

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02220

DEMOLITION

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS
- 1.4 DUST CONTROL
- 1.5 PROTECTION
 - 1.5.1 Protection of Personnel
 - 1.5.2 Protection of Structures
 - 1.5.3 Protection of Existing Property
 - 1.5.4 Protection From the Weather
 - 1.5.5 Protection of Trees
 - 1.5.6 Environmental Protection
- 1.6 BURNING
- 1.7 USE OF EXPLOSIVES

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 EXISTING STRUCTURES
- 3.2 UTILITIES
- 3.3 FILLING
- 3.4 DISPOSITION OF MATERIAL
 - 3.4.1 Salvageable Items and Material
 - 3.4.1.1 Material Salvaged for the Contractor
 - 3.4.1.2 Items Salvaged for Reuse
 - 3.4.2 Unsalvageable Material
- 3.5 CLEAN UP
- 3.6 PAVEMENTS

-- End of Section Table of Contents --

SECTION 02220

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

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

ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Work Plan; GA

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations in accordance with EM 385-1-1.

1.4 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

1.5 PROTECTION

1.5.1 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.5.2 Protection of Structures

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.3 Protection of Existing Property

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.4 Protection From the Weather

Salvageable materials and equipment shall be protected from the weather at all times.

1.5.5 Protection of Trees

Trees within the project site which might be damaged during demolition, and which are indicated by the Contracting Officer to be left in place, shall be protected by a 6 foot high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

1.5.6 Environmental Protection

The work shall comply with the requirements of Section 01410 ENVIRONMENTAL PROTECTION.

1.6 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.7 USE OF EXPLOSIVES

Use of explosives will not be permitted.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXISTING STRUCTURES

Existing structures indicated on plans to be removed shall be removed. See the attached schedule of existing structures to be demolished. Interior walls, other than retaining walls and partitions, shall be removed to 9.0 feet below grade. Basement slabs, foundation, and miscellaneous debris from sites where home have previously been removed shall be removed. Street and parking lot pavement and base courses, sidewalks, curbs, gutters, driveways, and street light bases shall be removed as indicated.

Abandoned storm sewers, sanitary sewers, and water mains shall be plugged by filling with grout or capped and removed as indicated or as approved by the Contracting Officer. The water main, storm and sanitary sewer plugs shall be inspected and approved by the City of Grand Forks Water Utility Department prior to backfilling.

3.2 UTILITIES

Disconnection of utility services, with related meters and equipment, shall be performed by the respective utilities. Contact list for coordination of utility disconnections are included at the end of this section. Existing utilities shall be removed as indicated. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

3.3 FILLING

Holes, open basements and other hazardous openings shall be filled in accordance with Section 02300 EARTHWORK.

3.4 DISPOSITION OF MATERIAL

Title to material and equipment to be demolished, except Government salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed.

3.4.1 Salvageable Items and Material

Contractor shall salvage items and material to the maximum extent possible.

3.4.1.1 Material Salvaged for the Contractor

Material salvaged for the Contractor shall be stored as approved by the Contracting Officer and shall be removed from the project site before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

3.4.1.2 Items Salvaged for Reuse

Salvaged items to be reused shall be removed in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents.

3.4.2 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed off-site.

3.5 CLEAN UP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

3.6 PAVEMENTS

Existing pavements designated for removal shall be saw cut at limits of removal and removed.

-- End of Section --

Attachment A

Grand Forks Phase 1 Levees
Utility Contact Summary
2/28/01

Utility Company Name	Utility Affected	Contact Person	Phone Number
Qwest	Telephone	Judy Gerszewski Gary Hubbard	701-775-1281 701-772-1056 2 18-779-6559 (Cell)
Xcel Energy	Gas and Electric	Deb Thompson	70 1-795-5229 70 1-74 1-4429 (Cell)
Midcontinent Communications	Cable TV	James Poole	701-746-1345 2 1 S-779-7672 (Cell)
City of Grand Forks	Storm and Sanitary Sewers and Water	Gary Urness	70 1-746-2649
North Dakota One-Call	Prior To Any Excavation		800-795-0555

PHASE 1 LEVEES, GRAND FORKS, ND, DEMOLITION SCHEDULE-REACH 1

Station	Side of Levee	Structure	Notes
179+00 to 189+00	L	Misc. Trails, Sidewalks and Drives	Asphalt and Concrete
179+00 to 189+00	L	Street Lights and Parking Lot Lights	Salvage for City
179+00 to 189+00	L	Misc. Park Structures	Salvage for City
179+30 to 180+70	L	Street	Riverboat Road - 6" Concrete
179+52 to 182+80	L	15" RCP Storm Sewer	Inv. 822' to 820.5' - Depth 8' - Remove
179+52 to 179+70	L	15" RCP Storm Sewer	Inv. 821' to 822' - Depth 7' - Remove
179+52	L	Manhole	Base slab elev. 820' - Depth 8' - Remove
179+60	C	Street	1st Avenue - 6" Concrete
179+90	C	Sidewalk	
180+00 to 183+00	C, L & R	Parking Lot	
181+30	L	Structure	Gazebo - Salvage for Reuse
182+30	L	Building	Pump Station - Salvage Equipment for City
182+82	L	Manhole w/ inlets	Inv. 820' to 823' - Depth 8' - Plus Outlets
182+90	L	Structure	Electric Panel - Salvage for City-
183+00	L	Structure	City Welcome Sign - Salvage for City
183+00 to 183+70	C, L & R	Tree Gates	Salvage for City
183+20	C & R	Sidewalk	
183+12	L	Inlet	Inv. 820' - Depth 8' - Remove
183+18	C & L	10" CIP Water Main	Inv. 819.5' - Depth 8' - Remove
183+18	R	10" CIP Water Main	Inv. 819.5' - Depth 8' - Remove
183+15 to 183+39	R	Manhole w/ inlets	Inv. 820' - Depth 8' - Remove
183+36	C, L & R	18" RCP Storm Sewer	Inv. 816.5' to 820' - Depth 8' - Remove
183+38	R	8" VCP Sanitary Sewer	Inv. 810' - Depth 18' - Verify that sewer has been filled with CDF
183+38	R	Sanitary manhole	Inv. 811' - Depth 17' - Remove
183+44	R	70" x 54" Storm Sewer	Inv. 802' - Depth 26' - Plug and till with CDF
183+50	C & R	Street	DeMers Avenue - 1.5" Asphalt over 8" Concrete
183+70	C	Sidewalk	
188+60	C	10" VCP Sanitary Sewer	Inv. unknown - Verify that sewer has been filled with CDF

Note:

(1) Pipe locations, invert elevations and depths are approximate and require field verification

PHASE 1 LEVEES, GRAND FORKS, ND, DEMOLITION SCHEDULE-REACH 2

Station	Side of Levee	Structure	Notes
237+60	C	Sidewalk	
237+70	C	6" CIP Sanitary Sewer	Invert unknown - Verify that sewer has been filled with CDF
237+75	C	6" CIP Water Main	Inv. 820' to 815' - Depth 8' - Remove
237+80	C	Street	Lincoln Drive - 6" Concrete
237+86	C	10" FM Sanitary Sewer	Invert unknown - Verify that sewer has been filled with CDF
237+94	C	15" VCP Sanitary Sewer	Inv. 808.5' - Depth 20' - Verify that sewer has been filled with CDF
237+99	R	Storm Sewer Manhole 6' x 10'	Inv. 813.96' - Depth 14' - Plug outlets and remove
237+99	C	60" RCP Storm Sewer	Inv. 811.5' - Depth 17' - Remove as required for new construction, fill remainder with CDF
238+20	C & R	Sidewalk	
240+00 to 241+00	L	Alley	Gravel
243+50	C & R	Sidewalk	
243+80	C	6" Water Main	Inv. 823.5' - Depth 8' - Remove
244+00	C	Street	Euclid Avenue - 6" Concrete
244+16	C	12" RCP Storm Sewer	Inv. 821' - Depth 10' - Remove
244+37	C	10" VCP Sanitary Sewer	Inv. 819' - Depth 12' - Plug and fill with CDF
244+50	C	Sidewalk	
245+60	C	Sidewalk	
245+85	C	8" Water Main	Inv. 823.5' - Depth 8' - Remove
246+00	C	Street	10th Avenue S. - 6" Concrete
246+00	C	Manhole and Inlets	Invert unknown - Remove
246+30	C	4" Gas Line (Steel Coated)	Invert unknown - Remove
246+10	C	24" RCP Storm Sewer	Inv. 821' - Depth 1' - Plug and fill with CDF
246+20	C	Sidewalk	
246+40	C	Drive	Concrete
246+00 to 253+00	L	Sidewalks	
247+00 to 249+60	R	Alley	
248+00 to 253+00	L	Street	Parkeham Drive - Concrete
248+30 to 249+30	C	Parking Lot	Concrete
248+50	L	Flagpole	Salvage for reuse
249+40	C	Sidewalk	
249+70	C	4" Gas Line (Steel Coated)	Invert unknown - Remove
249+80	C	Street	11th Avenue S. - 6" Concrete
249+89	C & L	15" RCP Storm Sewer	Inv. 820' - Depth 12' - Plug and fill with CDF
252+90	C	Sidewalk	
252+90	C & R	2" Gas Line (Polyethylene)	Invert unknown - Remove
253+08	C & R	21" RCP Storm Sewer	Inv. 820' - Depth 12' - Remove
253+15	C & R	8" VCP Sanitary Sewer	Inv. 825.5' - Depth 7' - Remove
253+20	C & R	Street	Lincoln Drive - 6" Concrete
253+35	C & R	6" Water Main	Inv. 824' - Depth 8' - Remove
253+40	C & R	Sidewalk	
253+50	L	Structure	Baseball Backstop - Salvage for City
254+00 to 256+00	R	Sidewalk	
256+00	R	Concrete Pavement	Remove and Replace as required for new storm sewer construction

Note:

(1) Utility pipe locations, invert elevations and depths are approximate and require field verification

PHASE 1 LEVEES, GRAND FORKS, ND, DEMOLITION SCHEDULE-REACH 3

Station	Side of Levee	Structure	Notes
323+50	R	Catch Basin	Remove to allow installation of new manhole.
326+40	C & R	Drive	Koinonia Retreat - Gravel
335+63	C	12" RCP Storm Sewer	Inv. 821' - Depth 9' - Remove
335+70	C	2" Gas Line (Steel Coated)	Invert unknown - Remove
335+80	C & L	8" VCP Sanitary Sewer	Inv. 821' - Depth 9' - Remove
331+20 to 336+00	R	Sidewalk	
336+10	C	8" ACP Water Main	Inv. 821' - Depth 9' - Remove
336+00	C	Street	Elmwood Drive - 6" Concrete
339+31	C	12" RCP Storm Sewer	Inv. 824' - Depth 8' - Remove
339+40	C	2" Gas Line (Polyethylene)	Invert unknown - Remove
339+46	C	8" VCP Sanka Sewer	Inv. 821' - Depth 11' - Plug and fill with CDF
339+20	C	Sidewalk	
339+50	C	Street	Olson Drive - 6" Concrete
339+60	L	Fire Hydrant	
339+64	C	8" ACP Water Main	Inv. 823' - Depth 9' - Remove
339+70	C	Sidewalk	
339+70 to 341+80	L	Sidewalk	
341+70	L	Fire Hydrant	
341+80	C	Sidewalk	
341+82	C	8" ACP Water Main	Inv. 824' Depth 8' - Remove
342+00	C	Street	32nd Avenue S. - 6" Concrete
342+16	C	12" RCP Storm Sewer and Curb inlets	Inv. 822.5' - Depth 9' - Remove
342+30	C	Sidewalk	
349+90	C	2" Gas Line (Steel Coated)	Invert unknown - Remove
350+09	C	8" VCP Sanitary Sewer	Inv. 818' - Depth 17' - Plug and fill with CDF
350+10	C	Street	34th Avenue S. - 6" Concrete
350+27	C	8" ACP Water Main	Inv. 825' - Depth 10' - Remove

Notes:

(1) Utility pipe locations, invert elevations and depths are approximate and require field verification.

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Clearing

1.1.2 Grubbing

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

3.2 GRUBBING

3.3 TREE REMOVAL

3.4 DISPOSAL OF MATERIALS

3.4.1 Materials Other Than Salable Timber

3.5 ACCEPTANCE

-- End of Section Table of Contents --

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Clearing

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared. Clearing operations shall be conducted in areas designated on the drawings.

1.1.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Grubbing operations shall be done in areas for structures and areas to receive levee fill or to be paved as shown on the drawings.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.2 GRUBBING

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 24 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for levees, buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 DISPOSAL OF MATERIALS

3.4.1 Materials Other Than Salable Timber

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of offsite, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

3.5 ACCEPTANCE

Upon completion of the site clearing, obtain the Contracting Officer's acceptance of the extent of clearing and grubbing.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02300

EARTHWORK

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SUBSURFACE DATA
- 1.4 ALTERNATE BORROW SOURCES AND EVALUATION
 - 1.4.1 Alternate Sources

PART 2 PRODUCTS

- 2.1 DEFINITIONS
 - 2.1.1 Satisfactory Materials
 - 2.1.2 Cohesionless and Cohesive Materials
 - 2.1.3 Proctor
- 2.2 MATERIALS
 - 2.2.1 Common Borrow
 - 2.2.2 Select Granular Fill
 - 2.2.3 Granular Fill
 - 2.2.4 Impervious Fill
 - 2.2.5 Select Impervious Fill
 - 2.2.6 Random Fill
- 2.3 CONSTRUCTION EQUIPMENT
 - 2.3.1 Levees

PART 3 EXECUTION

- 3.1 CLASSIFICATION OF SOIL MATERIALS
- 3.2 STOCKPILES
- 3.3 STRIPPING OF TOPSOIL
- 3.4 EXCAVATION
 - 3.4.1 Changes and Differing Site Conditions
- 3.5 DITCHES AND GUTTERS
- 3.6 BORROW MATERIAL
 - 3.6.1 Excavation and Borrow Pits
 - 3.6.2 Utilization of Excavated Materials
- 3.7 EMBANKMENTS
- 3.8 STRUCTURES
- 3.9 LEVEES
 - 3.9.1 Inspection Trench
- 3.10 SUBGRADE PREPARATION
 - 3.10.1 Subgrade Correction
- 3.11 FINISHING
 - 3.11.1 Pavement Subgrade Tolerances
- 3.12 PLACING TOPSOIL
- 3.13 COMPACTION
 - 3.13.1 Moisture Control
 - 3.13.2 Placement And Compaction
- 3.14 TESTING

Grand Forks Phase 1 Levees

- 3.14.1 General
- 3.14.2 Field Density Tests
- 3.14.3 Proctor Tests
- 3.14.4 Treatment of Oversize Particles for Density Tests
- 3.14.5 Corrective Action
- 3.14.6 Testing Schedule
- 3.15 NUCLEAR DENSITY TESTING EQUIPMENT
- 3.16 SUBGRADE AND EMBANKMENT PROTECTION

-- End of Section Table of Contents --

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer Than 75 Micrometers (No. 200 Sieve) in Mineral Aggregates by Washing
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1998) Particle Size Analysis of Soils
ASTM D 698	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D 1556	(1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2488	(1993) Description and Identification of Soils
ASTM D 2922	(1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4718	(1987; R 1994) Correction of Unit Weight and Water Content for Soils Containing Oversize Particles

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Testing; FIO

A summary of testing results indicated in PARAGRAPH: TESTING shall be submitted when the site work is substantially complete. The Contracting Officer shall be informed of test results daily for direction on corrective action required. Draft copies of field testing results shall be furnished to the Contracting Officer on a frequent and regular basis as directed, but do not need to be formally transmitted through the submittal process.

Daily Report Forms; FIO

A compilation of the daily report forms for earthwork observation and inspection trench observations ordered by date shall be submitted when the work is substantially complete. Preliminary copies shall be furnished to the Contracting Officer on a weekly or monthly basis as directed, but do not need to be formally transmitted through the submittal process.

1.3 SUBSURFACE DATA

Reference the Physical Data clause in Section 00800.

1.4 ALTERNATE BORROW SOURCES AND EVALUATION

Borrow materials shall be produced from the sources shown on drawings or listed in Section 00830 ATTACHMENTS. If Contractor proposes to furnish borrow from a source not shown or listed, Government approval of the source is required. The Government will make such investigations and evaluations as necessary to determine whether or not materials with acceptable characteristics can be obtained from the proposed source. Approval (or rejection) will require at least 30 days, but not more than 120 days. Borrow areas which involve the excavation of wetlands or wooded areas will not be approved.

1.4.1 Alternate Sources

a. Evaluation by Site Inspection. If the Contractor proposes to furnish borrow from an unlisted source, the Government will evaluate the alternate source. An investigation shall be performed by a Government geologist or engineer. The Contractor shall expose fresh soil for the full height of the face proposed for production during the field evaluation.

b. Evaluation by Test Data. If sufficient information is not available, the Government will reconsider the alternate source if evaluation is supplemented by sampling and testing of the properties specified for the material. If the Contractor wishes to pursue the alternate source, the Government will notify the Contractor of required sampling and number of tests required. The Contractor shall be responsible for sampling and testing costs for alternate sources. The Contracting Officer shall be

present during the sampling, unless waived. Information provided with the samples shall include the location and elevation from which the sample was taken. Testing shall be completed by a laboratory approved in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Test results and jar samples shall be furnished to the Government geologist at the District Office. This will require a 14 day evaluation period after the test results are received at the District Office.

PART 2 PRODUCTS

2.1 DEFINITIONS

2.1.1 Satisfactory Materials

Satisfactory materials shall be of a character and quality satisfactory for the purpose intended, and meet the applicable material specifications.

2.1.2 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

2.1.3 Proctor

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698. The maximum density is hereafter abbreviated as the "Standard Proctor" or "Proctor" value. The optimum moisture content, W_o , is the water content at which the soil is compacted to the maximum density as determined during the test procedure presented in ASTM D 698.

2.2 MATERIALS

All material placed as fill or backfill shall consist of material classified by ASTM D 2487 as GW, GP, GC, GM, SP, SM, SC, CL, CH AND SW. The material shall be free of ice, snow, frozen earth, trash, debris, sod, roots, organic matter, or stones larger than 3 inches in any dimension.

2.2.1 Common Borrow

Common borrow shall have less than 40 percent retained on the No. 4 sieve, and less than 30 percent retained on the 3/4 inch sieve.

2.2.2 Select Granular Fill

Select granular material shall meet requirements for common borrow and shall contain not more than 5 percent by weight of material passing the No. 200 sieve. The maximum allowable aggregate size shall be 1-1/2 inches.

2.2.3 Granular Fill

Granular material shall meet requirements for common borrow and shall contain not more than 12 percent by weight of material passing the No. 200 sieve.

2.2.4 Impervious Fill

Grand Forks Phase 1 Levees

Impervious fill shall meet requirements for common borrow and shall have a plasticity index less than 50.

2.2.5 Select Impervious Fill

Select impervious fill shall meet requirements for common borrow, shall have a plasticity index less than 30, and a clay fraction less than 40 percent by weight finer than 0.002 mm.

2.2.6 Random Fill

Random fill shall consist of native materials meeting the requirements for common borrow.

2.3 CONSTRUCTION EQUIPMENT

Compaction equipment shall consist of sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil type being compacted. Water flooding or jetting methods of compaction will not be permitted for any soil types. Sprinkling equipment for cohesive soils shall apply water uniformly, in controlled quantities, and be capable of variable application widths.

2.3.1 Levees

Use of sheepsfoot rollers (vibratory or non-vibratory), or scarification between lifts, is required for construction of levees (any water retaining structures). Construction equipment and methods shall avoid poor bonding between lifts, characterized by layered or laminated texture at the lift interfaces. Smooth surfaces (such as produced from smooth drum rollers, rubber tired rollers, and construction traffic) shall be scarified prior to placing subsequent lifts.

PART 3 EXECUTION

3.1 CLASSIFICATION OF SOIL MATERIALS

Classification of soil materials shall be performed by the Contractor in accordance with ASTM D 2488. The Contracting Officer reserves the right to revise the Contractor classifications. In the case of disagreement, the Contracting Officer's classification will govern unless the soils are classified in accordance with ASTM D 2487. All testing completed by the Contractor in conjunction with soil material classification will be considered incidental to the contract work.

3.2 STOCKPILES

Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed. Satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes contaminated, frozen or too wet for use, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government.

3.3 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth of 6 inches. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.4 EXCAVATION

After topsoil removal has been completed, excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Excavation material suitable for use as fill shall be transported to and placed in fill areas within the limits of the work. All unsatisfactory material, including any soil which is disturbed by the Contractor's operations or softened due to exposure to the elements and water, and surplus material shall be disposed of in areas approved for off site storage. Excavations carried below the depths indicated shall be refilled to the proper grade with satisfactory material. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.4.1 Changes and Differing Site Conditions

Any excavation subgrades that are unstable, pump, rut excessively, reveal soil conditions that are substantially different from that indicated in the contract, or are unsuitable for proceeding with the work shall immediately be reported to the Contracting Officer. In the event that it is necessary to remove material to a depth greater than specified, the Contracting Officer will provide direction for changed work; and an adjustment in the contract price will be considered in accordance with the contract. Unsatisfactory material encountered below the grades shown shall be removed as directed. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer. The Contracting Officer shall be notified prior to proceeding with any unauthorized work. Additional work not authorized by the Contracting Officer shall be at the Contractor's expense.

3.5 DITCHES AND GUTTERS

Ditches and gutters shall be cut accurately to the cross sections and grades indicated. Gutters and ditches shall be finished in a manner that will result in effective drainage. All roots, stumps, rock, and foreign matter in the sides and bottom of ditches and gutters shall be trimmed and dressed or removed to conform to the slope, grade, and shape of the section indicated. Care shall be taken not to excavate ditches and gutters below the grades indicated. Excessive ditch and gutter excavation shall be backfilled to grade with properly placed and compacted material. All ditches and gutters excavated under this section shall be maintained until

final acceptance of the work. Satisfactory material excavated from ditches and gutters shall be placed in fill areas.

3.6 BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas shown or from other approved sources, either private or within the limits of the project site, selected by the Contractor. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and drainage of borrow pits and the disposal of debris thereon and restoration shall be considered related operations to the borrow excavation.

3.6.1 Excavation and Borrow Pits

Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of, or used for special purposes. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.6.2 Utilization of Excavated Materials

Material removed from excavations shall be incorporated in the work insofar as practicable. No excavated material that is satisfactory for use as fill shall be wasted without specific written authorization. Material authorized to be wasted shall be stored in designated areas approved for surplus material storage and disposed of offsite. No excavated material shall be disposed of in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.7 EMBANKMENTS

Fills and embankments shall be constructed at the locations and to lines and grades indicated. Fill shall meet the material specifications for the zones indicated on the drawings. The material shall be placed in successive horizontal layers for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlaying lift is placed.

3.8 STRUCTURES

Excavation and backfilling for structures is specified in Section 02315 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES.

3.9 LEVEES

3.9.1 Inspection Trench

The inspection trench will be used to locate undesirable subsurface features. Any pipes, tiles, conduits, buried debris, or other unsatisfactory foundation materials encountered shall be removed from within the footprint of the levee or plugged as directed by the Contracting Officer. The Contractor shall notify the Contracting Officer 48 hours prior to start of this work. Observations shall be recorded on the daily report forms attached to this specification, or to a Contractor's special purpose form for observing trench excavations if approved by the Contracting Officer

a. Inspection Trench Excavation and Observation. An inspection trench will be excavated as shown on the drawings. Immediately after excavating the trench, the Contractor shall inspect and record the soil and water conditions encountered and any other pertinent features. Soils on the base and side slopes shall be identified in accordance with ASTM D 2488. In reaches where caving occurs, the Contractor shall either widen the trench, dewater to keep the trench stable, or assign a competent person to observe the excavation continuously in addition to the excavator operator. Excessive water seepage shall be removed to allow visual inspection. During construction of the inspection trench, the Contractor shall immediately notify the Contracting Officer in the event that soil conditions encountered differ significantly from those shown on the boring logs.

b. Inspection Trench Backfill. The Contracting Officer will observe the trench before backfilling, unless waived for trench stability reasons. All water and mud shall be removed from the trench before backfill is placed. The excavated material may be used for backfill only if it meets the material specified. All inspection trench backfill shall be placed in lifts and compacted as specified in paragraph COMPACTION.

c. Inspection Trench Location. The inspection trench shall generally be located close to the levee centerline. The inspection trench shall be continuous at all points, aligned with smooth curves, and free from abrupt changes in alignment. The Contracting Officer may direct the actual alignment of the inspection trench within the limits of the levee right of way to intercept suspect areas.

3.10 SUBGRADE PREPARATION

All areas upon which fill is to be placed shall be stripped before the fill is started. Material shall not be placed on surfaces that are muddy, frozen, contain frost, or where unsatisfactory material remains in or under the fill. For cohesionless soils, the subgrade surface shall be compacted to at least 100 percent of the Standard Proctor density. For cohesive soils, the subgrade shall be proof rolled with rubber tired equipment and any soft areas shall be brought to the Contracting Officer's attention. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be stepped such that the fill material will bond with the existing surface.

3.10.1 Subgrade Correction

Soft or otherwise unsatisfactory material shall generally be removed and replaced with satisfactory excavated material or other approved material as directed. Low areas resulting from removal of unsatisfactory material

shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified.

3.11 FINISHING

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing.

3.11.1 Pavement Subgrade Tolerances

When the final layer of base has been completed, and at the time any additional construction is to be placed thereon, the finished surface of the base shall not vary more than 0.05 feet from the plan elevation.

