storage shall be replaced by the Contractor.

The seed shall be a mixture of the species and variety specified and shall be applied at the pure live seed (not gross amount) rate of 15 lbs/acre for dryland or native grass. The seed shall be furnished in labeled bags and the tags shall be delivered to the Owner.

3.2 Native Grass Seed. The Contractor shall submit samples and certifications of each type of seed to the Owner for approval. The mixture shall have the follow percentages of each type of grass listed.

Species or Variety	Percentage by Weight in Mixture
Native Grass	
Western Wheatgrass	33%
Blue Bunch Wheatgrass	34%
Rough Fescue	33%

Seed shall comply with and be labeled in accordance with the Montana Seed Law. Seed shall have been grown in the North American Continent above 41 degrees latitude. All seed shall be standard grade adapted to Montana conditions.

3.3 Fertilizer. Fertilizer shall be furnished by the Contractor and shall be applied at the rates specified below:

Dryland Grass

50 lbs. Nitrogen/Acre
50 lbs. Phosphate/Acre

The commercial fertilizer shall be delivered in standard size bags of the manufacturer showing weight analysis and manufacturer's name.

The Owner reserves the right to test the material at any time and to accept or reject the material based on these tests.

If the fertilizer is not used immediately, the Contractor shall store the unused material in a place designated by the Owner's representative and in such a manner that its usefulness will not be impaired.

3.4 Topsoil. Topsoil shall be considered the top 12 inches of soil stripped from the site provided it is free of refuse and reasonably free of stumps, roots, brush, stones (1.5 inches or more in diameter), clay lumps, or similar objects. Brush and other vegetation which will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary herbaceous growth such as grass and weeds do not need to be removed but shall be thoroughly broken up and intermixed with the soil during handling operations.

4. CONSTRUCTION.

4.1 Time of Seeding. Seeding shall be planted after the top soiling and grading is completed. The planting will take place after the installation of all other items in this contract. Native grass seed shall be planted prior to June 1 or after September 15. Seeding shall be done in dry or moderately dry soil.

4.2 Preparation of Seedbed. After the finish grading, topsoil has been placed and compacted, and just before seeding, all cut and fill slopes and flatter surfaces shall be loosened and raked to true lines, free from all unsightly variations, humps, ridges and depressions.

4.3 Native or Dryland Grass Seeding. Native or dryland seeding shall be done using a grass drill. Hand application and raking may be used in confined areas not accessible to the drilling operation.

4.4 Application Rate. Seed shall be applied at the following rates of pure live seed per acre:

	Application Rate Pounds Live Seed per Acre
Western Wheatgrass	2.0
Blue Bunch Wheatgrass	2.3
Rough Fescue	1.6

4.5 Establishment.

4.5.1 General. The Contractor shall be responsible for the proper care and maintenance of the seeded areas during the period when the grass is becoming established.
The Owner shall assume responsibility for the maintenance of areas when the grass has reached a uniform height of four inches over an entire area or completion of the project, whichever is later. The Owner may accept definable areas for maintenance and may require the Contractor to maintain areas which are not acceptable at that time.

4.5.2 Reseeding. Areas that require reseeding will be designated by the Engineer. Reseeding shall be completed within the specified dates permitted for seeding or in such period as may be allowed by the Engineer. Reseeding shall be with the same seed types, mixture and method as originally used and shall be applied at the rate specified for the original seeding in a manner that will cause a minimum of disturbance of the existing stand of grass. Reseeding shall be accomplished at no additional cost to the Owner. Seed, equipment and labor for reseeding will be supplied by the Contractor.

4.5.3 Repair. If at any time before completion and acceptance of the entire work covered by this contract, any portion of the surface becomes gullied or otherwise damaged following seeding the affected portion shall be repaired to re-establish the condition and grade of the soil prior to seeding and shall then be reseeded as specified above.

END OF SECTION