3.12 PLACING TOPSOIL

Topsoil placement is covered in Section 02920 SEEDING, SODDING, AND TOPSOIL. The finished grade shall be such that after subsequent treatment (tillage, topsoiling and planting) the planted grade shall join 1 inch below adjoining surfaced grade of walks, curbs and drives and even with adjoining turfed areas.

3.13 COMPACTION

3.13.1 Moisture Control

Control of moisture in the fill shall be maintained to provide acceptable compaction. Dried or crusted cohesive soils shall be plowed, disked or otherwise broken up before compaction. If water is added to fills, the layer shall be spread in even lifts, moistened as necessary, thoroughly mixed, and compacted. Maintain moisture content for select impervious fill between $W_o - 3$ percent and $W_o + 3$ percent during placement and compaction

3.13.2 Placement And Compaction

Each layer shall be spread uniformly on an acceptable soil surface. The type of fill, its maximum uncompacted lift thickness, and the minimum compaction requirements (percent of Standard Proctor density) to which each type of fill shall be compacted shall be as listed below.

<u>Fill Zone</u>	<u>Maximum Uncompacted Lift Thickness (inches)</u>	<u>Percent of Standard Proctor Density</u>
General Grading	12	95
Building Subgrades Floor Slabs and Steps	9	100
Levees	12	95
Utility Backfill	Use specification for zone where utility is located.	

a. Fill materials shall be placed in horizontal layers not exceeding 6 inches loose depth when hand operated compactors are used.

b. Embankments and subgrade under pavements shall be compacted to at least the percent of Standard Proctor density as follows:

(1) For fill sections the top 36 inches below the aggregate base course shall be placed in uncompacted lifts not exceeding 9 inches and compacted to at least 100 percent of the Standard Proctor density.

(2) For cut sections in cohesionless soils the subgrade surface shall be compacted to at least 100 percent of the Standard Proctor density. For cut sections in cohesive soils, the subgrade shall be proof rolled and any soft areas shall be brought to the Contracting Officer's attention.

3.14 TESTING

3.14.1 General

All testing expenses shall be the Contractor's responsibility. Prior to sampling and testing the work, testing laboratories shall be inspected and approved in accordance with SECTION 01451: CONTRACTOR QUALITY CONTROL. The Contracting Officer reserves the right to direct the location and select the material for samples to be tested and to direct where and when moisture-density tests shall be performed

3.14.2 Field Density Tests

Report forms for summaries of field density tests shall include the minimum information. Additional data required by the applicable ASTM test methods shall be kept on file by the Contractor. Tests shall be numbered sequentially throughout the job, and retests shall reference the original test number (1A, 1B, etc.)/

- a. Test Number
- b. Dry density, water content and gravel content of field test
- c. Proctor Number, maximum dry density, optimum water content, and gravel content
- d. Relative Compaction
- e. Each test shall be plotted on the graphic presentation of the applicable Proctor test.

3.14.3 Proctor Tests

Report forms for summaries of Proctor tests shall include the minimum information. Additional data required by the applicable ASTM test methods shall be kept on file by the Contractor. Jar samples shall be retained by the testing laboratory for each Proctor test until field testing is completed.

- a. Test Number and method

- b. Sample location and visual soil description
- c. Maximum dry density, and optimum water content
- d. Gravel contents in sample and test specimens

3.14.4 Treatment of Oversize Particles for Density Tests

The fine gravel contents shall be corrected by selecting an appropriate Proctor sample. The fine gravel content shall be the particles retained on the No. 4 sieve and passing the 3/4 inch sieve. The fine gravel content of the field density test shall be within 5 percent of the fine gravel content of the Proctor sample.

The oversize fraction shall be particles retained on the 3/4 inch sieve. For oversize fractions greater than 5 percent, the oversize particles shall be corrected in accordance with the Finer Fraction Method specified in ASTM D 4718.

Each sand cone test shall report the gravel content retained on the No. 4, 3/8 inch and 3/4 inch sieve as appropriate for the Proctor method referenced.

Where nuclear testing is used and lack of uniformity in the soil due to layering, rock or voids are suspected, the test volume site shall be dug up and visually examined to determine if the test material is representative of the full material in general and if rock correction is required.

3.14.5 Corrective Action

Tests of materials which do not meet the contract requirements (failing test) will not be counted as part of the required testing. Each such failing test must be retaken at the same location as the failing test was taken. If testing indicates material does not meet the contract requirements, the material represented by the failing test shall not be placed in the contract work or shall be recompacted or removed. The quantity of material represented by the failing test shall be determined by the Contracting Officer up to the quantity represented by the testing frequency. The Contractor may increase testing frequency in the vicinity of a failing test in order to reduce removal requirements, as approved by the Contracting Officer. Such increases in testing frequency shall be at the Contractor's expense and at no additional cost to the Government.

3.14.6 Testing Schedule

- a. Moisture-Density Relations (ASTM D 698)
 - One test for each material variation, not less than 3 tests per levee reach total.
- b. In-Place Densities (ASTM D 1556 or ASTM D 2922)
 - 1) Typical, 1 test per 2000 cubic yards of fill placed
 - 2) Structure foundations and floor slabs, not less than 1 test for each 2 vertical feet of fill
- c. Percent Passing No. 200 sieve (ASTM C 117)

Grand Forks Phase 1 Levees

- 1) Select Granular Fill, 1 test per 1000 cubic yards of fill placed, not less than 1 test for each source placed
 - 2) Granular Fill, 1 test per 5000 cubic yards of fill placed, not less than 1 test for each source
- d. Sieve Analysis, (ASTM C 136)
- 1) Select Granular Fill, 1 test for each source
- e. Plasticity Index (ASTM D 4318)
- 1) Cohesive soils, 1 test for each Proctor test
 - 2) Impervious fill, 1 test per 5000 cubic yards of fill
 - 3) Select impervious fill, 1 test per 5000 cubic yards of fill
- e. Clay Fraction (percent smaller than 0.002 mm, determined in accordance with ASTM D 422)
- 1) Select impervious fill, 1 test per 5000 cubic yards of fill

3.15 NUCLEAR DENSITY TESTING EQUIPMENT

Nuclear density testing equipment shall be used in general accordance with ASTM D 2922 and ASTM D 3017. In addition, the following conditions shall apply:

- a. Prior to using the nuclear density testing equipment on the site, the Contractor shall submit to the Contracting Officer a certification that the operator has completed a training course approved by the nuclear density testing equipment manufacturer, the most recent data sheet from the manufacturer's calibration, and a copy of the most recent statistical check of the standard count precision.
- b. The first test and every tenth test thereafter shall include a sand cone correlation test. The sand cone test shall be centered over the prepared surface for the nuclear test, shall include a nominal 6 inch diameter sand cone, and shall include a minimum wet soil weight of 6 pounds extracted from the hole. In addition, testing of aggregate base soils shall include a minimum of 3 sand cone correlations for each day of testing; and testing of bituminous shall include a minimum of 3 core densities for each day of testing. The density correlations shall be submitted with test results. Each transmittal including density test data shall include a summary of all density correlations for the job neatly prepared on a summary sheet including at a minimum:
 - 1) date, meter serial number and operators initials.
 - 2) standard count and adjustment data for each test.
 - 3) material type.
 - 4) probe depth.
 - 5) moisture content by each test method and the deviation.
 - 6) wet density by each test method and the deviation.

- c. The nuclear density testing equipment shall be capable of extending a probe 6 inches minimum down into a hole. The probe shall generally be extended to the maximum depth obtainable.
- d. Nuclear density testing equipment used within 2 vertical feet from the existing ground water level, 5 horizontal feet from a vertical wall or massive concrete structure, or in a trench shall have the standard count changed before and after each test, or the manufacturers published correction procedure shall be followed.
- e. Nuclear density testing equipment shall not be used during rain.

3.16 SUBGRADE AND EMBANKMENT PROTECTION

Compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein to the required density prior to further construction thereon. Subgrades not meeting the specifications for finish, material type and density at the time of surface material placement shall be corrected at the Contractor's expense. Cohesive embankments and subgrades shall be kept crowned or sloped for drainage. Newly graded areas shall be protected from traffic and erosion. Any settlement or washing away that may occur from any cause shall be repaired. No base course or pavement shall be laid until the subgrade has been checked and approved by the Contracting Officer. Ditches and drains along subgrade shall be maintained to provide effective drainage. All work shall implement best management practices for erosion control.

-- End of Section --

DAILY REPORT FORM FOR EARTHWORK OBSERVATION

Project Name:	Date:
Contract Number: DACW37- - -	Temperature
QC Technician/Inspector:	Precipitation
Earthwork Contractor:	

Sunny partly cloudy overcast windy O t h e r

Stripping and Excavation

Area (sta., Elevation)	Depth/Thickness Removed	Excavated Material (ASTM D 2488)	Base Material (ASTM D 2488)

Excavation Equipment:

Description	No. Operating	Type (Make & Model or Capacity)
Dozers		
Backhoes		
Wheel Loaders		
Other		

Fill Placement

Area (Sta., Elevation) (Grids, depth below FFE)	Fill Material (ASTM D 2488)	Lift Thickness & Number of Passes

Hauling/Placing Equipment:

Description	No. Operating	Type (Make & Model or Capacity)
Trucks		
Scrapers		
Compactors		
Dozers/Graders		
Other		

Density Tests Taken (list numbers): _____

Notes: _____

DAILY REPORT FORM FOR INSPECTION TRENCH		
Project Name:		Date:
Contract Number: DACW37- - -		Temperature
QC Technician/inspector		Precipitation
Earthwork Contractor:		
Sunny <input type="checkbox"/> partly cloudy <input type="checkbox"/> overcast <input type="checkbox"/> windy <input type="checkbox"/> Other _____		
Soil Stratigraphy		
Zone (label in sketch)	Soil Description (ASTM D 2.488)	Water Conditions
Trench base soils		
Sketch of Trench Profile		
BeginningSta. _____		EndingSta. _____
Trench Width: _____		
Side Slopes (vert., 1V:1H, etc.): _____		
Pipes, tiles, or Conduits: _____		
(indicate sta., depth or elevation, leakage, etc.) _____		
Excavation Equipment:		
Description	No. Operating	Type (Make & Model or Capacity)
Backhoes		
Other-----		
Fill Material: - - - - - _____ - - - - -		
Borrow Area: _____		
Compaction Equipment: _____		
Lift Thickness: _____		
Number of passes: _____		
Density Tests Taken (list numbers): _____		
Notes: _____		

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02315

EXCAVATION, FILLING AND BACKFILLING FOR STRUCTURES

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEGREE OF COMPACTION
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Satisfactory Materials
 - 2.1.2 Granular Fill
 - 2.1.3 Unsatisfactory Materials
 - 2.1.4 Cohesionless and Cohesive Materials

PART 3 EXECUTION

- 3.1 CLEARING AND GRUBBING
- 3.2 TOPSOIL
- 3.3 EXCAVATION
- 3.4 DRAINAGE AND DEWATERING
 - 3.4.1 Drainage
 - 3.4.2 Dewatering
- 3.5 SHORING
- 3.6 CLASSIFICATION OF EXCAVATION
- 3.7 BLASTING
- 3.8 UTILITY AND DRAIN TRENCHES
- 3.9 BORROW
- 3.10 EXCAVATED MATERIALS
- 3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE
- 3.12 SUBGRADE PREPARATION
- 3.13 FILLING AND BACKFILLING
- 3.14 TESTING
 - 3.14.1 In-Place Densities
 - 3.14.1.1 In-Place Density of Paved Area Subgrades
 - 3.14.1.2 In-Place Density of Structure Subgrade
 - 3.14.1.3 In-Place Density of Fills and Backfills
 - 3.14.2 Optimum Moisture and Laboratory Maximum Density
- 3.15 GRADING
- 3.16 TOPSOIL AND SEEDING
- 3.17 PROTECTION

-- End of Section Table of Contents --

SECTION 02315

EXCAVATION, FILLING AND BACKFILLING FOR STRUCTURES

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 698 (1991; R 1998) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

ASTM D 2487 (1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

1.2 DEGREE OF COMPACTION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698, abbreviated as percent laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Testing; FIO

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials for general and structural backfill for structures located on the riverside of the levee and within the line of protection, pump stations, and storm sewer structures shall be comprised of native soils classified by ASTM D 2487 as SC, CL, CL-ML, and CH, unless otherwise shown.

2.1.2 Granular Fill

Granular material shall be satisfactory material containing not more than 12 percent by weight of material passing the No. 200 sieve. For free draining select granular fill, the material shall contain not more than 5 percent by weight of material passing the No. 200 sieve.

2.1.3 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 3 inches. The Contracting Officer shall be notified of any contaminated materials.

2.1.4 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM shall be identified as cohesionless only when the fines are nonplastic.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

Clearing and grubbing is specified in Section 02230 CLEARING AND GRUBBING.

3.2 TOPSOIL

Stripping topsoil is specified in Section 02300 EARTHWORK.

3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified, and shall include trenching for utility and foundation drainage systems to a point 5 feet beyond the building line of each building and structure and all work incidental thereof. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with satisfactory material; and payment will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced, at no additional cost to the Government, with satisfactory materials to the indicated excavation grade; except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.4 DRAINAGE AND DEWATERING

3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.4.2 Dewatering

See Section 01000 GENERAL for dewatering requirements. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.

Crushed rock or granular soils are not allowed beneath structure foundations, unless otherwise shown. Other methods to create a dry, stable subgrade on which to place reinforcement and concrete shall be used that will not create a permeable condition beneath the structure. Remove to the maximum extent possible, pervious materials incorporated into dewatering systems. Prior to placement of backfill the Contracting Officer will determine if materials used in dewatering are removed satisfactorily.

3.5 SHORING

See Section 01000 GENERAL for shoring requirements.

3.6 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

3.7 BLASTING

Blasting will not be permitted.

3.8 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length.

3.9 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained as specified in Section 02300 EARTHWORK.

3.10 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02300 EARTHWORK.

3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. For pile foundations, the excavation shall be stopped at an elevation of from 6 to 12 inches above the bottom of the footing before driving piles. After pile driving has been completed, the remainder of the excavation shall be completed to the elevations shown. All surfaces shall be protected from erosion resulting from ponding or flow of water.

3.12 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

3.13 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 8 inches in loose thickness, or 4 inches when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 2 feet above sewer lines and 1 foot above other utility

lines shall be free from stones larger than 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes to avoid damage to coatings, or wrappings. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

	<u>Percent Laboratory maximum density</u>	
	<u>Cohesive material</u>	<u>Cohesionless material</u>
<u>Fill, embankment, and backfill</u>		
Under structures, paved areas, around footings, and in trenches	100	100
Under grassed areas	95	95
<u>Subgrade</u>		
Under structures, steps, and paved areas, top 12 inches	100	100

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recomposition over underground utilities shall be by hand tamping.

3.14 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed in accordance with Section 01451 CONTRACTOR QUALITY CONTROL.

3.14.1 In-Place Densities

In-place density and moisture content test results shall be included with the Contractor's daily construction quality control reports.

3.14.1.1 In-Place Density of Paved Area Subgrades

One test per 100 linear feet or fraction thereof.

3.14.1.2 In-Place Density of Structure Subgrade

One test per 250 square feet or fraction thereof.

3.14.1.3 In-Place Density of Fills and Backfills

Not less than 1 test for each 2 vertical feet of fill per 100 linear feet or fraction thereof.

3.14.2 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material, including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per source or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

3.15 GRADING

Areas within 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.16 TOPSOIL AND SEEDING

Placement of topsoil and seeding is specified in Section 02920 SEEDING, SODDING, AND TOPSOIL.

3.17 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades reestablished to the required elevations and slopes.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 RELATED WORK OF OTHER SECTIONS
- 1.3 DEFINITIONS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Unyielding Material
 - 2.1.2 Unstable Material
 - 2.1.3 Select Granular Material
 - 2.1.4 Aggregate Bedding Material
- 2.2 PLASTIC MARKING TAPE

PART 3 EXECUTION

- 3.1 EXCAVATION
 - 3.1.1 Trench Excavation
 - 3.1.1.1 Bottom Preparation
 - 3.1.1.2 Unyielding Material
 - 3.1.1.3 Unstable Material
 - 3.1.1.4 Excavation for Appurtenances
 - 3.1.2 Stockpiles
- 3.2 BACKFILLING AND COMPACTION
 - 3.2.1 Levees
 - 3.2.2 Bedding and Initial Backfill
 - 3.2.3 Final Backfill
 - 3.2.4 Backfill for Appurtenances
- 3.3 SPECIAL REQUIREMENTS
 - 3.3.1 Burial Depth
 - 3.3.2 Plastic Marking Tape
- 3.4 DISPLACEMENT OF SEWERS

-- End of Section Table of Contents --

SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITY SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manua

1.2 RELATED WORK OF OTHER SECTIONS

Dewatering is covered in Section 01000 GENERAL. Material definitions, backfill compaction and testing requirements are covered in Sections 02300 EARTHWORK and 02630 STORM-DRAINAGE SYSTEM.

1.3 DEFINITIONS

Reference to pipes shall include conduits, cables, or other utility systems. Appurtenant structures include manholes, catch basins, inlets, outlets, headwalls, or similar structures.

PART 2 PRODUCTS

2.1 MATERIALS

In addition to the definitions below, material definitions shall be as specified in Section 02300 EARTHWORK.

2.1.1 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 3 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

2.1.2 Unstable Material

Unstable material shall consist of materials too soft and/or compressible to properly support the pipe or appurtenant structure.

2.1.3 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 5 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 3/4 inch sieve.

2.1.4 Aggregate Bedding Material

Aggregate bedding material shall be a well graded mineral product meeting the following gradation requirements:

<u>Sieve Siz</u>	<u>Percent Passing</u>
3/4 inch	100
3/8 inch	90-100
No. 4	35-75
No. 200	0-8

2.2 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. 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

PART 3 EXECUTION

3.1 EXCAVATION

Unless otherwise indicated, trench excavation shall be by open cut except that short sections may be jacked or bored if the utility can be safely and properly installed and ground loss can be properly controlled. All excavation shall be constructed in accordance with the Safety and Health Requirements Manual (EM 385-1-1) and/or OSHA Standards. Allowable trench widths, depths, side slopes, sheet and bracing requirements, and other considerations are given in the OSHA Standard; and an abbreviated version is given in the Safety and Health Requirements Manual. Provide full access to public/private premises and fire hydrants so as to prevent serious disruption of travel. Protect and maintain benchmarks and monuments during excavations.

3.1.1 Trench Excavation

Excavation shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in a neat and orderly manner at a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or caving. Topsoil shall be stockpiled separately from suitable backfill material. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized over

excavation shall be backfilled at no additional cost to the Government.

3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Pipe shall rest on undisturbed or properly placed and compacted soil along its entire length. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.2 Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed 8 inches below the required grade and replaced with select granular fill, except as provided below.

For levees, the replaced fill shall meet the requirements for the zone where it is located. Use of material more pervious than surrounding soils is not acceptable.

3.1.1.3 Unstable Material

Where wet, soft, unsuitable or otherwise unstable soil incapable of properly supporting pipe is encountered in the bottom of a trench or excavation, the Contractor shall immediately contact the Contracting Officer prior to proceeding with the associated work. When removal of unstable material is required due to inadequate shoring and sheeting, water removal, control of ground water or other similar operations, such unstable material shall be excavated and replaced with satisfactory material as directed at no additional cost to the Government.

3.1.1.4 Excavation for Appurtenances

Excavation for appurtenances shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.2 Stockpiles

Stockpiles of satisfactory material shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed. Excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government.

3.2 BACKFILLING AND COMPACTION

Backfilling shall not begin until construction below finish grade has been approved, storm drainage systems have been inspected, tested and approved; concrete forms have been removed and the excavation cleaned of frost, trash and debris. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall. Trenches not immediately backfilled to grade shall be sloped to drain if practicable. Heavy equipment for spreading and compacting backfill shall not be operated closer to a foundation or other underground structural element than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted with power driven hand tampers suitable for the material being compacted.

Backfill shall consist of satisfactory material meeting the requirements shown and specified. Compaction and testing requirements for backfill shall be as stated in Section 02300 EARTHWORK.

3.2.1 Levees

Where pipes are located within the right of way of levees, all fill materials shall meet the type and classification for the fill zone where the trench is located. The portion of the trench in native soils shall be backfilled with the excavated material that matches the surrounding soils.

3.2.2 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with manual tampers to a height above the pipe necessary to prevent damage, but not less than one foot. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.3 Final Backfill

Final backfill is all material necessary to complete backfilling at the trench above the bedding and initial backfill. Final backfill shall consist of native impervious fill, unless otherwise required beneath pavements, adjacent to structures, or other project features. Placement and compaction of final backfill shall comply with the requirements listed in Section 02300 EARTHWORK for the fill zone or feature in which the utility trench is located.

3.2.4 Backfill for Appurtenances

After the structure has been constructed and the concrete has been allowed to cure for 7 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for backfill in Section 02315 EXCAVATION, FILLING AND BACKFILLING FOR STRUCTURES, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 SPECIAL REQUIREMENTS

3.3.1 Burial Depth

Burial Depth of specific utilities is given below:

Grand Forks Phase 1 Levees

- a. Water lines. Trenches shall be of a depth to provide a minimum cover of 7 feet from the existing ground surface or from the indicated finished grade (whichever is lower) to the top of the pipe, unless otherwise indicated.
- b. Cables and Conduits. Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated.

3.3.2 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown.

3.4 DISPLACEMENT OF SEWERS

After other required tests have been performed and the trench backfill compacted to 2 feet above the top of the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02388

STONE PROTECTION (RIPRAP)

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 STONE SOURCES AND EVALUATION
 - 2.1.1 Alternate Sources
 - 2.1.2 Acceptance of Materials
- 2.2 RIPRAP
 - 2.2.1 General
 - 2.2.2 Production
- 2.3 BEDDING MATERIAL
- 2.4 GEOTEXTILE
- 2.5 SOURCE QUALITY CONTROL
 - 2.5.1 Sampling Requirements
 - 2.5.2 Riprap Gradation Testing
 - 2.5.2.1 Riprap Test Method A
 - 2.5.2.2 Riprap Test Method B
 - 2.5.3 Riprap Bedding Gradation Testing
 - 2.5.3.1 Gradation Tests for Riprap Bedding
- 2.6 STOCKPILES

PART 3 EXECUTION

- 3.1 CONSTRUCTION TOLERANCES
- 3.2 FOUNDATION PREPARATION
- 3.3 PLACEMENT OF GEOTEXTILE
 - 3.3.1 Construction Requirements
- 3.4 PLACEMENT OF BEDDING MATERIAL ON GEOTEXTILE
- 3.5 PLACEMENT OF RIPRAP
 - 3.5.1 Layer Requirements
 - 3.5.2 Construction Methods
 - 3.5.3 Riprap Placement on Geotextile
- 3.6 MAINTENANCE
- 3.7 CONTRACTOR QUALITY CONTROL

-- End of Section Table of Contents --

SECTION 02388

STONE PROTECTION (RIPRAP)

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33 (1999a) Concrete Aggregates

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse Aggregates

CORPS OF ENGINEERS (COE)

EM 1110-2-1906 (1986) Laboratory Soils Testing

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION (NDDOT)

NDDOT SS Section 709 (1997) Geotextile Fabrics

NDDOT SS Section 858 (1997) Geotextile Fabric

1.2 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Geotextile Data; FIO

Catalog cuts or technical data sheet shall be submitted for the geotextile showing that the product meets the specifications

SD-08 Statements

Material Sources; GA.

The Contractor shall designate in writing only one source or one combination of sources from which he proposes to furnish stone. The Contractor shall state in writing methods of processing and handling riprap, and shall notify the Contracting Officer when production methods are changed.

SD-09 Reports

Gradation Test; FIO.

Gradation Test Results for riprap and aggregates. Riprap gradation testing results shall be submitted on the WORKSHEET FOR GRADATION ANALYSIS OF RIPRAP and the gradation curve (form 4055). A blank copy of each form is included at the end of this section.

SD-13 Certificates

Certified Weight Scale Tickets; FIO.

Copies of all certified weight scale tickets shall be furnished to the Contracting Officer at a frequency as directed. The tickets do not need to be formally submitted through the submittal process.

PART 2 PRODUCTS

2.1 STONE SOURCES AND EVALUATION

Stone and aggregate materials may be quarried rock or durable fieldstone and shall be produced or obtained from the sources listed in Section 00830 ATTACHMENTS. If the Contractor proposes to furnish materials from a source not listed, the Government Geologist will make such investigations and evaluations as necessary to determine whether or not materials with acceptable durability can be produced from the proposed source. The rock supplied shall be composed of a quality fieldstone or be quarried from one rock formation to provide a product of uniform appearance. The Contractor shall not supply rock from various formations, or mix field stone with quarried rock, unless approved by the Contracting Officer. It is the Contractor's responsibility to determine that the stone source or combination of sources selected is capable of providing the quality, quantities and gradation needed and at the rate needed to maintain the scheduled progress of the work.

2.1.1 Alternate Sources

If the Contractor proposes to furnish stone materials from a source not listed in Section 00830 ATTACHMENTS, the Government Geologist will make such investigations and evaluations as necessary to determine whether or not materials meeting the requirements specified can be produced from the proposed source. Alternate sources from which the Contractor proposes to obtain stone materials shall be selected and submitted for approval at least 30 days in advance of the time when the material will be required.

2.1.2 Acceptance of Materials

Acceptance of a source of stone is not to be construed as acceptance of all material from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for stone as determined by the Contracting Officer. The Contracting Officer also reserves the right to reject individual units of produced specified materials in stockpiles at the quarry, all transfer points, and at the project construction site when such materials are determined to be unsuitable.

2.2 RIPRAP

Riprap gradation shall meet the requirements for HD, HI, HK, and LC riprap indicated on the attached FORM 4055. The stone shall be well graded within

the limits specified.

2.2.1 General

All stone shall be durable material. Stone for riprap shall have a specific gravity between 2.55 and 2.75 unless approved by the Contracting Officer. Stone shall be of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used. It shall be free from cracks, blast fractures, bedding, seams and other defects that would tend to increase its deterioration from natural causes. The stone shall be clean and reasonably free from soil, quarry fines, and shall contain no refuse. Any foreign material adhering to or combined with the stone as a result of stockpiling shall be removed prior to placement. Neither the breadth nor the thickness of any piece of stone shall be less than one-third of it's length. Occasional pieces of stone slightly larger than the maximum weight will be permitted provided the gradation and voids are not unduly affected and that surface tolerances are met.

2.2.2 Production

Riprap shall be handled and selectively loaded onto trucks in a manner to avoid segregation and provide a distribution of stone sizes consistent with the gradation band and test samples. Each truckload shall be representative of the gradation requirements.

2.3 BEDDING MATERIAL

Bedding material shall consist of cobbles, gravel, and sand or crushed stone and shall be well graded. The bedding material shall be composed of tough, durable particles, adequately free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered objectionable by the Contracting Officer. The aggregate shall meet the quality requirements of ASTM C 33. Grading shall conform to the following requirements:

U.S. STANDARD SIEVE	PERMISSIBLE LIMITS PERCENT BY WEIGHT, PASSING
BEDDING STONE	
6 in.	100
4 in.	79-100
3 in.	71-89
1-1/2 in.	54-71
3/4 in.	38-54
3/8 in.	22-38
No. 4	7-22
No. 10	0-5

The bedding materials shall be well-graded between the limits shown. At least one test shall be performed on each 1000 tons to be delivered to the project site in accordance with ASTM C 136. All points on individual grading curves obtained from representative samples of bedding material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated gradation limits plotted on ENG FORM 2087 or similar form. The individual gradation curves within these limits shall not exhibit abrupt changes in slope denoting either gap grading or scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the filter. Geotextile shall be as specified below.

2.4 GEOTEXTILE

Geotextile shall meet the requirements of NDDOT SS Section 858, geotextile fabric for riprap (Type RR).

2.5 SOURCE QUALITY CONTROL

Sampling and testing shall be performed by and at the expense of the Contractor at no additional cost to the Government. Gradation tests shall be performed by either Method A or B at the frequency listed below. A satisfactory gradation test shall be obtained prior to any hauling and delivery of materials. All tests, including failing tests shall be submitted. Tests performed on material which do not meet gradation and shape requirements will not be counted as part of the tests required. The Contracting Officer shall be informed immediately of test results and draft copies of test results shall be furnished at the Contracting Officers request.

2.5.1 Sampling Requirements

The Contracting Officer shall direct the time and location of sampling, unless waived. Samples shall be taken from stockpiles or loaded trucks, and not directly from conveyers or chutes.

2.5.2 Riprap Gradation Testing

a. Notification. The Contracting Officer shall be informed 24 hours before each riprap test

b. Testing Frequency. At least 1 gradation test shall be performed per source prior to delivery to the project site. Perform 1 test of riprap stockpiled or delivered to the project site.

c. Sample Size. The sample shall have a minimum gross weight not less than 25 times the maximum stone size in the specified gradation (25 * W₁₀).

2.5.2.1 Riprap Test Method A

Test method A shall consist of weighing all stones larger than 5 pounds in a sample. Five to seven weight classes shall be selected within the range of stone sizes. Each stone shall be weighed and recorded on the work sheet for method A. The weight of stones shall be summed for each weight class; after which calculations and a plot of the gradation shall be completed in accordance with accepted practice for soil and aggregate gradations

2.5.2.2 Riprap Test Method B

Test method B shall consist of separating the stones into 5 to 7 piles, ordered by size. The sample shall be separated on a clean, hard surface that is free of smaller stones that could become mixed with the sample. The stones shall be visually screened to place them into appropriate piles. All stones shall be separated and placed into a pile before weighing. After separating, the smallest and largest rock in each pile shall be weighed and recorded. The stones shall be adjusted as necessary so that the weight classes do not overlap. After adjustment is adequate and weight classes have been established, each pile of stone shall be weighed and recorded on the work sheet for method B. Calculations and a plot of the gradation

Grand Forks Phase 1 Levees

shall be completed in accordance with accepted practice for soil and aggregate gradations

2.5.3 Riprap Bedding Gradation Testing

- a. Notification: The Contracting Officer shall be informed 24 hours before each riprap bedding test.
- b. Testing frequency: At least 1 gradation test shall be performed per source prior to delivery to the project site. Perform 1 test of riprap bedding stockpiled or delivered to the project site.
- c. Sample size: The sample shall have a minimum gross weight of 150 pounds.

2.5.3.1 Gradation Tests for Riprap Bedding

The sampling and testing procedures for gradation tests for bedding shall be in accordance with EM 1110-2-1906. Report results on ENG FORM 2087, GRADATION CURVES, provided at the end of this Section.

2.6 STOCKPILES

Stockpiles shall be formed by a series of layers or truckload dumps, where the rock essentially remains where it is placed. Subsequent layers shall be started 10 feet from the edge of the previous layer so that the rock will not roll down the edges of the pile. Any stone which has become contaminated with soil or refuse shall not be put into the work unless the contaminating material has been removed prior to placement.

PART 3 EXECUTION

3.1 CONSTRUCTION TOLERANCES

Work shall generally meet the required elevations, slope and grade; and the outer surfaces shall be even and present a neat appearance.

- a. Subgrades. Areas on which stone protection will be placed shall be graded and/or dressed to conform to cross sections shown on the contract drawings within 2 inches above or below the neat lines. The surface shall be reasonably smooth to match tolerances normally obtained by rough grading with bladed equipment. For subaqueous construction in greater than 3 feet of water, the tolerance shall be 6 inches.
- b. Layer Thickness. Any layers found to be less than 80% of the specified thickness shall be corrected. This tolerance shall only be exceeded on isolated spot checks, and if the tolerance is commonly exceeded, the Contractor shall change his construction methods to improve the quality control. If it is necessary to estimate riprap quantities for changes, the volume shall be based on neat line dimensions and the plan dimension for thickness. A conversion factor of 1.5 tons/CY shall be used to determine quantity requirements, unless otherwise directed by the Contracting Officer.
- c. Surface Tolerances. The finished surface tolerance above the neat line shall generally not deviate from the lines and grades shown by

more than half (1/2) the average stone dimension of the gradation range. Riprap that has a rough and uneven surface shall be reworked by hand to stabilize stones that wobble and are out of tolerance, except where the Contracting Officer approves use of equipment. Rearranging of individual stones shall be required to the extent necessary to obtain a well-graded distribution of stone sizes.

3.2 FOUNDATION PREPARATION

Foundation areas shall be excavated or filled to the lines and grades shown. Filling shall be with earth similar to the adjacent material and shall be well compacted. Immediately prior to placing riprap, the prepared subgrade will be inspected by the Contracting Officer unless waived; and no material shall be placed thereon until that area has been approved.

3.3 PLACEMENT OF GEOTEXTILE

3.3.1 Construction Requirements

Installation, overlapping fabric and equipment restrictions shall conform with requirements of NDDOT SS Section 709. Geotextile fabric shall be placed perpendicular to the direction of flow with the upstream strip overlapping the downstream strip.

3.4 PLACEMENT OF BEDDING MATERIAL ON GEOTEXTILE

Bedding material shall be spread uniformly on the geotextile to the slope lines and grades as indicated on the contract drawings and in such manner as to avoid damage to the geotextile. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Placing of bedding material by methods which tend to segregate the particle sizes within the layer will not be permitted. Any damage to the surface of the geotextile during placement of bedding material shall be repaired before proceeding with the work. Compaction of material placed on the geotextile will not be required, but shall be finished to present an adequately even surface, free from mounds or windrows.

3.5 PLACEMENT OF RIPRAP

3.5.1 Layer Requirements

Riprap shall be placed in a manner which will produce a well-graded mass of rock with the minimum practicable percentage of voids. The large stones shall be well distributed. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones.

3.5.2 Construction Methods

Unsegregated stone shall be placed in a systematic manner. Riprap shall be placed to its full course thickness in one operation and in such manner as to avoid displacing underlying material. Placement shall typically begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Final finish of slope shall be performed as the material is placed.

Placing riprap in layers will not be permitted. Placing riprap by dumping

it into chutes, or by any method likely to cause segregation of the various sizes, shall not be permitted. Placing riprap by dumping it at the top of the slope and pushing it down the slope shall not be permitted. No equipment shall be operated directly on the completed stone protection system. Dump trucks shall be equipped with bottom hinged tailgates if rock is directly placed into position with the trucks.

3.5.3 Riprap Placement on Geotextile

Riprap shall be placed over the geotextile by methods that do not tear, puncture, or reposition the fabric. Equipment shall be operated so as to minimize the drop height of the stone without contacting and damaging the geotextile. Generally this will be about 1 foot of drop from the bucket to the placement surface. Riprap shall be placed so that stones do not roll downhill.

3.6 MAINTENANCE

The Contractor shall maintain the stone protection and underlying works until accepted by the Contracting Officer. When appropriate, the Contractor shall place stone protection in a timely manner to reduce risk of scour. Any material displaced prior to acceptance and due to the Contractor's negligence or neglect shall be replaced at the Contractor's expense.

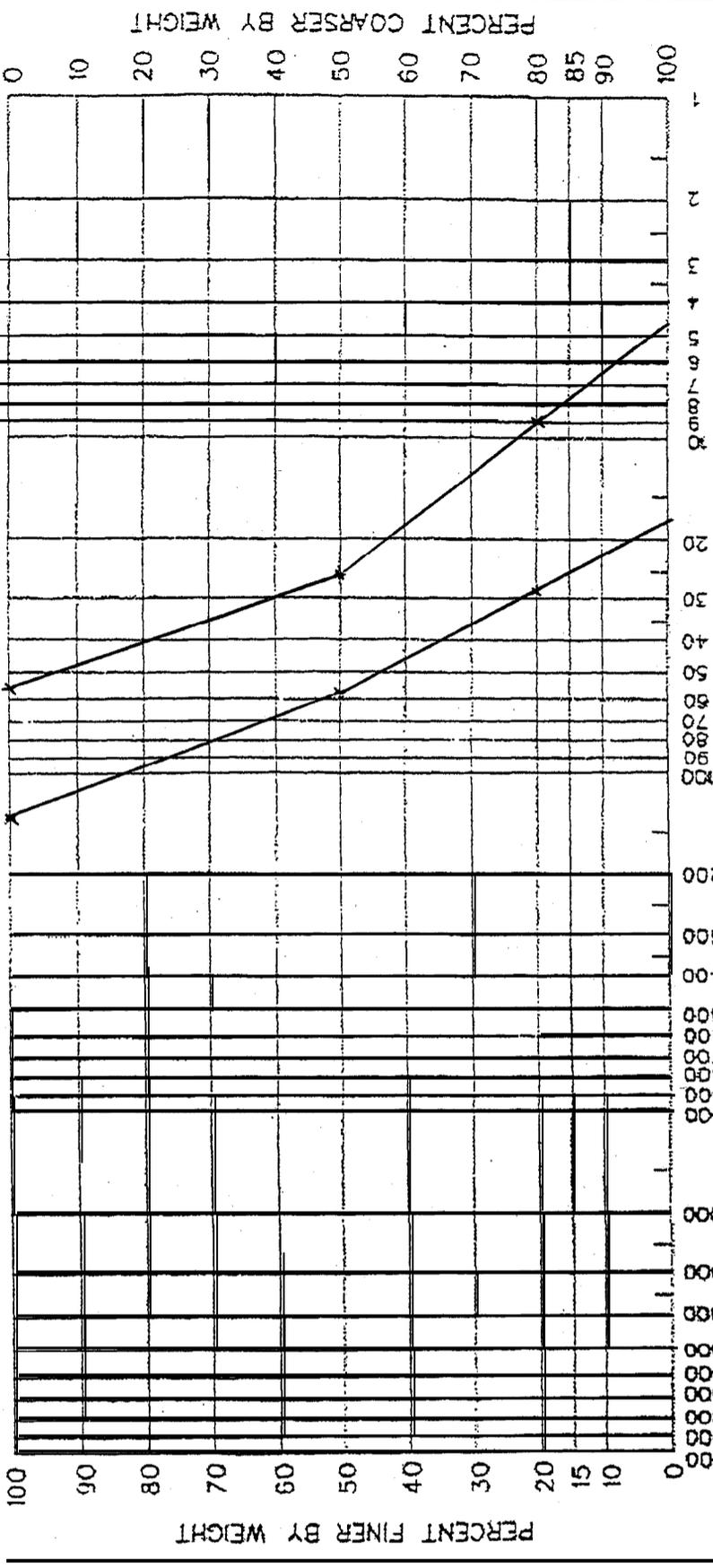
3.7 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain quality control for all work performed at the job site under this section to assure compliance with contract requirements. He shall maintain records of his quality control tests, inspections and corrective actions. Quality control measures shall cover all construction operations including, but not limited to, the placement of all materials to the slope and grade lines shown and in accordance with this section.

In addition to the Contractor's system to establish and maintain quality control for stone placement operations, the following information shall be recorded and promptly provided to the Contracting Officer on request:

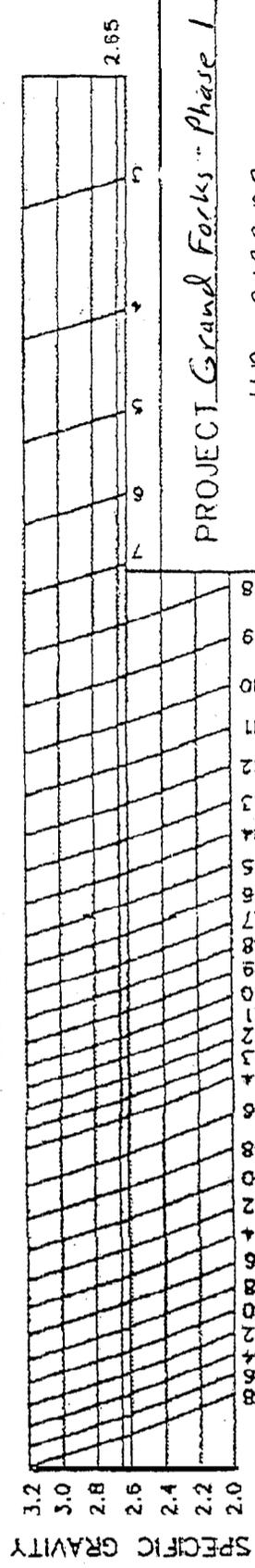
- a. Record tonnage of stone placed in completed sections of the work and check quantity for compliance with design sections.
- b. Check for uniform thickness of material layers.

-- End of Section --



SPECIFIC GRAVITY OF STONE
SPECIFIC GRAVITY OF STONE

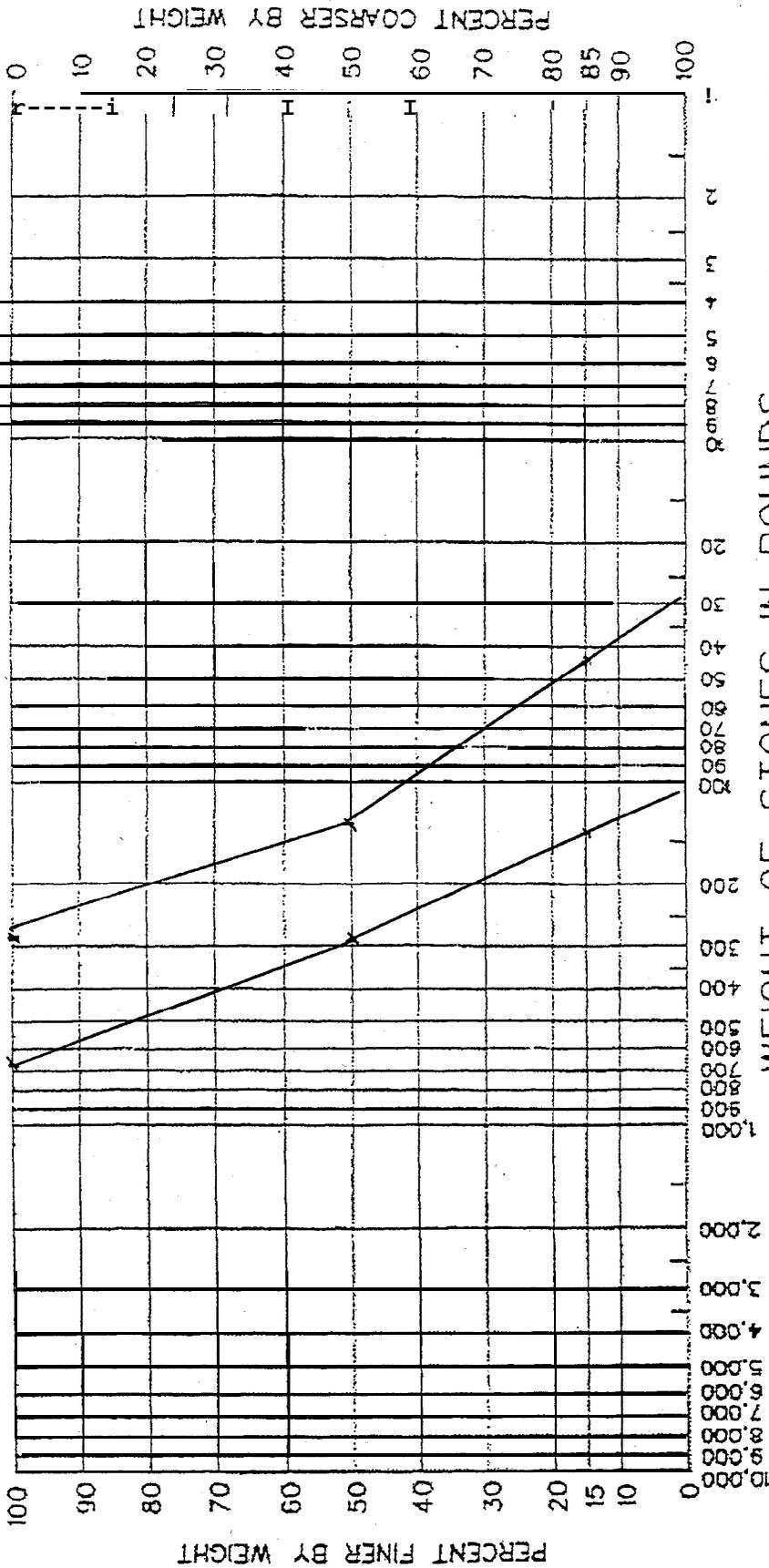
WEIGHT OF STONES IN POUNDS
(ASSUMING STONE SHAPE MIDWAY BETWEEN A SPHERE AND CUBE)



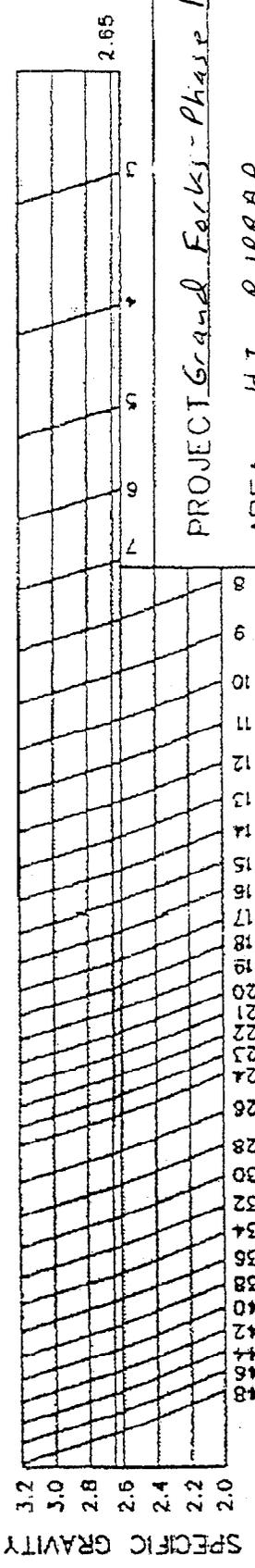
SPECIFIC GRAVITY OF STONE = 2.65

PROJECT Grand Forks - Phase 1
 AREA HD RIPRAP
 DATE 02/27/01

RIPRAP/ROCKFILL GRADATION CURVE

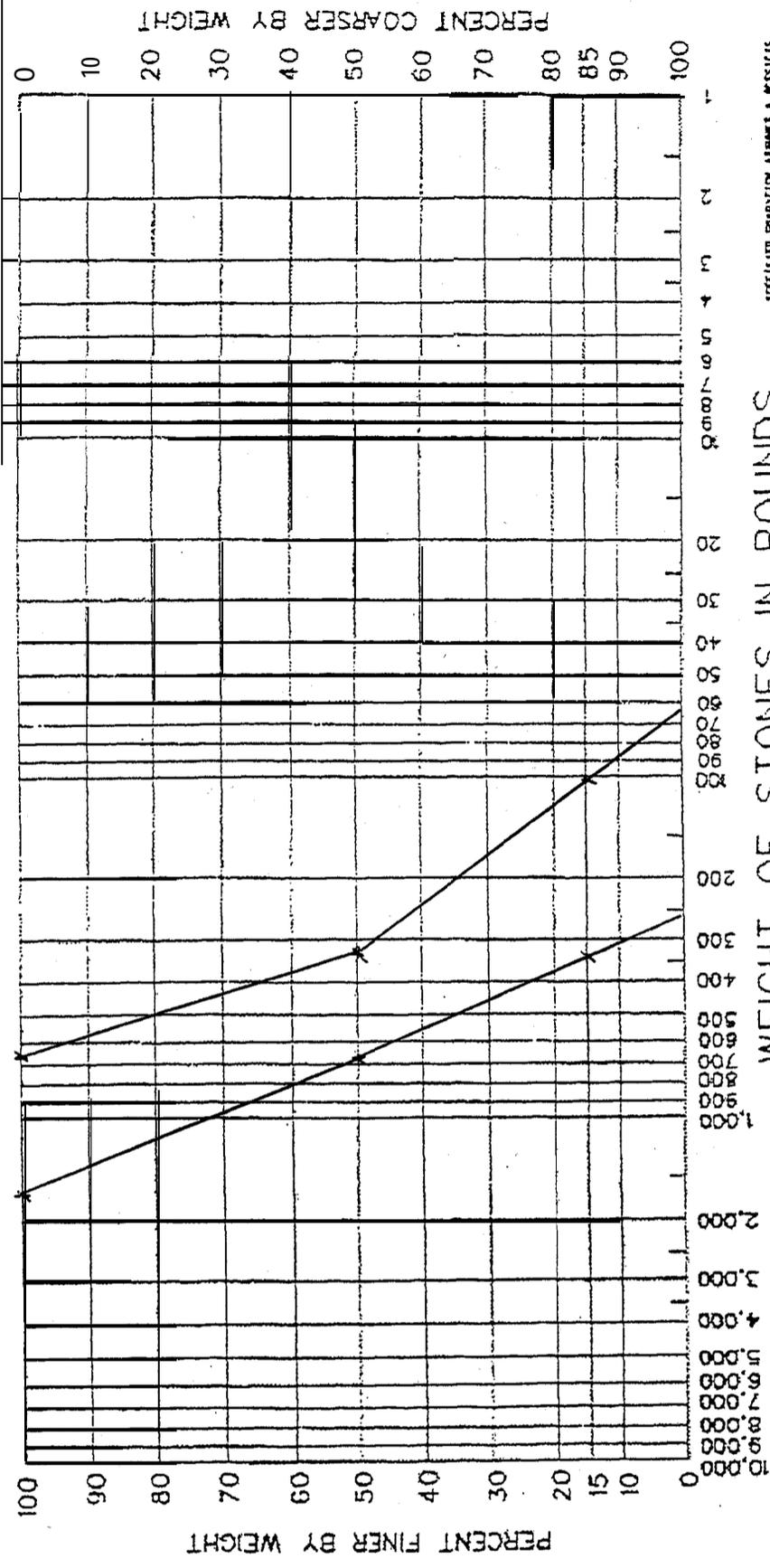


WEIGHT OF STONES IN POUNDS
 (ASSUMING STONE SHAPE MIDWAY BETWEEN A SPHERE AND CUBE)

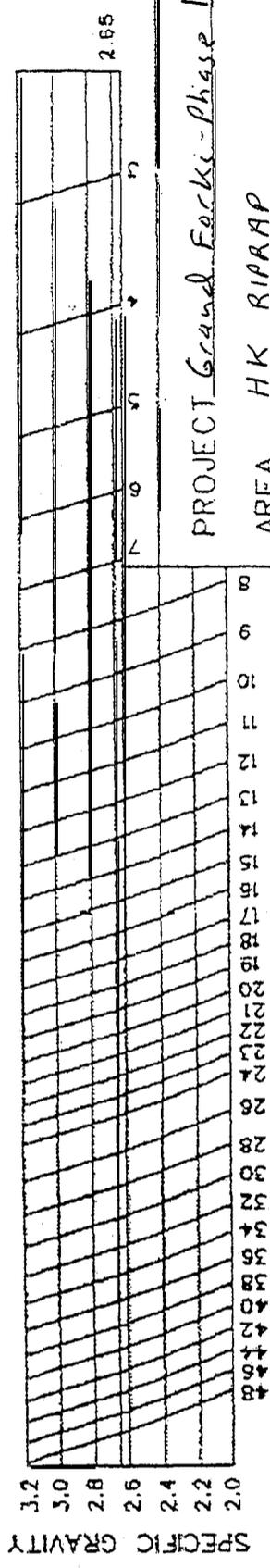


SPECIFIC GRAVITY OF STONE = **2.65**

PROJECT Grand Forks - Phase 1
 AREA HI RIPRAP
 DATE 02/27/01
 RIPRAP/ROCKFILL GRADATION CURVE



WEIGHT OF STONES IN POUNDS
 (ASSUMING STONE SHAPE MIDWAY BETWEEN A SPHERE AND CUBE)



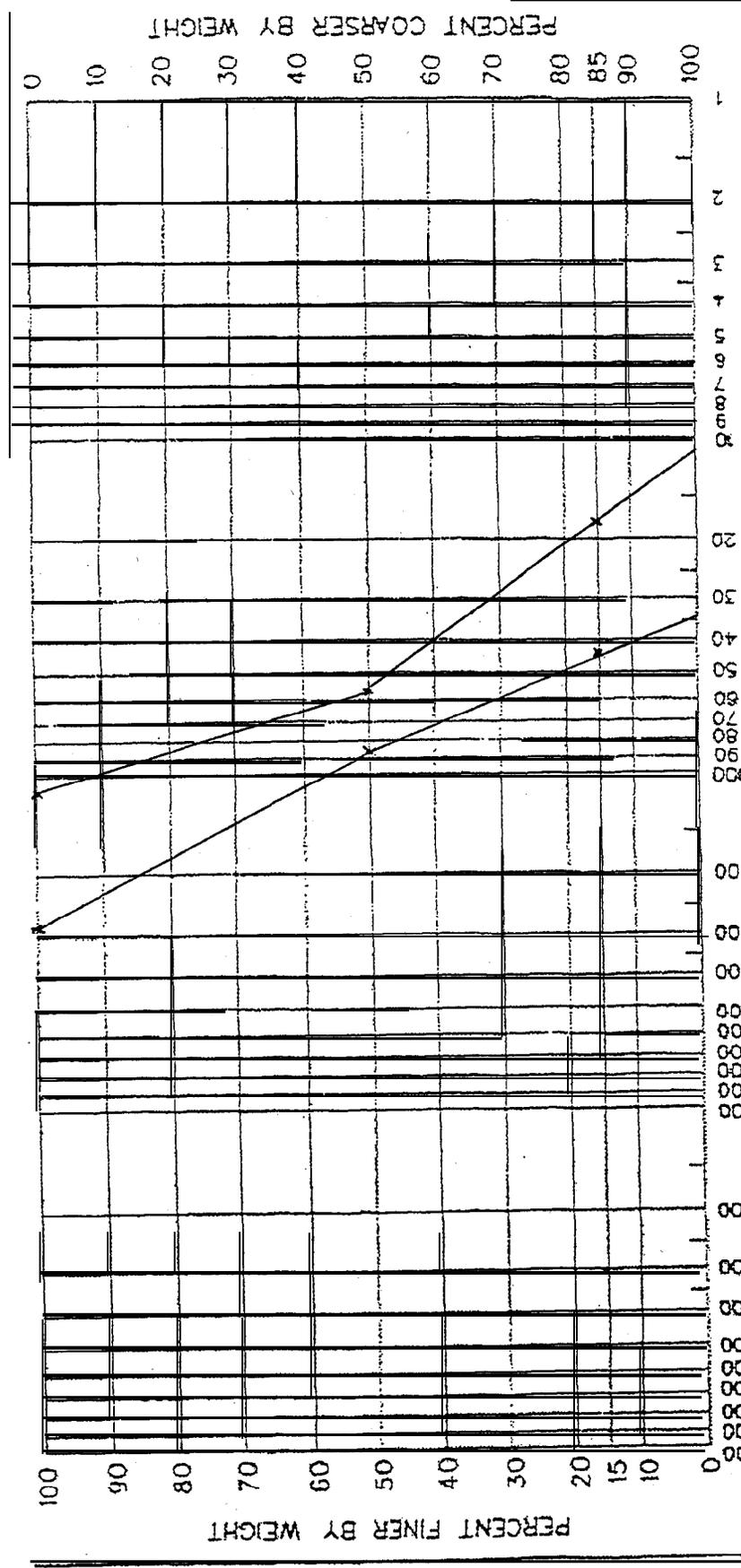
SIZE OF STONE IN INCHES

PROJECT Grand Forks - Phase 1
 AREA HK RIPRAP

DATE 02/27/01

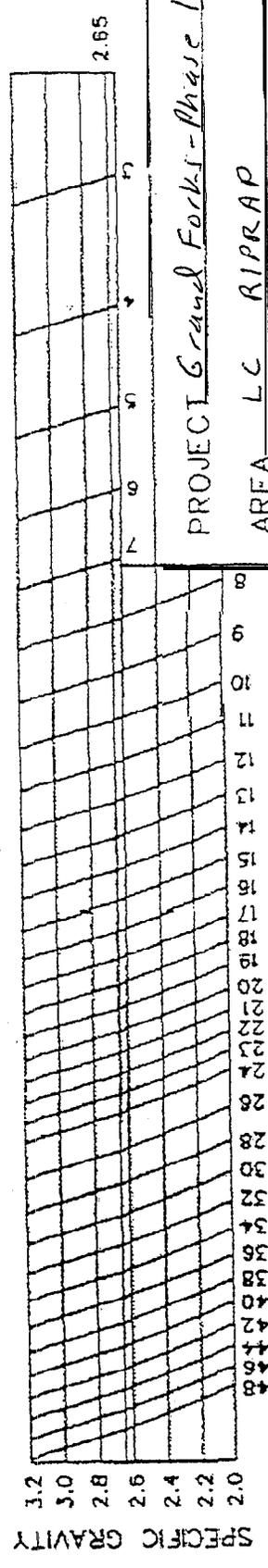
SPECIFIC GRAVITY OF STONE = 2.65

RIPRAP/ROCKFILL GRADATION CURVE



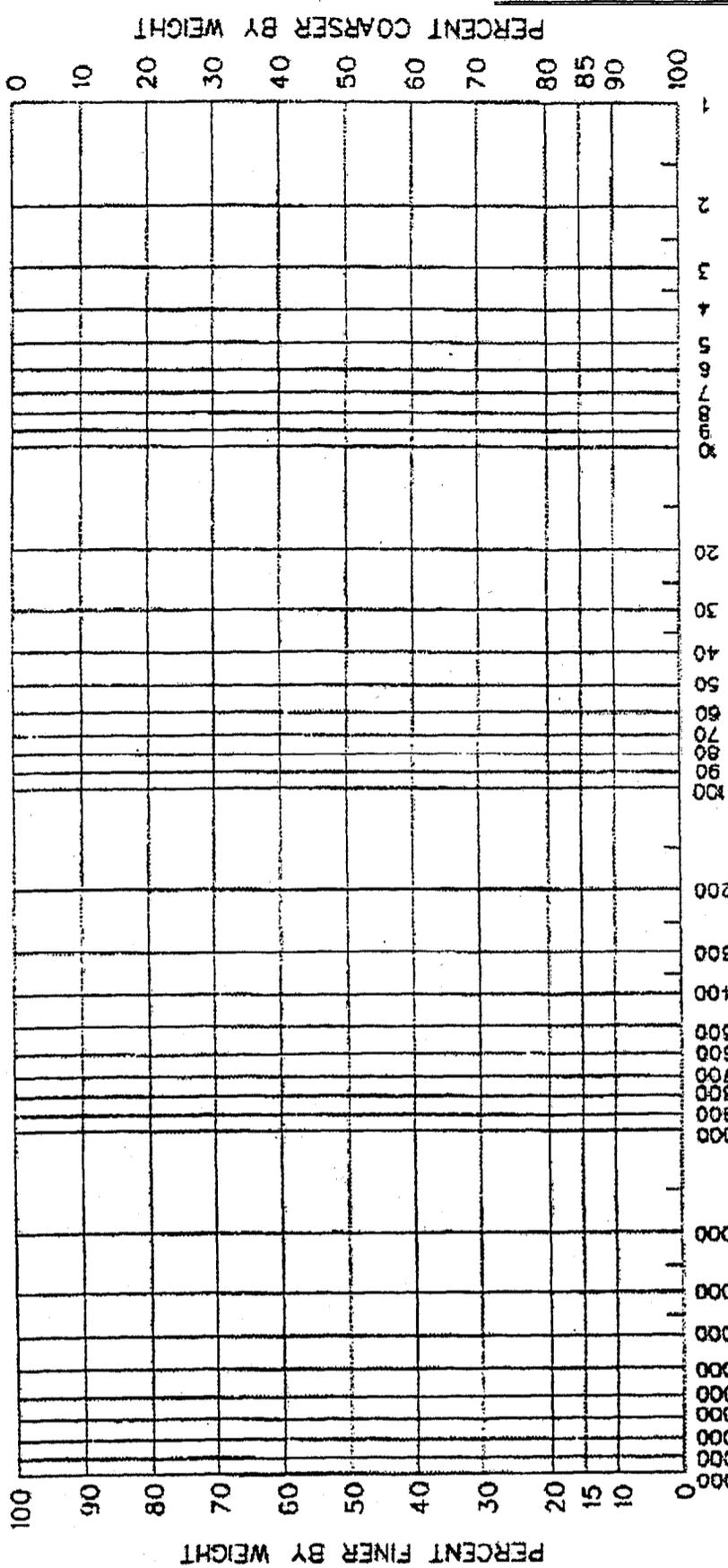
SPECIFIED GRADATION STONES & SPECIFIC GRAVITY OF STONE SAME TO 2.65

WEIGHT OF STONES IN POUNDS
(ASSUMING STONE SHAPE MIDWAY BETWEEN A SPHERE AND CUBE)



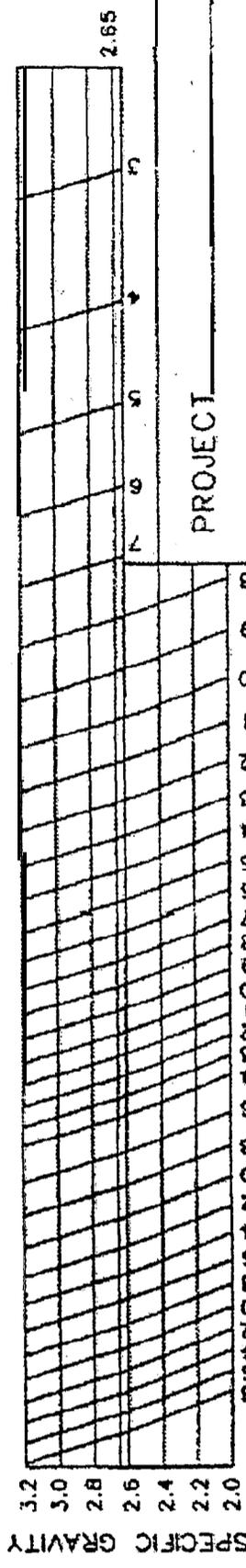
SPECIFIC GRAVITY OF STONE = 2.65

PROJECT Grand Forks - Phase 1
 AREA LC RIPRAP
 DATE 02/27/01
 RIPRAP/ROCKFILL GRADATION CURVE



WEIGHT OF STONES IN POUNDS
 (ASSUMING STONE SHAPE MIDWAY BETWEEN A SPHERE AND CUBE)

SPECIFIC GRAVITY ASSUMES A SPECIFIC GRAVITY OF STONE EQUAL TO 2.65



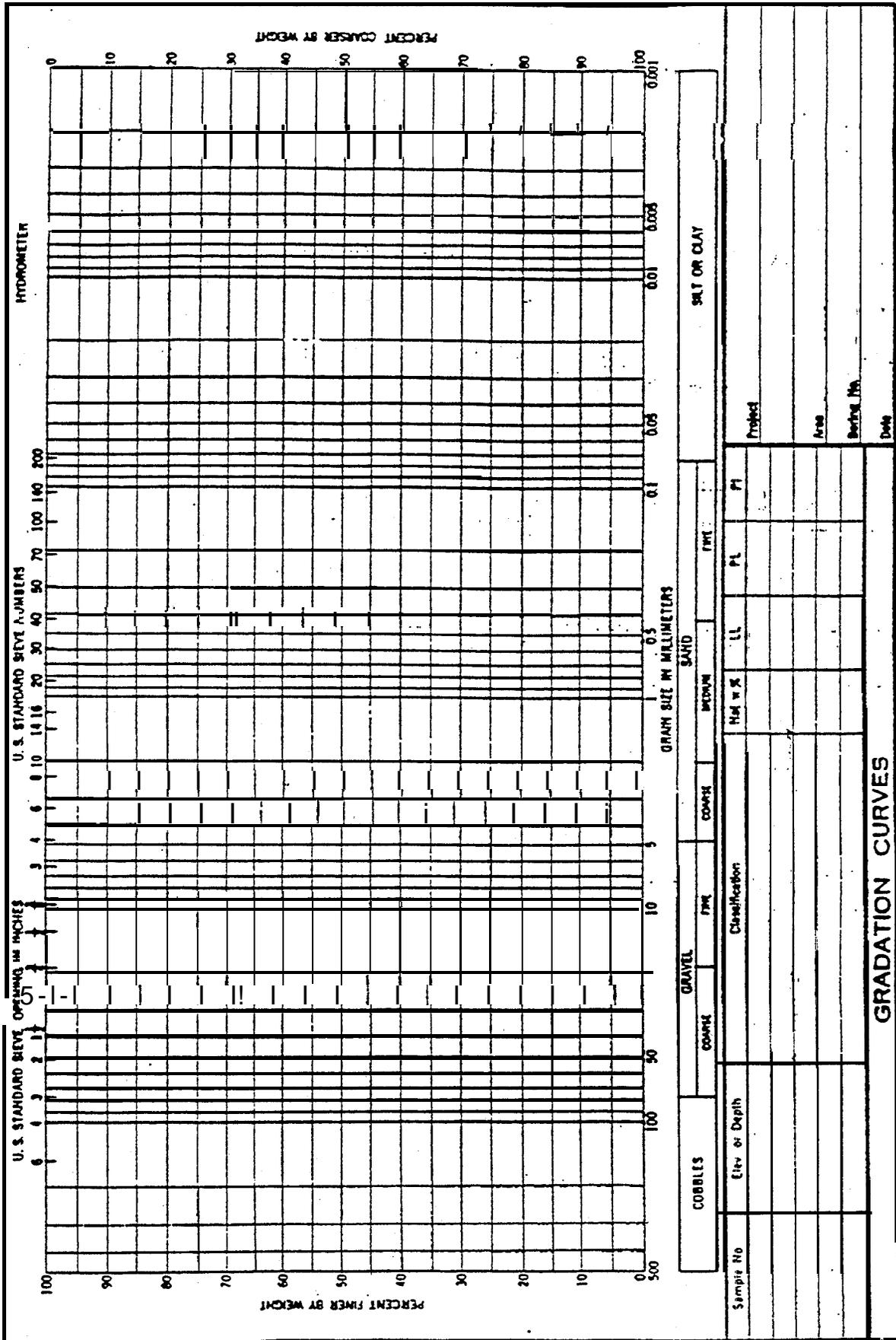
PROJECT _____

AREA _____

DATE _____

SPECIFIC GRAVITY OF STONE =

RIPRAP/ROCKFILL GRADATION CURVE



GRADATION CURVES

WORK SHEET FOR GRADATION ANALYSIS OF RIPRAP METHOD B

Project Name:	Date:
Riprap Type:	Test No.
Source, Quarry, or Pit:	
Sample Location:	Test Made By:

Part 1. Separate rock into 5 to 7 piles, ordered by size. The largest pile should contain 2 to 5 stones. Intermediate piles between the largest stones and those smaller than 5 pounds should be approximately equal in total weight. Separate all stones before weighing.

Part 2. Summary Table.

(1) WEIGHT CLASSES		(2)	(3)	(4)
PASSING (stone wt. in lbs.)	RETAINED (stone wt. in lbs.)	TOTAL WEIGHT EACH CLASS (lbs.)	CUMMULATIVE WEIGHT PASSING (lbs.)	TOTAL PERCENT PASSING (%)
	5 lbs.			
5 lbs.	PAN			
SAMPLE TOTAL			-----	-----

Column (1) Weigh the smallest and largest stone in each pile. If weight classes overlap, adjust stones as necessary and repeat.
 Column (2) Weigh the total amount of rock in each pile and record.
 Column (3) Add column (2) from bottom up to get cumulative weight passing.
 Column (4) Divide column (3) by sample total to get total percent passing.

**TABLE 3-1A
STANDARD RIPRAP GRADATIONS, LOW OR HIGH TURBULENCE ZONES**

Limits of Stone Weight (pounds) for Percent Lighter by Weight

ID ¹	D ₅₀ (max) ² [INCHES]	100		50		15		5 ³	
		MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
Specific weight = 155pcf⁴									
		90	40						
	12.4	140	60	40	20	20	5		
	14.4			60	30	30	10		
	16.2	200	80	80	40	80	10		
	ao.4	400	160	160	80	130	30		
	24.0	650	260	280	130		40		
	37.7	1000	400	430	200	210	60		
	31.7	raao	600	650	300	330	100		
Specific weight = 165pcf⁵									
R20							5		
R30	14.111.9	1485	40	35	20	30	10	15	5
			60	85	30	40	15		8
R45	16.0	205	90	170	45	80	25	65	15
R140	20.0	690	280	290	180	150	45	130	25
R270	30.0	1350	550	570	270	260	85	220	50

lot.8 :

1. The identifier (ID) designates Riprap gradation, and the approximate W₅₀ (min) in pounds.
2. Relationship between diameter and weight is based on the shape of a sphere.
3. Optional control of gradation.
4. Stone weight limit data from EM 1110-2-1601 (1 Jul 91), Appendix F, Table 6. Table 6 was developed by the Lower Mississippi Valley Division (LMVD) and was unintentionally omitted from the Engineering Manual.
5. Stone weight limit data developed by ED-GH branch for CENCS based on LMVD procedure.

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02464

METAL SHEET PILING

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE AND HANDLING

PART 2 PRODUCTS

- 2.1 METAL SHEET PILING
- 2.2 APPURTENANT METAL MATERIALS
- 2.3 TESTS, INSPECTIONS, AND VERIFICATIONS
 - 2.3.1 Materials Tests

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Pile Driving Equipment
 - 3.1.1.1 Driving Hammers
 - 3.1.2 Placing and Driving
 - 3.1.2.1 Placing
 - 3.1.2.2 Driving
 - 3.1.3 Cutting-Off and Splicing
 - 3.1.4 Inspection of Driven Piling
 - 3.1.5 Pulling and Redriving

-- End of Section Table of Contents --

SECTION 02464

METAL SHEET PILING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6/A 6M (2000) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

ASTM A 328/A 328M (2000) Steel Sheet Piling

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

 Pile Driving Equipment; GA

 Complete descriptions of sheet piling driving equipment including hammers, extractors, protection caps and other installation appurtenances shall be submitted for approval prior to commencement of work.

 Pulling and Redriving; GA

 The proposed method of pulling sheet piling shall be submitted and approved prior to pulling any piling.

SD-04 Drawings

 Metal Sheet Piling; GA

 Detail drawings for sheet piling including fabricated sections shall show complete piling dimensions and details, driving sequence and location of installed piling. Detail drawings shall include details and dimensions of templates and other temporary guide structures for installing piling. Detail drawings shall provide details of the method of handling piling to prevent permanent deflection, distortion or damage to piling interlocks.

 Driving; GA

 Records of the sheet piling driving operations shall be

submitted after driving is completed. These records shall provide a system of identification which shows the disposition of approved piling in the work, driving equipment performance data, piling penetration rate data, piling dimensions and top and bottom elevations of installed piling. The format for driving records shall be as directed.

SD-09 Reports

Materials Tests; GA

Certified materials tests reports showing that sheet piling and appurtenant metal materials meet the specified requirements shall be submitted for each shipment and identified with specific lots prior to installing materials. Material test reports shall meet the requirements of ASTM A 6/A 6M.

1.3 DELIVERY, STORAGE AND HANDLING

Materials delivered to the site shall be new and undamaged and shall be accompanied by certified test reports. The manufacturer's logo and mill identification mark shall be provided on the sheet piling as required by the referenced specifications. Sheet piling shall be stored and handled in the manner recommended by the manufacturer to prevent permanent deflection, distortion or damage to the interlocks. Storage of sheet piling should also facilitate required inspection activities. Sheet piling over 80 feet in length shall be handled using a minimum of two pickup points.

PART 2 PRODUCTS

2.1 METAL SHEET PILING

Metal sheet piling shall be hot-rolled steel sections conforming to ASTM A 328/A 328M or cold-formed steel sections formed from hot-rolled steel meeting the chemical and mechanical requirements of ASTM A 328/A 328M. The interlocks of sheet piling shall be free-sliding, provide a swing angle suitable for the intended installation but not less than 5 degrees when interlocked, and maintain continuous interlocking when installed. Sheet piling including special fabricated sections shall be full-length sections of the dimensions shown. Fabricated sections shall conform to the requirement and the piling manufacturer's recommendations for fabricated sections. Fabricated tees, wyes and cross pieces shall be fabricated of piling sections with a minimum web thickness of 1/2 inch. Sheet piling shall be provided with standard pulling holes.

2.2 APPURTENANT METAL MATERIALS

Metal plates, shapes, bolts, nuts, rivets and other appurtenant fabrication and installation materials shall conform to manufacturer's standards and to the requirements specified in the respective sheet piling standards.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

Requirements for material tests, workmanship and other measures for quality assurance shall meet all applicable standards.

2.3.1 Materials Tests

Materials tests shall conform to the following requirements. Sheet piling

and appurtenant materials shall be tested and certified by the manufacturer to meet the specified chemical, mechanical and section property requirements prior to delivery to the site. Testing of sheet piling for mechanical properties shall be performed after the completion of all rolling and forming operations. Testing of sheet piling shall meet the requirements of ASTM A 6/A 6M.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Pile Driving Equipment

Pile driving equipment shall conform to the following requirements.

3.1.1.1 Driving Hammers

Hammers shall be steam, air, or diesel drop, single-acting, double-acting, differential-acting, or vibratory type. The driving energy of the hammers shall be as recommended by the manufacturer for the piling weights and subsurface materials to be encountered.

3.1.2 Placing and Driving

3.1.2.1 Placing

Any excavation required within the area where sheet pilings are to be installed shall be completed prior to placing sheet pilings. Pilings shall be carefully located as shown. Pilings shall be placed plumb with out-of-plumbness not exceeding 1/8 inch per foot of length and true to line. Temporary wales, templates, master pilings current deflectors or guide structures shall be provided to insure that the pilings are placed and driven to the correct alignment. At least two templates shall be used in placing each piling and the maximum spacing of templates shall not exceed 20 feet. Pilings properly placed and driven shall be interlocked throughout their length with adjacent pilings to form a continuous diaphragm throughout the length or run of piling wall.

3.1.2.2 Driving

Prior to driving pilings in water a horizontal line shall be painted on both sides of each piling at a fixed distance from the bottom so that it shall be visible above the water line after installation. This line shall indicate the profile of the bottom elevation of installed pilings and potential problem areas can be identified by abrupt changes in its elevation. Pilings shall be driven with the proper size hammer and by approved methods so as not to subject the pilings to damage and to ensure proper interlocking throughout their lengths. Driving hammers shall be maintained in proper alignment during driving operations by use of leads or guides attached to the hammer. Caution shall be taken in the sustained use of vibratory hammers when a hard driving condition is encountered to avoid interlock-melt or damages. The use of vibratory hammers should be discontinued and impact hammers employed when the penetration rate due to vibratory loading is one foot or less per minute. A protecting cap shall be employed in driving when using impact hammers to prevent damage to the tops of pilings. Pilings damaged during driving or driven out of interlock shall be removed and replaced at the Contractor's expense. Pilings shall be driven without the aid of a water jet unless otherwise authorized. Adequate precautions shall be taken to insure that pilings are driven

plumb. If at any time the forward or leading edge of the piling wall is found to be out-of-plumb in the plane of the wall the piling being driven shall be driven to the required depth and tapered pilings shall be provided and driven to interlock with the out-of-plumb leading edge or other approved corrective measures shall be taken to insure the plumbness of succeeding pilings. The maximum permissible taper for any tapered piling shall be 1/8 inch per foot of length. Pilings in each run or continuous length of piling wall shall be driven alternately in increments of depth to the required depth or elevation. No piling shall be driven to a lower elevation than those behind it in the same run except when the pilings behind it cannot be driven deeper. If the piling next to the one being driven tends to follow below final elevation it may be pinned to the next adjacent piling. If obstructions restrict driving a piling to the specified penetration the obstructions shall be removed or penetrated with a chisel beam. If the Contractor demonstrates that removal or penetration is impractical the Contractor shall make changes in the design alignment of the piling structure as directed to insure the adequacy and stability of the structure. Pilings shall be driven to depths shown and shall extend up to the elevation indicated for the top of pilings. A tolerance of 1 inch above the indicated top elevation will be permitted. Pilings shall not be driven within 100 feet of concrete less than 7 days old.

3.1.3 Cutting-Off and Splicing

Pilings driven to refusal or to the point where additional penetration cannot be attained and are extending above the required top elevation in excess of the specified tolerance shall be cut off to the required elevation. Pilings driven below the required top elevation and pilings damaged by driving and cut off to permit further driving shall be extended as required to reach the top elevation by splicing when directed at no additional cost to the Government. Pilings adjoining spliced pilings shall be full length unless otherwise approved. Ends of pilings to be spliced shall be squared before splicing to eliminate dips or camber. Pilings shall be spliced together with concentric alignment of the interlocks so that there are no discontinuities, dips or camber at the abutting interlocks. Spliced pilings shall be free sliding and able to obtain the maximum swing with contiguous pilings. The tops of pilings excessively battered during driving shall be trimmed when directed at no cost to the Government. Piling cut-offs shall become the property of the Contractor and shall be removed from the site. The Contractor shall cut holes in pilings for bolts, rods, drains or utilities as shown or as directed. All cutting shall be done in a neat and workmanlike manner. A straight edge shall be used in cuts made by burning to avoid abrupt nicks. Bolt holes in steel piling shall be drilled or may be burned and reamed by approved methods which will not damage the surrounding metal. Holes other than bolt holes shall be reasonably smooth and the proper size for rods and other items to be inserted.

3.1.4 Inspection of Driven Piling

The Contractor shall inspect the interlocked joints of driven pilings extending above ground. Pilings found to be out of interlock shall be removed and replaced at the Contractor's expense.

3.1.5 Pulling and Redriving

In the pulling and redriving of piles as directed, the Contractor shall pull selected pilings after driving to determine the condition of the underground portions of pilings. Any piling so pulled and found to be

Grand Forks Phase 1 Levees

damaged to the extent that its usefulness in the structure is impaired shall be removed and replaced. Pilings pulled and found to be in satisfactory condition shall be redriven when directed.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02510

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 PIPING
 - 1.2.1 Service Lines
 - 1.2.2 Distribution Lines 80 mm (3 Inches) or Larger
 - 1.2.3 Potable Water Lines
 - 1.2.4 Excavation, Trenching, and Backfilling
- 1.3 SUBMITTALS
- 1.4 HANDLING
 - 1.4.1 Miscellaneous Plastic Pipe and Fittings

PART 2 PRODUCTS

- 2.1 PIPE
 - 2.1.1 Plastic Pipe
 - 2.1.1.1 PVC Plastic Pipe
 - 2.1.2 Copper Tubing
- 2.2 FITTINGS AND SPECIALS
 - 2.2.1 PVC Pipe System
 - 2.2.2 Copper Tubing System
- 2.3 JOINTS
 - 2.3.1 Plastic Pipe Jointing
 - 2.3.1.1 PVC Pipe
 - 2.3.2 Copper Tubing Jointing
- 2.4 MISCELLANEOUS ITEMS
 - 2.4.1 Service Clamps
 - 2.4.2 Corporation Stops
 - 2.4.3 Service Stops
 - 2.4.4 Service Boxes
 - 2.4.5 Disinfection
 - 2.4.6 Backflow Preventers
 - 2.4.7 Ball and Drain Valves
- 2.5 FRAMES AND COVERS
- 2.6 MANHOLE STEPS
- 2.7 STRUCTURES
 - 2.7.1 Precast Reinforced Concrete Manhole Sections
- 2.8 CHIMNEY SEALS

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Cutting of Pipe
 - 3.1.2 Adjacent Facilities
 - 3.1.2.1 Sewer Lines
 - 3.1.2.2 Water Lines

Grand Forks Phase 1 Levees

- 3.1.2.3 Copper Tubing Lines
- 3.1.2.4 Nonferrous Metallic Pipe
- 3.1.3 Joint Deflection
 - 3.1.3.1 Offset for Flexible Plastic Pipe
- 3.1.4 Placing and Laying
 - 3.1.4.1 Plastic Pipe Installation
 - 3.1.4.2 Piping Connections
- 3.1.5 Jointing
 - 3.1.5.1 PVC Plastic Pipe Requirements
 - 3.1.5.2 Copper Tubing Requirements
 - 3.1.5.3 Transition Fittings
- 3.1.6 Installation of Service Lines
- 3.1.7 Setting of Valves and Valve Boxes
 - 3.1.7.1 Location of Valves
 - 3.1.7.2 Location of Service Boxes
- 3.1.8 Thrust Restraint
 - 3.1.8.1 Thrust Blocks
- 3.1.9 Encasement
- 3.2 MANHOLE DETAILS
 - 3.2.1 General Requirements
 - 3.2.2 Jointing, Plastering and Sealing
 - 3.2.3 Setting of Frames and Covers
- 3.3 HYDROSTATIC TESTS
 - 3.3.1 Pressure Test
 - 3.3.2 Leakage Test
 - 3.3.3 Time for Making Test
 - 3.3.4 Concurrent Hydrostatic Tests
- 3.4 BACTERIALDISINFECTION
 - 3.4.1 Bacteriological Disinfection
- 3.5 CLEANUP

-- End of Section Table of Contents --

SECTION 02510

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 240/A 240M	(1996) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 923	(1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Materials
ASTM D 412	(1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 624	(1991; R 1998) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM F 593	(1998) Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F 594	(1998) Stainless Steel Nuts

ASME INTERNATIONAL (ASME)

ASME B16.26	(1988) Cast Copper Alloy Pip Flanges, Class 150, 300, 400, 600, 900, 1500, and 2500, and Flanged Fittings, Class 150 and 300
-------------	--

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(1992) Hypochlorites
-----------	----------------------

Grand Forks Phase 1 Levees

AWWA B301	(1992) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105	(1993) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids
AWWA C153	(1994; Errata Nov 1996) Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm Through 610 mm) and 54 In. Through 64 In. (1,400 mm Through 1,600 mm) for Water Service
AWWA C800	(1989) Underground Service Line Valves and Fittings
AWWA C900	(1997; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution
AWWA M23	(1980) Manual: PVC Pipe - Design and Installation

ASBESTOS CEMENT PIPE PRODUCERS ASSOCIATION (ACPPA)

ACPPA Work Practices	(1988) Recommended Work Practices for A/C Pipe
----------------------	--

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49	(1994) Hazardous Chemicals Data
NFPA 325-1	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 704	(1996) Identification of the Fire Hazards of Materials for Emergency Response

NSF INTERNATIONAL (NSF)

NSF 61	(1999) Drinking Water System Components - Health Effects (Sections 1-9)
--------	---

1.2 PIPING

This section covers water distribution and service lines, and connections to building service at a point approximately 5 feet outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Service Lines

Grand Forks Phase 1 Levees

Piping for water service lines less than 3 inches in diameter shall be copper tubing.

1.2.2 Distribution Lines 80 mm (3 Inches) or Larger

Piping for water distribution lines 3 inches or larger shall be polyvinyl chloride (PVC).

1.2.3 Potable Water Lines

Piping and components of potable water systems which come in contact with the potable water shall conform to NSF 61.

1.2.4 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Installation; FIO

The manufacturer's recommendations for each material or procedure to be utilized.

Satisfactory Installation; FIO

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications, and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

SD-09 Reports

Bacteriological Disinfection; GA.

Test results from commercial laboratory verifying disinfection.

1.4 HANDLING

Pipe and accessories shall be handled to ensure delivery to the trench in sound, undamaged condition, including no injury to the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor in a satisfactory manner, at no additional cost to the Government. No other pipe or material shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be

kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.4.1 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PVC Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

- a. Pipe 4 through 12 inch Diameter: Pipe, couplings and fittings shall conform to AWWA C900, SDR of 18, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.

2.1.2 Copper Tubing

Copper tubing shall conform to ASTM B 88M, Type K, annealed.

2.2 FITTINGS AND SPECIALS

2.2.1 PVC Pipe System

- a. For pipe 4 inch diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 150 psi pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or fittings and specials may be of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with AWWA C153. All fittings shall be encased in polyethylene conforming to AWWA C105.

2.2.2 Copper Tubing System

Fittings and specials shall be flared and conform to ASME B16.26.

2.3 JOINTS

Grand Forks Phase 1 Levees

2.3.1 Plastic Pipe Jointing

2.3.1.1 PVC Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer.

2.3.2 Copper Tubing Jointing

Joints shall be compression-pattern flared and shall be made with the specified fittings.

2.4 MISCELLANEOUS ITEMS

2.4.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a 18-8 Type 304 stainless steel shell, bolts, washers, and nuts. Clamps shall have a SBR compound gasket.

2.4.2 Corporation Stops

Corporation stops shall have standard corporation stop thread conforming to AWWA C800 on the inlet end, with flanged joints, compression pattern flared tube couplings, or wiped joints.

2.4.3 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 200 psi.

2.4.4 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

2.4.5 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

2.4.6 Backflow Preventers

Backflow preventers shall provide protection in cross-connection control and containment. They shall be furnished with NPT connections. Backflow preventers shall have bronze body construction, modular design, replaceable seats, ball valve test cocks, and captures spring assemblies.

Grand Forks Phase 1 Levees

2.4.7 Ball and Drain Valves

Ball and drain valves shall be full port resilient seated bronze valves having tee handles.

2.5 FRAMES AND COVERS

Frames and covers shall be cast iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, with 2 concealed pick holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Water" shall be stamped or cast into covers so that it is plainly visible.

2.6 MANHOLE STEPS

Provide manhole steps constructed of cast iron. Comply with all applicable OSHA regulations. Precast steps into barrel sections.

2.7 STRUCTURES

2.7.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

2.8 CHIMNEY SEALS

Chimney seals shall be provided with manhole castings. Extensions shall also be provided as required. When chimney seals are used, manhole cones shall have a minimum vertical top segment of 2 inches. The sleeve and extension shall be extruded from a high-grade rubber compound conforming to the applicable requirements of ASTM C 923. The bands used for compressing the sleeve and extension shall be fabricated from 16 gauge stainless steel conforming to ASTM A 240/A 240M Type 304. Screws, bolts and nuts shall be stainless steel conforming to ASTM F 593 and ASTM F 594, Type 304. Chimney seals shall be manufactured by Cretex Specialty Products, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.2 Adjacent Facilities

3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe, for a distance of at least 10 feet each side of the crossing, shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

3.1.2.3 Copper Tubing Lines

Copper tubing shall not be installed in the same trench with ferrous piping materials.

3.1.2.4 Nonferrous Metallic Pipe

Where nonferrous metallic pipe, e.g. copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches shall be maintained between pipes.

3.1.3 Joint Deflection

3.1.3.1 Offset for Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but shall not exceed 5 degrees.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Water-line materials shall not be dropped or dumped into the trench. Abrasion of the pipe coating shall be avoided. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by and at the Contractor's expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 Plastic Pipe Installation

PVC pipe shall be installed in accordance with AWWA M23.

3.1.4.2 Piping Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA Work Practices.

3.1.5 Jointing

3.1.5.1 PVC Plastic Pipe Requirements

- a. Pipe 4 through 12 inch diameter: Joints shall be elastomeric gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 4 inch diameter with configuration using elastomeric ring gasket.

3.1.5.2 Copper Tubing Requirements

Joints shall be made with flared fittings. The flared end tube shall be pulled tightly against the tapered part of the fitting by a nut which is part of the fitting, so there is metal-to-metal contact.

3.1.5.3 Transition Fittings

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.6 Installation of Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 5 feet outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines approximately 5 feet from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

3.1.7 Setting of Valves and Valve Boxes

3.1.7.1 Location of Valves

After delivery, valves shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be tamped around each valve box to a distance of 4 feet on all sides of the box, or the undisturbed trench face if less than 4 feet.

3.1.7.2 Location of Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

3.1.8 Thrust Restraint

Plugs, caps, tees and bends deflecting 11.25 degrees or more, either vertically or horizontally, on waterlines 4 inches in diameter or larger, shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be thrust blocks.

3.1.8.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2,000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.9 Encasement

Encase ductile iron fittings with polyethylene sheeting.

3.2 MANHOLE DETAILS

3.2.1 General Requirements

Manholes shall be constructed of precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. Free drop inside the manholes shall not exceed 18 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels; drop manholes shall be constructed whenever the free drop would otherwise be greater than 1 foot 6 inches.

3.2.2 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

3.2.3 Setting of Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 2 inches higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

3.3 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fittings, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

3.3.1 Pressure Test

After the pipe is laid, the joints completed and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

- a. Wet or unstable soil conditions in the trench.
- b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.
- c. Maintaining the trench in an open condition would delay completion of the project.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.3.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 200 psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled. Piping installation will not be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

$$L = 0.0001351ND(P \text{ raised to } 0.5 \text{ power})$$

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

3.3.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

3.3.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be as specified. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

- a. Pressure test and leakage test may be conducted concurrently.
- b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

3.4 BACTERIALDISINFECTION

3.4.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as specified. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be either

liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to paragraph MISCELLANEOUS ITEMS. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the water lines in an approved manner. Polyvinyl Chloride (PVC) pipe lines shall be chlorinated using only the above specified chlorinating material in solution. The agent shall not be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. Valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. From several points in the unit, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory shall be certified by the state's approving authority for examination of potable water. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

3.5 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02531

SANITARY SEWERS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 PIPE
 - 2.1.1 Plastic Pipe
 - 2.1.1.1 PVC Pipe
- 2.2 REQUIREMENTS FOR FITTINGS
 - 2.2.1 Fittings for Plastic Pipe
 - 2.2.1.1 Fittings for PVC Pipe
- 2.3 JOINTS
 - 2.3.1 Plastic Pipe Jointing
- 2.4 FRAMES AND COVERS
- 2.5 MANHOLE STEPS
- 2.6 STRUCTURES
 - 2.6.1 Precast Reinforced Concrete Manhole Sections
- 2.7 CHIMNEY SEALS
- 2.8 VALVES
 - 2.8.1 Gate Valves
- 2.9 VALVE BOXES

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Adjacent Facilities
 - 3.1.1.1 Water Lines
 - 3.1.2 Pipe Laying
 - 3.1.2.1 Trenches
 - 3.1.2.2 Backfill
 - 3.1.2.3 Width of Trench
 - 3.1.2.4 Jointing
 - 3.1.2.5 Handling and Storage
 - 3.1.3 Test for Deflection
- 3.2 CONCRETE CRADLE AND ENCASMENT
- 3.3 INSTALLATION OF WYE BRANCHES
- 3.4 MANHOLE DETAILS
 - 3.4.1 General Requirements
 - 3.4.2 Jointing, Plastering and Sealing
 - 3.4.3 Setting of Frames and Covers
- 3.5 CONNECTING TO EXISTING MANHOLES
- 3.6 BUILDING CONNECTIONS
- 3.7 CLEANOUTS AND OTHER APPURTENANCES

-- End of Section Table of Contents --

SECTION 02531

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 240/A 240M	(1996) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 923	(1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Materials
ASTM D 412	(1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 624	(1991; R 1998) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 593	(1998) Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F 594	(1998) Stainless Steel Nuts

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C509	(1994) Resilient-Seated Gate Valves for Water Supply Service
AWWA C900	(1997; C900a) Polyvinyl Chloride (PVC)

Pressure Pipe, 4 In. Through 12 In., for
Water Distribution

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49	(1994) Hazardous Chemicals Data
NFPA 325-1	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 704	(1996) Identification of the Fire Hazards of Materials for Emergency Respons

1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Portland Cement; FIO

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PVC Pipe

ASTM D 3034, Type PSM with a maximum SDR of 35, Size 6 inches or less in

diameter. For pipe 8 inches in diameter, pipe, couplings and fittings shall conform to AWWA C900, SDR of 18, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or indicated. PVC shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills.

2.2 REQUIREMENTS FOR FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below. Wye saddles, strap-on wyes, and T-fittings are prohibited.

2.2.1 Fittings for Plastic Pipe

2.2.1.1 Fittings for PVC Pipe

ASTM D 3034 for type PSM pipe.

2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions.

2.3.1 Plastic Pipe Jointing

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

2.4 FRAMES AND COVERS

Frames and covers shall be cast iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, with 2 concealed pick holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Sanitary Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.5 MANHOLE STEPS

Provide manhole steps constructed of cast iron. Comply with all applicable OSHA regulations. Precast steps into barrel sections.

2.6 STRUCTURES

2.6.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

2.7 CHIMNEY SEALS

Chimney seals shall be provided with manhole castings. Extensions shall also be provided as required. When chimney seals are used, manhole cones shall have a minimum vertical top segment of 2 inches. The sleeve and extension shall be extruded from a high-grade rubber compound conforming to the applicable requirements of ASTM C 923. The bands used for compressing

the sleeve and extension shall be fabricated from 16 gauge stainless steel conforming to ASTM A 240/A 240M Type 304. Screws, bolts and nuts shall be stainless steel conforming to ASTM F 593 and ASTM F 594, Type 304. Chimney seals shall be manufactured by Cretex Specialty Products, or approved equal.

2.8 VALVES

2.8.1 Gate Valves

Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

- a. Resilient-Seated Gate Valves: For valves 3 to 12 inches in size, resilient-seated gate valves shall conform to AWWA C509.

2.9 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "SEWER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Adjacent Facilities

3.1.1.1 Water Lines

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 10 feet to a water-supply main or service line, except that where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, the horizontal spacing may be a minimum of 6 feet. Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 10 feet on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 3 feet to the crossing. The thickness of the concrete encasement including that at the pipe joints shall be not less than 4 inches.

3.1.2 Pipe Laying

- a. Pipe shall be protected during handling against impact shocks and free fall; the pipe interior shall be free of extraneous material.
- b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert.

As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.

- c. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.

3.1.2.1 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

3.1.2.2 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

3.1.2.3 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, is exceeded for any reason other than by direction, the Contractor shall install, at no additional cost to the Government, concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

3.1.2.4 Jointing

Joints between different pipe materials shall be made as specified, using approved jointing materials.

3.1.2.5 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

3.1.3 Test for Deflection

When flexible pipe is used, a deflection test shall be made on the entire length of the installed pipeline not less than 30 days after the completion of all work including backfill and placement of any fill, grading, paving, concrete, or superimposed loads. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 95 percent of the inside diameter of the pipe. A tolerance of plus 0.5 percent will be permitted. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall

have a surface brinell hardness of not less than 150. The device shall be center bored and through bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of 70,000 psi or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer; a pull exerted on the opposite end of the shaft shall produce compression throughout the remote end of the ball, cylinder or circular section. Circular sections shall be spaced so that the distance from the external faces of the front and back sections shall equal or exceed the diameter of the circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through or by being flushed through with water, shall be cause for rejection of that run. When a deflection device is used for the test in lieu of the ball, cylinder, or circular sections described, such device shall be approved prior to use. The device shall be sensitive to 1.0 percent of the diameter of the pipe being measured and shall be accurate to 1.0 percent of the indicated dimension. Installed pipe showing deflections greater than 5.0 percent of the normal diameter of the pipe shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

3.2 CONCRETE CRADLE AND ENCASEMENT

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.3 INSTALLATION OF WYE BRANCHES

Wye branches shall be installed where sewer connections are indicated or where directed. Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.4 MANHOLE DETAILS

3.4.1 General Requirements

Manholes shall be constructed of precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's

recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. Free drop inside the manholes shall not exceed 18 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels; drop manholes shall be constructed whenever the free drop would otherwise be greater than 1 foot 6 inches.

3.4.2 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

3.4.3 Setting of Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 2 inches higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

3.5 CONNECTING TO EXISTING MANHOLES

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.6 BUILDING CONNECTIONS

Building connections shall include the lines to and connection with the building waste drainage piping at a point approximately 5 feet outside the building, unless otherwise indicated. Where building drain piping is not installed, the Contractor shall terminate the building connections approximately 5 feet from the site of the building at a point and in a manner designated.

3.7 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to the detail of the drawings.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02630

STORM-DRAINAGE SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
 - 1.3.1 Delivery and Storage
 - 1.3.2 Handling

PART 2 PRODUCTS

- 2.1 PIPE FOR CULVERTS AND STORM DRAINS
 - 2.1.1 Concrete Pipe
- 2.2 DRAINAGE STRUCTURES
 - 2.2.1 Flared End Sections
- 2.3 MISCELLANEOUS MATERIALS
 - 2.3.1 Concrete
 - 2.3.2 Mortar
 - 2.3.3 Precast Reinforced Concrete Manholes
 - 2.3.4 Frame and Cover Castings
 - 2.3.5 Chimney Seal
 - 2.3.6 Steel Gratings
 - 2.3.7 Joints
 - 2.3.7.1 Flexible Watertight Joints
- 2.4 CHIMNEY SEALS
- 2.5 STEEL LADDER
- 2.6 DOWNSPOUT BOOTS
- 2.7 HYDROSTATIC TEST ON WATERTIGHT JOINTS
 - 2.7.1 Concrete Pipe

PART 3 EXECUTION

- 3.1 EXCAVATION FOR PIPE CULVERTS AND DRAINAGE STRUCTURES
 - 3.1.1 Trenching
 - 3.1.2 Removal of Unstable Material
- 3.2 BEDDING
 - 3.2.1 Concrete Pipe Requirements
- 3.3 PLACING PIPE
 - 3.3.1 Concrete Pipe
 - 3.3.2 Multiple Culverts
- 3.4 JOINTING
 - 3.4.1 Concrete Pipe
 - 3.4.1.1 Flexible Watertight Joints
- 3.5 DRAINAGE STRUCTURES
 - 3.5.1 Manholes
- 3.6 STEEL LADDER INSTALLATION
- 3.7 BACKFILLING

Grand Forks Phase 1 Levees

- 3.7.1 Backfilling Pipe in Trenches
- 3.7.2 Backfilling Pipe in Fill Sections
- 3.7.3 Movement of Construction Machinery
- 3.7.4 Compaction
 - 3.7.4.1 General Requirements
 - 3.7.4.2 Minimum Density
- 3.7.5 Determination of Density
- 3.8 PIPELINE TESTING

-- End of Section Table of Contents --

SECTION 02630

STORM-DRAINAGE SYSTEM

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 240/A 240M	(1996) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 536	(1999el) Ductile Iron Castings
ASTM C 76	(1999) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(1997ael) Mortar for Unit Masonry
ASTM C 923	(1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Materials
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2,700 kN-m/cu m))
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods

(Shallow Depth)

ASTM D 3017 (1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM F 593 (1998) Stainless Steel Bolts, Hex Cap Screws, and Studs

ASTM F 594 (1998) Stainless Steel Nuts

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Placing Pipe; FIO

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-13 Certificates

Pipe Certification; GA
Pipeline Testing; GA
Hydrostatic Test on Watertight Joints; GA
Determination of Density; GA
Frame and Cover Castings; GA

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

ASTM C 76 with pipe class as indicated on drawings.

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design meeting requirements of ASTM C 76.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements under Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall be as shown on the drawings. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.3.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.3.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure.

2.3.4 Frame and Cover Castings

Frame and cover for gratings shall be cast gray iron, ASTM A 48, Class 35B or cast ductile iron, ASTM A 536, Grade 65-45-12. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3.5 Chimney Seal

Contractor may provide a standard type manhole casting with chimney seal in place of providing a floating type manhole casting. Provide chimney seals

on all inlet castings. Provide chimney seals on all inlet castings. Provide extensions as required.

If this option is chosen, new or existing manhole cones used for this installation must have a vertical top segment of 2 inches minimum length as shown on Chimney Seal & Casting Detail Option. For installation on existing manhole cone with 2 inch vertical top segment, this option may also be used is an adjusting ring is fastened to top of existing manhole as shown on drawings and as specified. Standard type manhole castings used in place of a floating type manhole casting shall have flanges drilled to receive rebar as shown on drawings.

Chimney seals shall be manufactured by Cretex Specialty Products, or approved equal. The sleeve and extension shall be extruded from a high-grade rubber compound conforming to the applicable requirements of ASTM C 923. The bands used for compressing the sleeve and extension against the manhole shall be fabricated from 16 gauge stainless steel conforming to ASTM A 240/A 240M Type 304. Screws, bolts and nuts used on this band shall be stainless steel conforming to ASTM F 593 and ASTM F 594, Type 304.

2.3.6 Steel Gratings

Steel gratings shall be in accordance with Section 05500 MISCELLANEOUS METALS.

2.3.7 Joints

2.3.7.1 Flexible Watertight Joints

- a. Materials: Flexible watertight joints shall be made with rubber-type gaskets for concrete pipe. The design of joints and the physical requirements for rubber-type gaskets shall conform to ASTM C 443. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 54 inches.
- b. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C 443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished, if specifically approved.

2.4 CHIMNEY SEALS

Chimney seals shall be provided with manhole castings and inlet castings. Extensions shall also be provided as required. When chimney seals are used, manhole cones shall have a minimum vertical top segment of 2 inches. The sleeve and extension shall be extruded from a high-grade rubber compound conforming to the applicable requirements of ASTM C 923. The bands used for compressing the sleeve and extension shall be fabricated from 16 gauge stainless steel conforming to ASTM A 240/A 240M Type 304. Screws, bolts and nuts shall be stainless steel conforming to ASTM F 593 and ASTM F 594, Type 304. Chimney seals shall be manufactured by Cretex Specialty Products, or approved equal.

2.5 STEEL LADDER

Grand Forks Phase 1 Levees

Steel ladder shall be provided. These ladders shall be not less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2-1/2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

2.6 DOWNSPOUT BOOTS

Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to ASTM A 48, Class 30B or 35B. Shape and size shall be as indicated.

2.7 HYDROSTATIC TEST ON WATERTIGHT JOINTS

2.7.1 Concrete Pipe

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced concrete pipe shall conform to ASTM C 443.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts shall be in accordance with the applicable portions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, Section 02300 EARTHWORK, and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 24 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing, where required, shall be placed within the trench width as specified. Contractor shall not overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheet piling, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

Bedding Class B shall be used. Concrete pipe shall be bedded in aggregate bedding material accurately shaped and rounded to conform to the lowest one-half of the outside portion of circular pipe for the entire length of the pipe. The bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.

3.3.1 Concrete Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.3.2 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.4 JOINTING

3.4.1 Concrete Pipe

3.4.1.1 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes

Construction shall be of precast reinforced concrete, complete with frames and cover castings or gratings, and equipped with manhole steps as indicated on drawings. Pipe connections to concrete manholes and inlets

shall be made with flexible water connectors.

3.6 STEEL LADDER INSTALLATION

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet vertically, and shall be installed to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.7 BACKFILLING

3.7.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 12 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.7.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in loose layers not exceeding 12 inches.

3.7.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be replace and joints repaired.

3.7.4 Compaction

3.7.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays,

silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.7.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

- a. Under paved roads, including adjacent shoulder areas, the density shall be not less than 95 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control. See Section 02300 EARTHWORK.
- b. Under unpaved roads, density shall not be less than 95 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
- c. Under nontraffic areas and levees, density shall be not less than that of the surrounding material.

3.7.5 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.8 PIPELINE TESTING

Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate. Low pressure air testing for concrete pipes shall conform to ASTM C 924. Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C 1103. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2

feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 0.2 gallons per inch in diameter per 100 feet of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correcting, and retesting shall be made at no additional cost to the Government.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02721

RIGID BASE COURSE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SAMPLING AND TESTING

PART 2 PRODUCTS

- 2.1 MATERIALS

PART 3 EXECUTION

- 3.1 GENERAL

-- End of Section Table of Contents --

SECTION 02721

RIGID BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

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

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION (NDDOT)

NDDOT SS	(1997) Standard Specifications for Road and Bridge Construction
NDDOT SS Section 302	(1997) Standard Specifications for Road and Bridge Construction - Aggregate Base or Surface Course
NDDOT FSTM	Field Sampling and Testing Manua

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Waybills and Delivery Tickets; FIO

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all aggregates actually used.

SD-09 Reports

Sampling and Testing; FIO

Copies of initial and in-place test results.

1.3 SAMPLING AND TESTING

Sampling and testing shall be performed in accordance with NDDOT FSTM.

The following revision is made to NDDOT FSTM, NDDOT SS Section 302: Perform gradation on every 1,000 ton of material placed, or fraction thereof, determine physical properties once.

PART 2 PRODUCTS

2.1 MATERIALS

Grand Forks Phase 1 Levees

All products shall meet the requirements of NDDOT SS Section 302 and all other reference sections and manuals indicated in NDDOT SS Section 302. Aggregate gradations for aggregate base course and surface course specified in the NDDOT SS shall be strictly adhered to.

PART 3 EXECUTION

3.1 GENERAL

Furnishing, placing, compaction, preparation, and testing shall meet the requirements of the NDDOT SS.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02741

ASPHALTIC CONCRETE PAVEMENT

PART 1 GENERAL

- 1.1 DESCRIPTION
- 1.2 CONSTRUCTION REQUIREMENTS

PART 2 PRODUCTS

- 2.1 ASPHALTIC CONCRETE PAVEMENT

PART 3 EXECUTION

- 3.1 ASPHALTIC CONCRETE PAVEMENT

-- End of Section Table of Contents --

SECTION 02741

ASPHALTIC CONCRETE PAVEMENT

PART 1 GENERAL

1.1 DESCRIPTION

This work shall consist of the construction of an asphaltic concrete pavement including a plant mixed base and surface course of the thickness and dimensions shown on the plans, typical sections, special provisions and described in the proposal. A single surface treatment aggregate seal coat shall be required and included as part of the pavement unless otherwise specified in the bidding documents.

1.2 CONSTRUCTION REQUIREMENTS

All construction shall meet the requirements of the City of Grand Forks standard construction specifications.

PART 2 PRODUCTS

2.1 ASPHALTIC CONCRETE PAVEMENT

All materials and construction shall meet the requirements of the City of Grand Forks standard construction specifications.

PART 3 EXECUTION

3.1 ASPHALTIC CONCRETE PAVEMENT

All construction shall meet the requirements of the City of Grand Forks standard construction specifications.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02754

CONCRETE PAVEMENTS FOR SMALL PROJECTS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 SAMPLING AND TESTING

-- End of Section Table of Contents --

SECTION 02754
CONCRETE PAVEMENTS FOR SMALL PROJECTS

PART 1 GENERAL

1.1 REFERENCES

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

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION (NDDOT)

NDDOT SS	(1997) Standard Specifications for Road and Bridge Construction
NDDOT SS Section 550	(1997) Standard Specifications for Road and Bridge Construction - Portland Cement Concrete Pavement
NDDOT FSTM	Field Sampling and Testing Manua

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Paving; GA

Paving Schedules at least 7 days prior to start of paving.

Mixture Proportions; GA

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 14 days prior to commencing concrete placing operations.

SD-09 Reports

Testing; FIO

Copies of testing results as required.

PART 2 PRODUCTS

2.1 MATERIALS

All products shall meet the requirements of NDDOT SS Section 550 and all ohter referenced sections and manuals indicated in NDDOT SS Section 550.

PART 3 EXECUTION

3.1 GENERAL

All work of constructing concrete pavement shall be the requirements of the NDDOT SS.

3.2 SAMPLING AND TESTING

Sampling and testing shall be performed in accordance with NDDOT FSTM.

The following revisions are made to NDDOT FSTM, NDDOT SS Section 550:

- a. Cast 2 flexure test beams.
- b. No depth check as described will be required.
- c. Provide a certification for cement only.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02760

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

PART 2 PRODUCTS

2.1 MATERIALS

PART 3 EXECUTION

3.1 GENERAL

-- End of Section Table of Contents --

SECTION 02760

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

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

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION (NDDOT)

- | | |
|----------------------|--|
| NDDOT SS | (1997) Standard Specifications for Road and Bridge Construction |
| NDDOT SS Section 826 | (1997) Standard Specifications for Road and Bridge Construction - Joint Material |

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Product Information; FIO

The Contractor shall submit product information and certification that verifies products meet the requirements specified in the NDDOT SS Section 826.

PART 2 PRODUCTS

2.1 MATERIALS

Joint material in concrete pavement shall be silicone sealant. Material shall meet the requirements of the specified sections of the NDDOT SS.

PART 3 EXECUTION

3.1 GENERAL

Installation of joint material shall meet the requirements of the specified sections of the NDDOT SS.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02763

PAVEMENT MARKINGS

PART 1	GENERAL
1.1	REFERENCES
1.2	SUBMITTALS
PART 2	PRODUCTS
2.1	MATERIALS
PART 3	EXECUTION
3.1	GENERAL

-- End of Section Table of Contents --

SECTION 02763

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

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

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION (NDDOT)

NDDOT SS (1997) Standard Specifications for Road and Bridge Construction

NDDOT SS Section 762 (1997) Standard Specifications for Road and Bridge Construction - Pavement Markings

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Materials; FIO

Certificate stating that the proposed pavement marking paint meets the requirements of the NDDOT SS.

PART 2 PRODUCTS

2.1 MATERIALS

All materials shall meet the requirements of NDDOT SS Section 762 and all other referenced sections and manuals indicated in NDDOT SS Section 762.

PART 3 EXECUTION

3.1 GENERAL

All construction shall meet the requirements of the NDDOT SS.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02770

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 SAMPLING AND TESTING

-- End of Section Table of Contents --

SECTION 02770

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 GENERAL

1.1 REFERENCES

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

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION (NDDOT)

NDDOT SS	(1997) Standard Specifications for Road and Bridge Construction
NDDOT SS Section 748	(1997) Standard Specifications for Road and Bridge Construction - Curbs and Gutters
NDDOT SS Section 750	(1997) Standard Specifications for Road and Bridge Construction - Sidewalks
NDDOT FSTM	Field Sampling and Testing Manua

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Sampling and Testing; FIO

Copies of all test reports within 24 hours of completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

All materials shall meet the requirements of the NDDOT SS Section 748 and NDDOT SS Section 750 and all other referenced sections and manuals indicated in NDDOT SS Section 748 and NDDOT SS Section 750.

PART 3 EXECUTION

3.1 GENERAL

All construction shall meet the requirements of the NDDOT SS.

3.2 SAMPLING AND TESTING

Grand Forks Phase 1 Levees

Sampling and testing shall be performed in accordance with NDDOT FSTM.

The following revisions are made to the referenced NDDOT FSTM, NDDOT SS Section 748 and NDDOT SS Section 750:

- a. Perform only 1 sieve analysis per source.
- b. No moisture test will be required.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02780

UNIT PAVERS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 QUALITY ASSURANCE
 - 1.3.1 Installer Qualifications
 - 1.3.2 Source Limitations
- 1.4 DELIVERY, STORAGE, AND HANDLING
- 1.5 PROJECT CONDITIONS

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
- 2.2 COLORS AND TEXTURES
- 2.3 UNIT PAVERS
 - 2.3.1 Concrete Pavers
 - 2.3.2 Job-Built Concrete Edge Restraints
- 2.4 AGGREGATE SETTING-BED MATERIALS
 - 2.4.1 Graded Aggregate for Base
 - 2.4.2 Geotextile
 - 2.4.3 Sand for Leveling Course
 - 2.4.4 Sand for Joints

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 PREPARATION
- 3.3 INSTALLATION, GENERAL
- 3.4 AGGREGATE SETTING-BED PAVER APPLICATIONS
- 3.5 REPAIR, POINTING, CLEANING, AND PROTECTION

-- End of Section Table of Contents --

SECTION 02780

UNIT PAVERS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------|--|
| ASTM C 33 | (1999a) Concrete Aggregates |
| ASTM C 936 | (1996) Solid Concrete Interlocking Paving Units |
| ASTM D 1557 | (1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2,700 kN-m/cu m)) |

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION (NDDOT)

- | | |
|----------|---|
| NDDOT SS | (1997) Standard Specifications for Road and Bridge Construction |
|----------|---|

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Concrete Pavers; FIO

DESCRIPTION OF THE SUBMITTAL FOR CONCRETE PAVER

Qualifications; FIO

For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.3 QUALITY ASSURANCE

1.3.1 Installer Qualifications

Grand Forks Phase 1 Levees

An experienced installer who has completed unit paver installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.3.2 Source Limitations

Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect unit pavers and aggregate during storage and construction against soiling or contamination from earth and other materials. Cover pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping.

1.5 PROJECT CONDITIONS

For cold weather protection, do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Manufacturers shall be subject to compliance with requirements, provide products by the following:

Concrete Pavers: Anchor Block Company or approved equal.

2.2 COLORS AND TEXTURES

Princeton Series: Large rectangle pavers field stone 20 percent (product #75SF) and 80 percent Pipestone (Product #75PS) Blend colors at job site.

2.3 UNIT PAVERS

2.3.1 Concrete Pavers

Solid, interlocking paving units, ASTM C 936, made from normal-weight aggregates in sizes and shapes indicated.

2.3.2 Job-Built Concrete Edge Restraints

Comply with requirements in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi.

2.4 AGGREGATE SETTING-BED MATERIALS

2.4.1 Graded Aggregate for Base

Sound crushed stone or gravel complying with NDDOT SS Class 5.

2.4.2 Geotextile

Grand Forks Phase 1 Levees

Woven or nonwoven geotextile manufactured from polyester or polypropylene fibers, with a permeability rating 10 times greater than that of soil on which paving is founded and an apparent opening size small enough to prevent passage of fines from leveling course into graded aggregate of base course below.

2.4.3 Sand for Leveling Course

Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements of ASTM C 33 for fine aggregate.

2.4.4 Sand for Joints

Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

PART 3 EXECUTION

3.1 EXAMINATION

Examine areas indicated to receive paving, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Proof-roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction complying with ASTM D 1557. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase for unit pavers.

3.3 INSTALLATION, GENERAL

Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable. For concrete pavers, a block splitter may be used. Match existing unit paver joint pattern on DeMers Avenue. For tolerances, do not exceed 1/32 inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving. Provide edge restraints as indicated. Install edge restraints before placing unit pavers. Install job-built concrete edge restraints to comply with requirements in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.4 AGGREGATE SETTING-BED PAVER APPLICATIONS

Compact soil subgrade uniformly to at least 95 percent of ASTM D 1557 laboratory density. Place geotextile over prepared subgrade, overlapping ends and edges at least 12 inches. Place aggregate base in thickness indicated. Compact by tamping with plate vibrator and screed to depth required to allow setting of pavers. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted. Treat leveling base with soil sterilizer to inhibit growth of

grass and weeds. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:

a. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.

b. Before ending each day's work, fully compact installed concrete pavers to within 36 inches of the laying face. Cover open layers with nonstaining plastic sheets overlapped 48 inches on each side of the laying face to protect it from rain.

Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling. Do not allow traffic on installed pavers until sand has been vibrated into joints. Repeat joint-filling process 30 days later.

3.5 REPAIR, POINTING, CLEANING, AND PROTECTION

Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02791

PLAYGROUND PROTECTIVE SURFACING

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
- 1.3 CHILD SAFETY AND ACCESSIBILITY STANDARDS
 - 1.3.1 CHILD SAFETY
 - 1.3.2 CHILD ACCESSIBILITY
- 1.4 SUBMITTALS
- 1.5 DELIVERY, STORAGE, AND HANDLING
- 1.6 INSPECTION
- 1.7 MANUFACTURER'S QUALIFICATION
- 1.8 INSTALLER'S QUALIFICATION
- 1.9 WARRANTY
- 1.10 MANUFACTURER'S REPRESENTATIVE

PART 2 PRODUCTS

- 2.1 MATERIALS
- 2.2 SYNTHETIC SURFACING
 - 2.2.1 Subbase
 - 2.2.1.1 Concrete Subbase
 - 2.2.2 Impact Attenuating Substrate
 - 2.2.2.1 Poured-In-Place Substrate
 - 2.2.2.2 Loose Fill Substrate
 - 2.2.3 Wear Surface
 - 2.2.3.1 Poured-in-Place Wear Surface
 - 2.2.3.2 Synthetic Turf Wear Surface
 - 2.2.3.3 Rubber Sheet Wear Surface
 - 2.2.3.4 Polyethylene Plastic Woven Sheet Wear Surface
 - 2.2.4 Color
 - 2.2.5 Sealant
 - 2.2.6 Hardware
 - 2.2.7 Binder
 - 2.2.8 Adhesive
 - 2.2.9 Containment Curbs
 - 2.2.10 Transition Edge
 - 2.2.11 Combination System
- 2.3 LOOSE-FILL SURFACING
 - 2.3.1 Pea Gravel
- 2.4 GEOTEXTILE FABRIC
- 2.5 RECYCLED PLASTIC
 - 2.5.1 High Density Polyethylene
 - 2.5.2 Structural Component
- 2.6 CURBS
 - 2.6.1 Concrete Curb

PART 3 EXECUTION

- 3.1 SITE PREPARATION
 - 3.1.1 Finished Grade and Underground Utilities
 - 3.1.2 Layout
 - 3.1.2.1 Use Zone
 - 3.1.2.2 Shop Drawings
 - 3.1.3 Obstructions Below Ground
 - 3.1.4 Percolation Test
 - 3.1.5 Substitution
 - 3.1.6 Subgrade
 - 3.1.7 Subsurface
 - 3.1.8 Subbase
 - 3.1.9 Concrete Curing
 - 3.1.10 Fall Height
 - 3.1.10.1 General Requirements
 - 3.1.10.2 Measuring Fall Height
- 3.2 INSTALLING SYNTHETIC SURFACING SYSTEM
 - 3.2.1 Temperature Limitation
 - 3.2.2 Poured-in-Place System
 - 3.2.2.1 Geotextile Fabric for Poured-In-Place
 - 3.2.2.2 Poured-in-Place Substrate
 - 3.2.2.3 Poured-in-Place Wear Surface
 - 3.2.2.4 Geotextile Fabric for Combination System
 - 3.2.2.5 Modular Substrate for Combination System
 - 3.2.2.6 Poured-in-Place Substrate for Combination System
 - 3.2.2.7 Synthetic Turf Wear Surface for Combination System
 - 3.2.2.8 Rubber Sheet Wear Surface for Combination System
 - 3.2.2.9 Poured-in-Place Wear Surface for Combination System
 - 3.2.2.10 Polyethylene Plastic Woven Sheet Wear Surface for Combination System
- 3.3 INSTALLING LOOSE FILL SURFACING SYTEM
 - 3.3.1 Pea Gravel Surfacing System
- 3.4 RESTORATION AND CLEAN UP
 - 3.4.1 Clean Up
 - 3.4.2 Protection
 - 3.4.3 Disposal of Materials
- 3.5 PROTECTIVE SURFACING ACCEPTANCE
 - 3.5.1 Child Safety and Accessibility Evaluation
 - 3.5.2 Spare Parts
 - 3.5.3 Maintenance Instruction
- 3.6 RE-INSTALLATION

-- End of Section Table of Contents --

SECTION 02791

PLAYGROUND PROTECTIVE SURFACING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 412	(1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2,700 kN-m/cu m))
ASTM D 2047	(1993) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
ASTM D 2261	(1996) Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant rate-of-extension tensile testing method)
ASTM F 1015	(1986; R 1995) Relative Abrasiveness of Synthetic Turf Playing Surfaces
ASTM F 1292	(1996) Impact Attenuation of Surface Systems Under and Around Playground Equipment
ASTM F 1487	(1998) Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
ASTM PS 83	(1997) Determination of Accessibility of Surface Systems Under and Around Playground Equipment

CONSUMER PRODUCT SAFETY COMMISSION (CPSC)

CPSC Pub No 325	(1994) Handbook for Public Playground Safety
-----------------	--

1.2 DEFINITIONS

Critical Height: The fall height at which the protective surfacing meets the requirements of ASTM F 1292.

Designated Play Surface: Any elevated surface for standing, walking, sitting, or climbing; or a flat surface a minimum 2 inches wide having up to a maximum 30 degree angle from horizontal. In some play events the platform surface will be the same as the designated play surface. However, the terms should not be interchanged as they do not define the same point of measurement according to ASTM F 1487.

Head Injury Criteria (HIC): A measure of impact severity that considers the duration over which the most critical section of the deceleration pulse persists as well as the peak level of that deceleration. Head impact injuries are not believed to be life threatening if the HIC does not exceed a value of 1,000.

Impact Attenuation: The ability of protective surfacing to reduce and dissipate the energy of an impacting body.

Loose Fill: Consisting of small independent movable components such as sand, gravel, or wood chip. The percent of fine material in the loose fill affects its compression properties from rainfall.

Maximum Equipment Height: The highest point on the equipment (i.e.: roof ridge, top of support pole).

Play Event: A piece of manufactured playground equipment that supports one or more play activities.

1.3 CHILD SAFETY AND ACCESSIBILITY STANDARDS

The perimeters of the play event use zone shall be measured in accordance with the requirements of Section 02882 PLAYGROUND EQUIPMENT.

1.3.1 CHILD SAFETY

Synthetic surfacing and loose-fill surfacing systems installed in the use zones shall meet or exceed the impact attenuating performance requirements as follows. The surfacing critical height value shall yield up to both a maximum 200 G's peak deceleration, and a maximum 1,000 Head Injury Criteria (HIC) value for a head-first fall from the play event in accordance with CPSC Pub No 325 and ASTM F 1292. The protective surfacing should have a minimum critical height value equal to the height of the highest designated play surface. Measuring fall heights for play events is defined in paragraph FALL HEIGHT. Sand, gravel, and wood products shall not be installed over a concrete or bituminous subsurface per CPSC Pub No 325.

1.3.2 CHILD ACCESSIBILITY

The accessibility requirement in accordance with ASTM F 1487 includes the following: When the play event use zone consists of a protective surfacing rated as unaccessible, at least one accessible route shall be provided from the use zone perimeter to the play event. When there is more than one of the same play activity provided, only one shall meet accessibility requirements i.e.: one swing seat or one spring rocking play event). When the access and egress points are not the same for a play event, an accessible route shall be provided to both. The accessible route shall

access all accessible play events and elements. The protective surfacings that meet accessibility are synthetic surfacing and engineered wood fiber per ASTM PS 83. When the accessible surface is within the use zone, it shall meet the requirements of paragraph CHILD SAFETY

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Synthetic Surfacing; GA
Loose Fill Surfacing; GA
Geotextile Fabric; GA

Manufacturer's descriptive data; catalogue cuts; and the latest edition of ASTM F 1487 and CPSC Pub No 325.

Synthetic Surfacing; GA

Manufacturer's specifications, handling and storage requirements, installation procedures, and safety data sheets to include warnings and critical height performance standards.

Synthetic Surfacing; GA

A list to include part numbers of furnished protective surfacing materials and components.

Synthetic Surfacing; GA

Delivery schedule and manufacturer's name.

Manufacturer's Qualification; GA

Name of the owner or user; service or preventive maintenance provider; date of the installation; point of contact and telephone number; and address for 10 sites.

Site Preparation; GA

Playground equipment and site furnishings installed.

Temperature Limitation; GA

Temperature limitation for applying adhesive.

Color; GA

Two color charts displaying surfacing colors, color granule percentages and finishes.

Synthetic Surfacing; GA

Impact attenuation and critical height performance for each thickness provided.

SD-04 Drawings

Shop Drawings; GA

Scale drawings defining the revised use zone configuration.

Finished Grade and Underground Utilities; GA

Finished grade, underground utilities, storm-drainage system and irrigation system status; and location of underground utilities and facilities.

SD-09 Reports

Percolation Test; GA

A certified report of inspection, test method used and compliance with recognized test standard shall be described.

Synthetic Surfacing; GA

Chemical composition, color granule percentage, and test results to which material has been subjected; identifying each material and component containing recycled materials and showing the estimated percentage of recovered material content. Freezing temperature life-cycle durability.

SD-13 Certificates

Materials; GA

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include composition and tests to which the material has been subjected.

Manufacturer's Qualification; GA

Certificate of Insurance AA rated for a minimum one million dollars.

Manufacturer's Representative; GA

The individual's name, company name and address, and playground safety training certificate.

Installer's Qualification; GA

The installer's company name and address, and training and experience certification.

Substitution; GA

Technical representative's written approval.

Child Safety and Accessibility Evaluation; GA

Record of measurements and findings by the certified playground safety inspector. Verification that installed protective

surfacing meets manufacturer's recommendations and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

SD-14 Samples

Synthetic Surfacing; GA
Loose Fill Surfacing; GA

- a. Synthetic Surfacing: A minimum 2 by 2 inch sample.
- b. Loose Fill Surfacing: A minimum 0.125 cu. ft sample.

SD-19 Operation and Maintenance Manuals

Maintenance Instruction; GA

Two bound copies of manufacturer's operation and maintenance manuals. The Contractor shall include manufacturer supplied spare parts.

1.5 DELIVERY, STORAGE, AND HANDLING

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery. Protective surfacing material shall be delivered, handled, and stored in accordance with the manufacturer's recommendations. The storage area shall be as designated. The materials shall be stored in a dry, covered area until installed.

1.6 INSPECTION

Protective surfacing material shall be inspected upon arrival at the job site for meeting specified quality. Unacceptable materials shall be removed from the job site.

1.7 MANUFACTURER'S QUALIFICATION

Protective surfacing should have been installed in a minimum 10 sites and been in successful service for a minimum 5 year calendar period. The manufacturer shall provide a Certificate of Insurance AA rated for a minimum one million dollars covering both product and general liability.

1.8 INSTALLER'S QUALIFICATION

The installer shall be certified by the manufacturer for training and experience installing the protective surfacing.

1.9 WARRANTY

Furnished protective surfacing shall have a minimum 1 year calendar period warranty.

1.10 MANUFACTURER'S REPRESENTATIVE

The manufacturer's certified playground safety inspector or the manufacturer's designated certified playground safety representative shall supervise the installation and adjustment of the protective surfacing to verify the installation meets the requirements of the manufacturer, this specification, and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be the standard products of a manufacturer regularly engaged in the manufacture of protective surfacing and shall be similar to surfacing in satisfactory use a minimum 5 year calendar period. Protective surfacing consists of two systems; synthetic surfacing and loose fill surfacing.

2.2 SYNTHETIC SURFACING

Synthetic surfacing includes the following: poured-in-place system; tile system; and combination system. The synthetic surfacing consists of either impact attenuating substrate covered by a wear surface bonded to produce a unified system; a shredded rubber or aggregate substrate covered by a polyethylene plastic woven sheet wear surface; or a uniform material manufactured in such a way that the top portion meets the requirements specified for wear surface.

2.2.1 Subbase

The subbase for synthetic surfacing may be either concrete, aggregate, or bituminous material.

2.2.1.1 Concrete Subbase

Concrete material shall conform to Section 02754 CONCRETE PAVEMENTS FOR SMALL PROJECTS.

2.2.2 Impact Attenuating Substrate

The substrate shall be compatible with the wear surface, and shall consist of modular units; poured-in-place; or loose fill.

2.2.2.1 Poured-In-Place Substrate

Poured-in-place substrate shall consist of a 100 percent recycled shredded styrene butadiene rubber (SBR) adhered with a 100 percent solid polyurethane binder to form a resilient, porous material or shredded rubber. Strands of SBR may vary from a minimum 1/50 inch to a maximum 2/25 inch thickness; by a minimum 1/8 inch to a maximum 4/5 inch length. Binder shall be between a minimum 12 percent and a maximum 16 percent of the total weight of the mixture of rubber and urethane; and shall provide 100 percent coating of the particles. Foam rubber will not be accepted in the substrate.

2.2.2.2 Loose Fill Substrate

The loose fill substrate shall consist of 100 percent recycled shredded rubber produced from recycled vehicle tires without non-steel belts. Loose-fill strands may vary from a minimum 1/8 inch to a maximum 1/4 inch thickness; a minimum 1/8 inch to a maximum 1/2 inch width; and a minimum 1/2 inch to a maximum 2 inch length.

2.2.3 Wear Surface

Wear surfaces consist of the following: a poured-in-place durable, weather-resistant, ultraviolet stable, water permeable material top-coat; an integral component of a tile system; synthetic turf wear surface; rubber

sheet wear surface; or a polyethylene woven plastic sheet wear surface. The wear surface shall meet requirements of ASTM D 2047 for a minimum 0.8 coefficient of friction.

2.2.3.1 Poured-in-Place Wear Surface

Poured-in-place wear surface shall consist of ethylene propylene diene monomer (EPDM) particles adhered with a polyurethane binder formulated to produce an even, uniform surface. Particles of EPDM shall meet ASTM D 412 for tensile strength and elongation, and contain a minimum 25 percent of rubber hydrocarbons. Particles of EPDM shall be peroxide or sulfur cured in accordance with the manufacturer. Size of rubber particles shall be between a minimum 1/32 inch, and a maximum 1/8 inch diameter. Binder shall be between a minimum 16 percent and a maximum 21 percent total weight of rubber used in the wear surface, and shall provide 100 percent coating of the particles. Wear surface shall be a minimum 3/8 inch thick. The wear surface shall be porous.

2.2.3.2 Synthetic Turf Wear Surface

Synthetic turf wear surface shall consist of nylon fibers a minimum 500 denier, or heavy face weight polypropylene fiber a minimum 5,000 denier; and tufted construction conforming to ASTM F 1015. Fibers in each roll shall be from the same dye lot.

2.2.3.3 Rubber Sheet Wear Surface

Rubber sheet wear surface shall consist of a smooth, uniform formulation of EPDM rubber granules bonded under pressure in the factory with polyurethane to form a continuous sheet, and shall be a minimum 3/8 inch thick. Up to a maximum 80 percent of the rubber may consist of SBR particles. Particle size shall vary from a minimum 1/32 inch to a maximum 3/16 inch diameter.

2.2.3.4 Polyethylene Plastic Woven Sheet Wear Surface

Polyethylene plastic woven sheet wear surface shall be lockstitched and meet the tear resistance test, ASTM D 2261 and shall have an accelerated ultra-violet degradation protection feature.

2.2.4 Color

The color shall be Sand. An EPDM wear surface is preferred for color retention. Black or the following dark colored SBR wear surfaces retain heat and are not acceptable: color combinations containing more than 10 percent black; or color combinations averaging more than 10 percent dark colors.

2.2.5 Sealant

Sealant for tile or combined protective surface systems shall be compatible with the protective surfacing, and shall match the color of the wear surface.

2.2.6 Hardware

Hardware, anchors or fasteners shall be corrosion resistant stainless steel or galvanized steel to anchor the surfacing system securely, in accordance with manufacturer's instructions. Hardware shall provide or be recessed to provide a flat surface and shall be covered by the required depth of

protective surfacing.

2.2.7 Binder

Binder for synthetic surfacing shall be nontoxic, weather-resistant, ultraviolet stable, non-hardening, and retaining impact-attenuating performance. It shall be 100 percent solids containing polyurethane, methylene diphenyl isocyanate (MDI), or as recommended by the manufacturer.

A maximum 2 percent of toluene diphenyl isocyanate (TDI) shall be used. Weight of polyurethane shall be between a minimum 8.5 lbs/gal and a maximum 9.5 lbs/gal. Coloring pigments shall be inorganic oxides.

2.2.8 Adhesive

Adhesive shall be a two component polyurethane providing extremely high impact resistant bond and shall be installed as recommended by the manufacturer. The adhesive shall be non-toxic, resistant to ultraviolet light, and safe for children.

2.2.9 Containment Curbs

Containment curbs include concrete. Containment curbs shall provide a smooth and hazard-free transition from the protective surfacing to the adjacent surface. Curbs shall be free of sharp vertical edges, protruding elements and trip hazards. Curbs shall be as recommended by the manufacturer. All edges should be provided with a minimum 1/2 inch radius.

2.2.10 Transition Edge

The transition edge shall be designed to maintain the protective surfacing performance, support the surfacing between changes of material, and shall be concrete in accordance with paragraph CONCRETE CURB. The face of the edge to the subgrade shall be covered with the impact attenuating surface and meet the requirements of paragraph CHILD SAFETY.

2.2.11 Combination System

Combination systems shall consist of combined protective surfacing materials specified. Each component is a part of a manufactured surfacing system. Wear surface shall be of the materials specified.

2.3 LOOSE-FILL SURFACING

Loose-fill surfacing installed in the use zone shall consist of pea gravel.

2.3.1 Pea Gravel

Pea gravel shall be washed, free of dust, clay, dirt, hazardous substances or foreign objects. Gravel particles shall be rounded naturally or by mechanical means and sieved in accordance with ASTM C 136 to be in the following gradation range.

SIEVE SIZE	PERCENT PASSING
1/2 inch	100 percent
3/8 inch	75-85 percent

2.4 GEOTEXTILE FABRIC

Grand Forks Phase 1 Levees

Geotextile fabric consists of the following: nonwoven polypropylene sheet; nonwoven 100 percent polyester sheet; or nonwoven needle punched polyester sheet composed of recycled polyester resins.

2.5 RECYCLED PLASTIC

Recycled plastic shall contain a minimum 85 percent of recycled post-consumer product.

2.5.1 High Density Polyethylene

The material shall be molded of ultraviolet (UV) and color stabilized polyethylene; and consist of a minimum 75% plastic profile of high-density polyethylene, low-density polyethylene, and polypropylene raw material. The material shall be non-toxic and have no discernible contaminants such as paper, foil, or wood. The material shall contain a maximum 3 percent air voids. The material shall be free of splinters, chips, peels, buckling, and cracks. Material shall be resistant to deformation from solar heat gain. Material shall have factory-drilled holes. Components with extra holes not filled by hardware or covered by other components shall be rejected. The material shall not be painted.

2.5.2 Structural Component

Recycled plastic materials will not be used as load bearing structural members.

2.6 CURBS

2.6.1 Concrete Curb

Concrete curbs shall conform to Section 02770 CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 3 EXECUTION

3.1 SITE PREPARATION

Prior to installing the protective surfacing, verify the playground equipment and site furnishings are installed in accordance with Section 02882 PLAYGROUND EQUIPMENT, and Section 02870 SITE FURNISHINGS.

3.1.1 Finished Grade and Underground Utilities

The Contractor shall verify that finished grades are as indicated; the smooth grading has been completed in accordance with Section 02300 EARTHWORK; installation of the underground utilities through the area has been completed in accordance with Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS; installation of the storm-drainage system through the area has been completed in accordance with Section 02630 STORM-DRAINAGE SYSTEM. The location of underground utilities and facilities in the area of the operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.1.2 Layout

The layout of the entire use zone perimeter shall be staked before excavation begins. The location of all elements shall be staked to include

the following: All play event configuration access and egress points; and use zone perimeters.

3.1.2.1 Use Zone

The use zone is defined as the area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around equipment; and on whose surface it is predicted that a user would land when falling from or exiting the equipment. Also, the use zone is associated with the following terms; "Clear Area," and "Fall Zone". The use zone shall be free of hard surfaces, objects or obstacles that a child could run into or fall on top of and be injured. Use zone perimeters shall not overlap hard surfaces. The use zone perimeter shall meet or exceed the requirements of paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS. Use zone perimeters shall not overlap except for certain play events as defined in ASTM F 1487.

3.1.2.2 Shop Drawings

When the use zone perimeter and play event configuration conflict with the requirements and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS, shop drawings defining corrective measures shall be submitted to include the following: Adjustment to the play event with the use zone perimeter; use zone perimeter overlaps; fall height and critical height value.

3.1.3 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments shall be provided.

3.1.4 Percolation Test

A test for percolation shall be done to determine positive drainage, to include the lowest elevation of the subgrade in the areas containing the following: sand; gravel; wood by-products; or synthetic surfacing installed over a pervious base. A positive percolation shall consist of a minimum 1 inch per 3 hour period. When a negative percolation test occurs, a shop drawing shall be provided to indicate the corrective measures.

3.1.5 Substitution

Under no circumstances are substitutions to be allowed or protective surfacing to be selected without written approval from the technical representative. Evaluate manufacturer substitutions for the critical height value with meeting the site conditions and paragraph FALL HEIGHT.

3.1.6 Subgrade

Subgrade irregularities shall be corrected to ensure the required depth of protective surfacing is provided. The subgrade elevation shall be as required by the manufacturer.

3.1.7 Subsurface

The subsurface shall be installed in a true, even plane, and sloped to provide positive drainage as indicated.

3.1.8 Subbase

Tolerance of the concrete or bituminous subbase shall be within a maximum 1/4 inch in 10 feet . Tolerance of aggregate subbase shall be within a maximum similar to 1/4 inch in 10 feet. Aggregate subbase shall be compacted to a maximum 95 percent, ASTM D 1557. The compaction shall be completed in accordance with Section 02300 EARTHWORK. Sand, gravel, and wood products shall not be installed over a concrete, aggregate, or bituminous subbase, perparagraph CHILD SAFETY.

3.1.9 Concrete Curing

Concrete subbase shall be cured a minimum of 7 days in accordance with the manufacturer's requirements. Curing compounds and other deleterious substances that adversely affect adhesion shall be removed. Surface shall be clean and dry.

3.1.10 Fall Height

3.1.10.1 General Requirements

The fall height is defined as the vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it. For some play events the fall height and platform height are the same, while for other play events the fall height and maximum equipment height are the same, Section 02882 PLAYGROUND EQUIPMENT. When the furnished play event fall height varies from the play event shown, shop drawings shall be provided defining the revised depth or type of protective surfacing to meet or exceed the requirements of paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

3.1.10.2 Measuring Fall Height

EQUIPMENT	MEASURING FALL HEIGHT
Composite Equipment Structure:	For a platform surrounded by protective barriers, measure from the platform finished elevation. For a platform surrounded by guardrails, measure from the guardrail top elevation.
Infant Crawl Area:	A maximum 24 inch height, measured from the crawl wall or barrier finished elevation.
Playhouse, Nonclimbable:	Measure from the designated play surface finished elevation.
Spring Rocking Equipment:	Measure from the seat top elevation.
Stationary Equipment, Climbable:	Measure from the maximum equipment height finished elevation.
Stationary Equipment, Nonclimbable:	Measure from the designated play surface finished elevation.

EQUIPMENT
Swing:

MEASURING FALL HEIGHT
Measure from the bottom of the
pivot point.

3.2 INSTALLING SYNTHETIC SURFACING SYSTEM

Surfacing edges shall fully adhere to the subsurface. Fully cover the subsurface to ensure no hard surfaces are exposed through displacement of loose fill. Rolled or beveled containment curb or transition edges shall maintain the full thickness required to meet paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS. Material shall cover foundation and cutouts around elements penetrating the surface. Seams shall be the minimum necessary and shall be tight.

3.2.1 Temperature Limitation

Temperature limitation for applying adhesive shall be provided.

3.2.2 Poured-in-Place System

Components of the poured-in-place system shall be mixed mechanically on site in accordance with manufacturer's recommendations. Hand-mixing is prohibited. Installation of poured-in-place surfacing shall be seamless and completely bonded to subsurface. Material shall cover foundations and shall be tight around elements penetrating the surface. Add a minimum 1/16 inch depth to the required surfacing depth to ensure the full depth of material is installed to meet paragraph CHILD SAFETY.

3.2.2.1 Geotextile Fabric for Poured-In-Place

Geotextile fabric shall be installed over a compacted aggregate base as indicated. Fabric shall cover the entire area and shall be lapped a minimum 4 inch width at the seams. Seams shall be adhered in accordance with manufacturer's recommendations. The aggregate base shall be free of ruts or protruding objects. The fabric shall be installed smooth; and free of tensile stresses, folds, and wrinkles. The fabric shall be protected from clogging, tears, or other damage. Damaged fabric shall be repaired or replaced as directed.

3.2.2.2 Poured-in-Place Substrate

The substrate layer of the poured-in-place system shall be installed in one continuous pour on the same day. When a second pour is required, the edge of the previous work shall be fully coated with polyurethane binder to ensure 100 percent bond with new work. Adhesive shall be applied in small quantities so that new substrate can be placed before the adhesive dries.

3.2.2.3 Poured-in-Place Wear Surface

Wear surface shall be bonded to substrate. Adhesive shall be applied to substrate in small quantities so that wear surface can be applied before adhesive dries. Surface shall be hand troweled to a smooth, even finish. When wear surface is composed of different color patterns, pour shall be continuous and seamless. When seams are required due to color change or field conditions, the adjacent wear surface shall be placed as soon as possible, before initial pour has cured. The edge of initial pour shall be coated with adhesive and wear surface mixture shall be immediately applied.

3.2.2.4 Geotextile Fabric for Combination System

Geotextile fabric shall be installed where a modular or shredded rubber substrate is installed over an aggregate base. It should be installed with poured-in-place wear surface or polyethylene plastic woven sheet wear surface installed over substrate. Fabric shall cover the entire area to receive the tile system and shall be lapped a minimum 4 inch width at the seams. Seams shall be adhered in accordance with manufacturer's recommendations.

3.2.2.5 Modular Substrate for Combination System

Modular substrate shall be laid out to minimize small end pieces. The substrate shall be installed in accordance with manufacturer's instructions.

3.2.2.6 Poured-in-Place Substrate for Combination System

Same as paragraph POURED-IN-PLACE SYSTEM.

3.2.2.7 Synthetic Turf Wear Surface for Combination System

Wear surface shall be bonded to substrate with 100 percent solids polyurethane adhesive. Surface irregularities and wrinkles shall be corrected. Seams shall be secured in accordance with manufacturer's recommendations. Wear surface roll width shall be as wide as practical for the installation.

3.2.2.8 Rubber Sheet Wear Surface for Combination System

Wear surface shall be bonded to substrate with 100 percent solids polyurethane adhesive. Surface irregularities and wrinkles shall be corrected. Seams shall be secured in accordance with manufacturer's recommendations. Wear surface roll width shall be as wide as practical for the installation.

3.2.2.9 Poured-in-Place Wear Surface for Combination System

Same as paragraph POURED-IN-PLACE SYSTEM.

3.2.2.10 Polyethylene Plastic Woven Sheet Wear Surface for Combination System

Wear surface shall be securely anchored to a perimeter containment material with hardware in accordance with the manufacturer's instructions. Hardware shall be appropriate for the type of system and secured to eliminate protrusions.

3.3 INSTALLING LOOSE FILL SURFACING SYTEM

3.3.1 Pea Gravel Surfacing System

Pea gravel shall be installed over a compacted subgrade at a minimum 12 inch depth throughout the use zone. The depth of gravel in high play activity areas shall be as indicated. Gravel shall meet the requirements of paragraph CHILD SAFETY.

3.4 RESTORATION AND CLEAN UP

When the operation has been completed, the Contractor shall clean up and

protect the site. Existing areas that have been damaged from the operation shall be restored to original condition at the Contractor's expense.

3.4.1 Clean Up

The site and play events shall be cleaned of all materials associated with the operation. Play events and surfaces shall be cleaned of dirt, stains, filings, and other blemishes occurring from shipment and installation. Cleaning methods and agents shall be as recommended by the manufacturer.

3.4.2 Protection

The area shall be protected as required or directed by providing barricades and signage. Signage shall be in accordance with Section 10430 EXTERIOR SIGNAGE

3.4.3 Disposal of Materials

Excess and waste material shall be removed and disposed of off Government property.

3.5 PROTECTIVE SURFACING ACCEPTANCE

3.5.1 Child Safety and Accessibility Evaluation

When the protective surfacing is installed, the play events and protective surfacing shall be thoroughly inspected and measured to verify the playground meets manufacturer's recommendations, paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS, and paragraph FALL HEIGHT as follows: 1) secure anchoring; 2) all hardware and connectors are tight and below the wear surface; 3) sharp points, edges, and protrusions; 4) entanglement; and 5) pinch, crush, and shear points. Measure use zone distances to determine the area is free of hard surfaces, objects or obstacles. Determine exceptions to use zone overlaps occur in accordance with ASTM F 1487. Measure play event fall height and compare to critical height value for the thickness of installed synthetic surfacing. Measure play event fall height and depth of loose fill protective surfacing. Ensure installed chopped tire material is free from steel belts. Ensure the slide exit region has the required clear zone. Swing seat clearances are measured while occupied by a maximum user for the age group using the equipment. The finished installation shall have the appearance of a single covering. Protective surfacing that does not comply shall be reinstalled. Hardware that does not comply shall be replaced. Ensure positive drainage for the area and the lowest elevation of protective surfacing subgrade has been provided. A written report describing the results of the evaluation shall be provided.

3.5.2 Spare Parts

Protective surfacing spare parts provided by the manufacturer shall be furnished.

3.5.3 Maintenance Instruction

The manufacturer's operation and maintenance manual describing the recommended preventive maintenance, inspection frequency and techniques, periodic adjustments, lubricants, and cleaning requirements shall be furnished.

3.6 RE-INSTALLATION

When re-installation is required, the following shall be accomplished. Re-install the product as specified. Provide new replacement materials supplied by the manufacturer (material acquisition of replacement parts is the responsibility of the Contractor). Damage caused by the failed installation shall be repaired at the Contractor's expense.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02824

ORNAMENTAL PICKET FENCE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SPECIAL WARRANTY

PART 2 PRODUCTS

- 2.1 ORNAMENTAL PICKET FENCE
 - 2.1.1 Pickets
 - 2.1.2 Rails
 - 2.1.3 Posts
 - 2.1.4 Accessories
 - 2.1.5 Finish
- 2.2 GATES
- 2.3 ACCESSORIES
 - 2.3.1 Rail Attachment Brackets
 - 2.3.2 Industrial Drive Rivets
 - 2.3.3 Ornamental Picket Fence Accessories
 - 2.3.4 Post Caps
 - 2.3.5 Picket Tops
- 2.4 SETTING MATERIALS
 - 2.4.1 Flanged Posts

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 INSTALLATION
- 3.3 GATE INSTALLATION
- 3.4 ACCESSORIES
- 3.5 CLEANING

-- End of Section Table of Contents --

SECTION 02824

ORNAMENTAL PICKET FENCE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 607	(1998) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbian or Vandadium, or both, Hot-Rolled and Cold-Rolled
ASTM A 653	(1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 787	(1996) Electric-Resistance-Welded Metallic-Coated Carbon Steel Mechanical Tubin

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Ornamental Picket Fence; GA

Manufacturer's catalog cuts indicating material compliance and specified options.

SD-04 Drawings

Ornamental Picket Fence; GA

Layout of fences and gates with dimensions, details, and finishes of components, accessories, and post foundations.

SD-14 Samples

Color selection for PVC finishes; GA

If requested, samples of materials (e.g., fabric, wires and accessories).

1.3 SPECIAL WARRANTY

Provide manufacturer's standard limited warranty that its ornamental fence system is free from defects in material and workmanship including cracking, peeling, blistering and corroding for a period of 15 years from the date of purchase.

PART 2 PRODUCTS

2.1 ORNAMENTAL PICKET FENCE

Ornamental picket fence style shall be as shown on Drawings. Fence shall be 6 feet in height.

2.1.1 Pickets

Galvanized square steel tubular members manufactured in accordance with ASTM A 787, having a 45,000 psi yield strength and G90 zinc coating, 0.90 oz/f². Minimum size of pickets shall be 1 inch. Attach each picket to each rail with 1/4-inch industrial drive rivets. Size #4. Minimum gauge wall thickness shall be 14 gauge.

2.1.2 Rails

1-1/2 inches x 1-3/8 inches x 1-1/2 inches, 11-gauge thick galvanized steel "U" channel per ASTM A 653 or ASTM A 607, having a 50,000 psi yield strength and G90 zinc coating, 0.90 oz/f². Punch rails to receive pickets and rivets and attach rails to rail brackets with 2 each, 1/4-inch industrial drive rivets. Size #4. Steel for rail produced under ASTM A 653.

2.1.3 Posts

Galvanized square steel tubular members manufactured in accordance with ASTM A 787 having a 45,000 psi yield strength and G90 zinc coating, 0.90 oz/f². Zinc coating is (inside and outside), (Posts zinc-coated outside and painted inside, is unacceptable). Minimum post size shall be 6 inches square, having 10-gauge wall thickness.

2.1.4 Accessories

Assembled panels with ornamental accessories attached using industrial drive rivets to prevent removal and vandalism.

2.1.5 Finish

All pickets, channels, posts, fittings and accessories shall be polyester coated individually after drilling and layout, to ensure maximum corrosion protection. (Coating of assembled sections is unacceptable). Components shall be given 4-stage "Power Wash" pre-treatment process to clean and prepare the galvanized surface to assure complete adhesion of the finish coat. Metal shall then be given polyester resin based power coating applied by the electrostatic spray process, to a 2.5 mils thickness. Finish shall then be baked in a 450-degree C (metal temperature) oven for 20 minutes.

2.2 GATES

Ornamental picket swing gates as specified in Section 02825 ORNAMENTAL PICKET SWING GATES.

2.3 ACCESSORIES

2.3.1 Rail Attachment Brackets

Brackets shall be die cast of zinc (ZAMAK #3 Alloy). Ball and socket design capable of 30-degree swivel (up/down - left/right). Bracket to fully encapsulate rail end for complete security.

2.3.2 Industrial Drive Rivets

Rivets shall be of sufficient length to attach items in a secure non-rattling position. Rivet to have a minimum of 1100 pounds (4894 N) holding power and a shear strength of 1500 pounds (6674 N).

2.3.3 Ornamental Picket Fence Accessories

Provide indicated items required to complete fence system. Galvanized each ferrous metal item in accordance with ASTM B 695 and finish to match framing.

2.3.4 Post Caps

Formed steel, cast of malleable iron or aluminum alloy, weather-tight closure cap. Provide one ball style post cap for each post.

2.3.5 Picket Tops

Pickets tops shall terminate inside of rail.

2.4 SETTING MATERIALS

2.4.1 Flanged Posts

Provide flange type base plates with 4 holes for surface mounting of posts where indicated.

PART 3 EXECUTION

3.1 EXAMINATION

Verify areas to receive fencing are completed to final grades and elevations. Ensure property lines and legal boundaries of work are clearly established.

3.2 INSTALLATION

Install fence in accordance with manufacturer's instructions. Surface mount with lag bolts and shields. Check each post for vertical and top alignment, and maintain in position during placement and finishing operation. Align fence panels between posts. Firmly attach rail brackets to posts with 1/4-inch bolt and lock nut, ensuring panels and posts remain plumb. Attach securely to concrete slab with expansion bolts.

3.3 GATE INSTALLATION

Install gates plumb, level and secure for full opening without interference. Attach hardware by means that will prevent unauthorized removal. Adjust hardware for smooth operation.

3.4 ACCESSORIES

Install post caps and other accessories to complete fence.

3.5 CLEANING

Clean up debris and unused material, and remove from site.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02825

ORNAMENTAL PICKET SWING GATE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 MANUFACTURER'S QUALIFICATIONS

PART 2 PRODUCTS

- 2.1 ORNAMENTAL PICKET SWING GATE
 - 2.1.1 Gate Frames
 - 2.1.2 Ornamental Picket Infill
 - 2.1.3 Bracing
 - 2.1.4 Hardware Materials
 - 2.1.5 Hinges
 - 2.1.6 Latch
 - 2.1.7 Keeper
 - 2.1.8 Double Gates
 - 2.1.9 Gate Posts
 - 2.1.10 Polyester Powder Coat Finish
- 2.2 SETTING MATERIAL
 - 2.2.1 Concrete

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 ORNAMENTAL PICKET GATE FRAMING INSTALLATION
- 3.3 GATE INSTALLATION
- 3.4 CLEANING

-- End of Section Table of Contents --

SECTION 02825

ORNAMENTAL PICKET SWING GATE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 787 (1996) Electric-Resistance-Welded
Metallic-Coated Carbon Steel Mechanical
Tubin

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Ornamental Picket Swing Gate; GA

Manufacturer's catalog cuts indicating material compliance and specified options.

SD-04 Drawings

Ornamental Picket Swing Gate; GA

Layout of fences and gates with dimensions, details, and finishes of components, accessories, and post foundations.

SD-14 Samples

Color selection for polymer finishes; GA

If requested, samples of materials.

1.3 MANUFACTURER'S QUALIFICATIONS

Products from qualified manufacturers having a minimum of 5 years experience Manufacturing ornamental picket fencing will be acceptable by the architect as equal, if approved in writing, ten days prior to bidding, and if they meet the following specifications for design, size, gauge of metal parts and fabrication.

PART 2 PRODUCTS

Grand Forks Phase 1 Levees

2.1 ORNAMENTAL PICKET SWING GATE

2.1.1 Gate Frames

Fabricate ornamental picket swing gate using galvanized steel members, structural quality steel, 45,000 psi tensile strength, with galvanized G90 coating. Frame members welded using stainless steel welded to form rigid one-piece unit. Minimum size vertical uprights, 2-inch square 13 gauge wall thickness.

2.1.2 Ornamental Picket Infill

"U" channel rails, formed from hot rolled, structural steel, 1-3/8 inches wide x 1-1/2 inches deep, 11-gauge wall thickness. Punch rails to receive pickets, and weld inside gate frame. Pickets, galvanized steel, 1-inch square tube of gauge, spacing, and with accessories to match fence. Attach pickets to "U" rails by 1/4-inch industrial drive rivets, Size #4.

2.1.3 Bracing

Provide diagonal adjustable length truss rods on gates to prevent sag.

2.1.4 Hardware Materials

Galvanized steel or malleable iron shapes to suit gate size.

2.1.5 Hinges

Hinges shall be structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180 degrees .

2.1.6 Latch

Latch shall be capable of retaining gate in closed position and have provision for padlocking.

2.1.7 Keeper

Provide keeper for each gate leaf over 5 feet wide. Gatekeeper shall consist of mechanical device for securing free end of gate when in full open position.

2.1.8 Double Gates

Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of latch, requiring one padlock for locking both gate leaves.

2.1.9 Gate Posts

6-inch square members, ASTM A 787, structural quality steel 45,000 psi tensile strength, with galvanized G90 coating.

2.1.10 Polyester Powder Coat Finish

After components have been galvanized to provide maximum corrosion resistance, pretreat, clean, and prepare galvanized surface to assure complete adhesion of finish coat. Apply 2.5-mil thickness of polyester

Grand Forks Phase 1 Levees

resin-based powder coating by electrostatic spray process. Bake finish for 20 minutes at 450 degrees F , metal temperature.

2.2 SETTING MATERIAL

2.2.1 Concrete

Minimum 28-day compressive strength of 3,000 psi.

PART 3 EXECUTION

3.1 EXAMINATION

Verify areas to receive fencing are completed to final grades and elevations. Ensure property lines and legal boundaries of work are clearly established.

3.2 ORNAMENTAL PICKET GATE FRAMING INSTALLATION

Install gate posts in accordance with manufacturer's instructions. Attach gate post securely to concrete slab with flange-type base plate with 4 holes and expansion anchors.

3.3 GATE INSTALLATION

Install gates plumb, level and secure for full opening without interference. Attach hardware by means that will prevent unauthorized removal. Adjust hardware for smooth operation.

3.4 CLEANING

Clean up debris and unused material, and remove from site.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02870

SITE FURNISHINGS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
- 1.4 INSPECTION

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Concrete
 - 2.1.2 Masonry
 - 2.1.3 Metal
 - 2.1.3.1 Steel
 - 2.1.3.2 Reinforcing Steel
 - 2.1.3.3 Cast Iron
 - 2.1.3.4 Cast Aluminum
 - 2.1.3.5 Bronze, Copper and Other Ounce Metals
 - 2.1.4 Wood
 - 2.1.4.1 Treatment
 - 2.1.4.2 Selection
 - 2.1.5 Recycled Material
 - 2.1.5.1 General Requirements
 - 2.1.5.2 High Density Polyethylene
 - 2.1.5.3 Structural Component
 - 2.1.6 Fiberglass
- 2.2 HARDWARE
- 2.3 ANCHORS
- 2.4 FINISH
 - 2.4.1 Coatings
 - 2.4.1.1 Galvanizing
 - 2.4.1.2 Polyester Powder
 - 2.4.1.3 Polyvinyl-chloride (PVC)
 - 2.4.2 Paint
- 2.5 SITE FURNISHING STANDARDS
 - 2.5.1 Benches
 - 2.5.2 Picnic Tables
 - 2.5.3 Trash Receptacles
 - 2.5.4 Bike Racks
 - 2.5.5 Bollards
 - 2.5.6 Drinking Fountain
 - 2.5.7 Phone Booth
 - 2.5.8 Grills
 - 2.5.9 Signs
 - 2.5.10 Picnic Shelters
 - 2.5.11 Flagpoles

Grand Forks Phase 1 Levees

- 2.5.12 Sign Panel
- 2.5.13 Metal Sign Cabinets

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Parts
 - 3.1.2 Assembly
 - 3.1.3 Testing
- 3.2 RESTORATION AND CLEAN UP
 - 3.2.1 Clean Up
 - 3.2.2 Protection
 - 3.2.3 Disposal of Materials
- 3.3 RE-INSTALLATION

-- End of Section Table of Contents --

SECTION 02870

SITE FURNISHINGS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997ael) Carbon Structural Steel
ASTM A 48M	(1994el) Gray Iron Castings (Metric)
ASTM A 123/A 123M	(1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1999) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 615/A 615M	(1996ael) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM B 26/B 26M	(1999) Aluminum-Alloy Sand Castings
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 108	(1999) Aluminum-Alloy Permanent Mold Castings
ASTM C 150	(1999a) Portland Cement
ASTM D 648	(1998c) Deflection Temperature of Plastics Under Flexural Load
ASTM D 2990	(1995) Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
ASTM F 1487	(1998) Standard Consumer Safety Performance Specification for Playground Equipment for Public Use

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Site Furnishings; GA

Manufacturer's descriptive data and catalog cuts.

Installation; GA

Manufacturer's installation and maintenance instructions.

Materials; GA

A listing indicating the furnishings provided have been in proven satisfactory use for at least 2 years.

SD-04 Drawing .

Site Furnishing Standards; GA

Drawings showing scaled details of proposed site furnishings, elevations for each type of site furnishing; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction.

SD-09 Reports

Recycled Material; GA

A report of site furnishing parts consisting of recycled materials. Product specification data shall provide test information for deflection and creep in accordance with ASTM D 648 and ASTM D 2990 for site furnishings which use plastic lumber as a component, shall be submitted. The data shall provide a comparison of deflection and creep measurements to other comparable materials.

SD-14 Samples

Finish; GA

Two sets of color data for each furnishing displaying manufacturer's color selections and finishes, and identifying those colors and finishes proposed for use.

1.3 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered, handled, and stored in accordance with the manufacturer's recommendations. The storage area shall be as designated. The materials shall be stored in a dry, covered area until installed.

1.4 INSPECTION

Site furnishings shall be inspected upon arrival at the job site for

conformity to specifications and quality in accordance with paragraph MATERIALS. Unacceptable items shall be removed from the job site.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. The materials provided shall be of a type with proven satisfactory use for at least 2 years.

2.1.1 Concrete

Portland cement shall conform to ASTM C 150 Types I, II, or III.

2.1.2 Masonry

Masonry material and products shall conform to Section 04200 MASONRY.

2.1.3 Metal

Metallic materials and products shall conform to Section 05500 MISCELLANEOUS METAL. Metal components shall be furnished with factory drilled holes. Components shall be free of excess weld and spatter. Metal components with holes that will not be filled by hardware or hidden by other components will be rejected.

2.1.3.1 Steel

Structural steel products shall conform to ASTM A 36/A 36M, ASTM A 500 and ASTM A 501.

2.1.3.2 Reinforcing Steel

Steel used for reinforcement shall be deformed billet steel Grade 40. Steel shall conform to ASTM A 615/A 615M.

2.1.3.3 Cast Iron

Cast iron shall conform to ASTM A 48M Class 35 or better. The Contractor shall provide castings manufactured true to pattern and component parts that fit together in a satisfactory manner. Castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. Smooth castings shall be well-cleaned by sand or shot blasting.

2.1.3.4 Cast Aluminum

Cast aluminum shall conform to ASTM B 26/B 26M and ASTM B 108. The Contractor shall provide castings manufactured true to pattern and component parts that fit together in a satisfactory manner. Castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. Smooth castings shall be well-cleaned by sand or shot blasting.

2.1.3.5 Bronze, Copper and Other Ounce Metals

Bronze, copper, and other ounce metals shall conform to ASTM B 62.

Grand Forks Phase 1 Levees

2.1.4 Wood

The Contractor shall provide premium grade wood free of knots; boards with eased edges and ends; and wood components with factory drilled holes. Components with holes that will not be filled by hardware or hidden by other components will be rejected.

2.1.4.1 Treatment

Wood that is not naturally rot and insect resistant shall be treated with standard procedures. Creosote, pentachlorophenol, tributyl tin oxide shall not be used in conformance with ASTM F 1487. Ammonium Copper Quat (ACQ) shall not be used for surfaces likely to contact the skin of small children.

2.1.4.2 Selection

Wood products shall be selected to withstand the climatic conditions of the region in which the site is located.

2.1.5 Recycled Material

2.1.5.1 General Requirements

Recycled materials shall contain a minimum 85 percent recycled post-consumer product. Recycled materials shall be constructed or manufactured with a maximum 1/4 inch deflection or creep in any member in conformance with ASTM D 648 and ASTM D 2990.

2.1.5.2 High Density Polyethylene

The Contractor shall provide panels and components molded of ultraviolet (UV) and color stabilized polyethylene, with minimum 1/4 inch wall thickness; exposed edges shall be smoothed, rounded, and free of burrs and points; and the material shall be resistant to fading, cracking, fogging, and shattering. The material shall be non-toxic and have no discernible contaminants such as paper, foil, or wood. The material shall contain no more than 3 percent air voids. Material shall be resistant to deformation from solar radiation heat gain.

2.1.5.3 Structural Component

Recycled materials to include plastic lumber will not be used as structural components of site furnishings.

2.1.6 Fiberglass

Fiberglass shall consist of at least 3 laminations of chopped glass fibers impregnated with polyester resin, with colors and textures molded into all exposed surfaces so that colors resist fading. Fiberglass shall be resistant to cleaners, fertilizers, high power spray and salt.

2.2 HARDWARE

Hardware shall be stainless steel or galvanized steel in accordance with ASTM A 153/A 153M and compatible with the material to which applied. All exposed hardware shall match in color and finish. Mounting hardware shall be concealed, recessed, and plugged.

2.3 ANCHORS

Anchors shall be provided, where necessary, for fastening site furnishings securely in place and in accordance with approved manufacturer's instructions. Anchoring devices that may be used, when no anchors are otherwise specified or indicated, include anchor bolts, slotted inserts, expansion shields for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; and lag bolts and screws for wood.

2.4 FINISH

Finish shall be as specified by the manufacturer or as indicated. Exposed surfaces and edges shall be rounded, polished, or sanded. Finish shall be non-toxic, non-glare, and resistant to corrosion. Exposed surfaces shall be smooth and splinter-free exposed surfaces.

2.4.1 Coatings

2.4.1.1 Galvanizing

Galvanized components shall be hot-dipped in zinc after fabrication in accordance with ASTM A 123/A 123M. Tailings and sharp protrusions formed as a result of the hot-dip process shall be removed and exposed edges burnished.

2.4.1.2 Polyester Powder

Powder-coated surfaces shall receive electrostatic zinc coating prior to painting. Powder coating shall be electrostatically applied and oven cured. Polyester powder coating shall be resistant to ultraviolet (UV) light.

2.4.1.3 Polyvinyl-chloride (PVC)

PVC coating shall be primed with a clear acrylic thermosetting solution. The primed parts shall be preheated prior to dipping. The liquid polyvinyl chloride shall be ultraviolet (UV) stabilized and mold-resistant. The coated parts shall be cured. The coating shall be a minimum 2/25 inches thick plus or minus 0.020 inches and shall have an 85 durometer hardness with a slip-resistant finish.

2.4.2 Paint

Paint shall be factory applied with a minimum of 2 coats. Paint shall be weather-resistant and resistant to cracking, peeling and fading.

2.5 SITE FURNISHING STANDARDS

Site furnishings shall be furnished with the dimensions and requirements indicated.

2.5.1 Benches

- a. Type "A" Bench: DuMor Recycled Plastic Bench Model 16-PL, 6 feet, or approved equal. Surface mount, recycled plastic slats in 'Cedar', 'Brown' polyester powder-coat finish and fixed arm for ADA accessibility.
- b. Type "B" Bench: DuMor Recycled Plastic Bench Model 32PL (62-489-6PL), 6 feet, or approved equal. Surface mount, recycled

Grand Forks Phase 1 Levees

plastic slats in 'Cedar', 'Brown' polyester powder-coat finish and fixed arm for ADA accessibility.

- c. Type "C" Bench: DuMor Recycled Plastic Glider Bench Model 30PL (62-745-6PL), 6 feet, or approved equal. Surface mount, recycled plastic slats in 'Cedar', 'Brown' polyester powder-coat finish and fixed arm for ADA accessibility.
- d. Contact: Nancy Teel, Earl F. Andersen Company, Phone: 952-884-7300, Fax: 952-884-5619.

2.5.2 Picnic Tables

- a. Type "A" (ADA) Picnic Table: Eaglebrook Products ADA Portable Picnic Table Model 9853, or approved equal. Galvanized metal finish, 'Cedar' recycled plastic slats and extended table surface for wheelchair access.
- b. Type "B" Picnic Table: Eaglebrook Products Non-ADA Portable Picnic Table Model 9853 (modified), or approved equal. Galvanized metal finish, 'Cedar' recycled plastic slats.
- c. Type "C" Picnic Table: DuMor Square Pedestal Table Model 7633-33, or approved equal. 'Cedar' recycled plastic slats, 3 bench option for ADA accessibility, surface mount, 'Brown' polyester powder-coat finish.
- d. Type "D" Picnic Table: DuMor Square Pedestal Table Model 7634-34, or approved equal. 'Cedar' recycled plastic slats, 4 bench option, surface mount, 'Brown' polyester powder-coat finish.
- e. Contact: Nancy Teel, Earl F. Andersen Company, Phone: 952-884-7300, Fax: 952-884-5619.

2.5.3 Trash Receptacles

- a. Type "A" Trash Can: DuMor Trash Receptacle Model 124-31PL, or approved equal. 'Cedar' recycled plastic slats, surface mount, 'Brown' polyester powder-coat finish.
- b. Type "B" Trash Can: DuMor Trash Receptacle Model 124-31PL, or approved equal. 'Cedar' recycled plastic slats, surface mount, 'Brown' polyester powder-coat finish and recycle lid with "CANS ONLY" printed on top.
- c. Type "C" Trash Can: DuMor Trash Receptacle Model 124-31PL, or approved equal. 'Cedar' recycled plastic slats, surface mount, 'Brown' polyester powder-coat finish and recycle lid with "PAPER ONLY" printed on top.
- d. Type "D" Trash Can: DuMor Trash Receptacle Model 124-31PL, or approved equal. 'Cedar' recycled plastic slats, surface mount, 'Brown' polyester powder-coat finish and recycle lid with "GLASS & PLASTIC ONLY" printed on top.
- d. Contact: Nancy Teel, Earl F. Andersen Company, Phone: 952-884-7300, Fax: 952-884-5619.

2.5.4 Bike Racks

Grand Forks Phase 1 Levees

- a. Timberform: Cycloops Bike Rack: Model 2170-13-E-G, or approved equal. Thirteen bike capacity, surface mount, galvanized metal finish. Contact: John Masciopinto, Park and Plaza Products, Inc., Phone: 651-653-0556, Fax: 651-653-0598.

2.5.5 Bollards

- a. Type "B" Bollard: Timberform Recycled Plastic Removable Bollard, Model 2553-3-R, or approved equal. Color shall be "Cedar". Government to specify arrow direction.
- b. Type "C" Bollard: Timberform Recycled Plastic Bollard, Model 2553-3-E, or approved equal. Color shall be "Cedar". Government to specify arrow direction.
- c. Aluminum Bollard: Holophane Charleston Series Cast Aluminum Bollard, Model BOL/CH44/12/DT/L-CA/BK, or approved equal. Color shall be "Black".
- d. Contact: John Masciopinto, Park and Plaza Products, Inc., Phone: 651-653-0556, Fax: 651-653-0598.

2.5.6 Drinking Fountain

- a. Most Dependable Fountains: Model Jug Filler DB, ADA-accessible, or approved equal. Direct embed mount, green polyester powder-coat finish. Contact: Most Dependable Fountains, Phone: 901-867-0039, Fax: 901-867-4008.

2.5.7 Phone Booth

- a. PBG Traditional Enclosure, or approved equal. Color shall be black; surface mounted pedestal enclosure. Contact: Jessica Raynor, PBG, Phone: 800-264-8888, Fax: 770-887-9511.

2.5.8 Grills

- a. Small Grill Type A: DuMor Grill Model 28, or approved equal. Surface mount, include optional utility shelf. Mount at 33 inches for ADA accessibility. Contact: Nancy Teel, Earl. F. Andersen, Phone: 952-884-7300, Fax: 952-884-5619.
- b. Large Grill Type B: DuMor Dual Level Grill Model #24, or approved equal. Surface mount. Mount at 33 inches for ADA accessibility. Contact: Nancy Teel, Earl. F. Andersen, Phone: 952-884-7300, Fax: 952-884-5619.

2.5.9 Signs

- a. Best Signs Custom Regulatory Signage, or approved equal. See drawings for signage type and quantity. Contact: Paula, Construction Supply, Inc., Phone: 763-537-5018.

2.5.10 Picnic Shelters

Both shelters listed below shall have custom masonry work on the columns and shall have pre-cut steel roof in "hunter green".

Grand Forks Phase 1 Levees

- a. Picnic Shelter, large: Litchfield Industries 'Telluride' Shelter, Model: 7253, or approved equal, quantity: 2. Steel columns, vented roof.
- b. Picnic Shelter, small: Litchfield Industries 'Steel Beam' Shelter (20' x 36'), Model: 2217, or approved equal, quantity: 2.
- c. Contact: Litchfield Industries, Inc., Phone: 800-542-5282, Fax: 517-542-3939.

2.5.11 Flagpoles

Flagpoles shall be manufactured by Concord, Model 35 foot Independence, or approved equal. Flagpole shall have a concealed halyard, 7 inch butt diameter, 0.156 foot wall thickness, and satin finish. Verify access door elevation with drawings. Contact: Patti Patterson, Specialty Sales Service, Inc., 763-544-1562, fax 763-544-0764.

2.5.12 Sign Panel

- a. Hopewell Manufacturing: Low profile frame and backing plate with standalls, or approved equal. 24 inches wide x 36 inches high frame, dark brown finish. Wall mount at 45 degree angle. Contact: Paul Kramer, Hopewell Manufacturing. Phone: 301-582-2343, fax: 301-582-2343.

2.5.13 Metal Sign Cabinets

- a. Hopewell Manufacturing: Bulletin case, or approved equal. 36 inches wide x 48 inches high frame sandblasted with clear finish. Custom mount vertical. Contact: Paul Kramer, Hopewell Manufacturing. Phone: 301-582-2343, fax: 301-582-2343.

PART 3 EXECUTION

3.1 INSTALLATION

The Contractor shall verify that finished grades and other operations affecting mounting surfaces have been completed prior to the installation of site furnishings. Site furnishings shall be installed plumb and true in accordance with the approved manufacturer's instructions.

3.1.1 Parts

New parts shall be acquired from the manufacturer. Substitute parts will not be accepted unless approved by the manufacturer.

3.1.2 Assembly

When the inspection of parts has been completed, the site furnishings shall be assembled and anchored according to manufacturer's instructions or as indicated. When site furnishings are assembled at the site, assembly shall not interfere with other operations or pedestrian and vehicular circulation.

3.1.3 Testing

Each site furnishing shall be tested to determine a secure and correct installation. A correct installation shall be according to the manufacturer's recommendations and by the following procedure: The

Contractor shall measure the physical dimensions and clearance of each installed site furnishing for compliance with manufacturer's recommendations and as indicated. Site furnishings which do not comply shall be reinstalled. Fasteners and anchors determined to be non-compliant shall be replaced. A written report describing the results of the testing shall be provided.

3.2 RESTORATION AND CLEAN UP

When the installation has been completed, the Contractor shall clean up and protect the site. Existing areas that have been damaged from the installation operation shall be restored to original condition at Contractor's expense.

3.2.1 Clean Up

The site shall be cleaned of all materials associated with the installation. Site furnishing surfaces shall be cleaned of dirt, stains, filings, and other blemishes occurring from shipment and installation. Cleaning methods and agents shall be according to manufacturer's instructions or as indicated.

3.2.2 Protection

The area shall be protected as required or directed by providing barricades and signage. Signage shall be in accordance with Section 10430 EXTERIOR SIGNAGE.

3.2.3 Disposal of Materials

Excess and waste material shall be removed and disposed off Government property.

3.3 RE-INSTALLATION

Where re-installation is required, the following shall be accomplished:

- a. Re-install the product as specified. Material acquisition of replacement parts is the responsibility of the Contractor. Provide replacement materials that are new and supplied by the original manufacturer to match.
- b. Damage caused by the failed installation shall be repaired.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02882

PLAYGROUND EQUIPMENT

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
- 1.3 CHILD SAFETY AND ACCESSIBILITY STANDARDS
 - 1.3.1 Child Safety
 - 1.3.2 Child Accessibility
- 1.4 SUBMITTALS
- 1.5 DELIVERY, STORAGE, AND HANDLING
- 1.6 EQUIPMENT IDENTIFICATION
- 1.7 INSPECTION
- 1.8 PROHIBITED EQUIPMENT
- 1.9 AGE GROUPS
 - 1.9.1 Playground Areas
- 1.10 MANUFACTURER QUALIFICATION
- 1.11 INSTALLER QUALIFICATION
- 1.12 WARRANTY
- 1.13 MANUFACTURER'S REPRESENTATIVE

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Powder Coat Finish
 - 2.1.2 Rotationally Molded Products
 - 2.1.3 Steel Tubing
 - 2.1.4 Hardware
 - 2.1.5 Galvanneal Coating
 - 2.1.6 Kickplates
 - 2.1.6.1 12 Inch Powerscape Filler/Kickplate
 - 2.1.6.2 18 Inch Powerscape Filler/Kickplate
 - 2.1.6.3 24 Inch Powerscape Filler/Kickplate
 - 2.1.7 Powerscape Handholds
 - 2.1.8 TotTime Handholds
 - 2.1.9 Step Down Rungs
 - 2.1.10 Powerscape Aluminum Uprights
 - 2.1.11 TotTime Aluminum Uprights
 - 2.1.12 Powerscape and TotTime Uprights
 - 2.1.13 Upright Caps
 - 2.1.14 Powerscape Megalog™ Bolt-Through Connection
 - 2.1.15 TotTime Bolt-Through Connection
 - 2.1.16 Powerscape Punched Steel Decks and PVC-Coated Components
 - 2.1.17 Powerscape Square Decks
 - 2.1.18 Powerscape Triangular Decks
 - 2.1.19 Powerscape Stepped Platforms
 - 2.1.20 TotTime Expanded Metal Decks and Components
 - 2.1.21 Powerscape Pentagonal Deck with Internal Climber

Grand Forks Phase 1 Levees

- 2.1.22 TotTime Square Decks
 - 2.1.23 TotTime Rectangular Decks
 - 2.1.24 TotTime Triangular Decks
 - 2.1.25 TotTime Transfer Platform
 - 2.1.26 Powerscape Transition Step
 - 2.1.27 Powerscape Suspension Bridge
 - 2.1.28 Powerscape 90 Degree Funnel Bridge
 - 2.1.29 Powerscape Mini-Arch Bridge
 - 2.1.30 TotTime Zipper Climber
 - 2.1.31 Powerscape Clover Climber
 - 2.1.32 Powerscape Crazy-Eight Climber
 - 2.1.33 TotTime Crazy-Eight Climber
 - 2.1.34 Powerscape Rung Ladder
 - 2.1.35 Powerscape Tree Climber
 - 2.1.36 TotTime Tree Climber
 - 2.1.37 TotTime Corkscrew Climber
 - 2.1.38 Powerscape Five Ring Climber
 - 2.1.39 Powerscape DNA Climber
 - 2.1.40 Powerscape Spiney Arch Climber
 - 2.1.41 Powerscape Twister Climber
 - 2.1.42 Powerscape Chinning Bars
 - 2.1.43 Powerscape Climbing Pole
 - 2.1.44 Powerscape Crunch Bar
 - 2.1.45 Powerscape Horizontal Ladders (Straight and Curved)
 - 2.1.46 Powerscape Horizontal and Inclined Loop Ladders
 - 2.1.47 Powerscape Criss Cross Overhead Loop Ladders
 - 2.1.48 Rotationally Molded Crawl Tubes
 - 2.1.48.1 24 Inch Inside Diameter
 - 2.1.48.2 30 Inch Inside Diameter
 - 2.1.49 Powerscape and TotTime Rotationally Molded Rung Enclosure
 - 2.1.50 Powerscape and TotTime Metal Rung Enclosures
 - 2.1.51 Powerscape Metal Panel Enclosures
 - 2.1.52 Powerscape Ramps/Connecting Walks Without Incline
 - 2.1.53 Powerscape 360 Degree Spiral Slide
 - 2.1.54 Powerscape and TotTime Roatationally Molded Slides (Single and Double Wide, Tidal Wave and Rumble 'N Roll)
 - 2.1.55 TotTime Rotationally Molded Curved Slide
 - 2.1.56 Powerscape Rotationally Molded Wishbone Slide
 - 2.1.57 Powerscape Cyberslide™
 - 2.1.58 Concrete
 - 2.1.59 Color
- 2.2 EQUIPMENT
- 2.2.1 Configuration
 - 2.2.2 Substitution
 - 2.2.3 Platform Height
 - 2.2.3.1 Pre-Toddler Age Group
 - 2.2.3.2 Toddler Age Group
 - 2.2.3.3 Pre-School Age Group
 - 2.2.3.4 School-Age Age Group
 - 2.2.3.5 Pre-Teen Age Group
 - 2.2.4 Protective Barrier and Guardrail
 - 2.2.4.1 Protective Barrier

PART 3 EXECUTION

- 3.1 SITE PREPARATION
 - 3.1.1 Finished Grade and Underground Utilities
 - 3.1.2 Layout
 - 3.1.2.1 Use Zone

Grand Forks Phase 1 Levees

- 3.1.2.2 Shop Drawings
- 3.1.3 Orientation
- 3.1.4 Obstructions Below Ground
- 3.2 INSTALLATION
 - 3.2.1 Play Event Modification
 - 3.2.2 Plastic Play Events
 - 3.2.3 Footings
 - 3.2.4 Multiple-Axis (Rotating) Swing
 - 3.2.5 Single-Axis (To-Fro) Swing
 - 3.2.6 Slide
 - 3.2.7 Chain or Rope Ladder, Climber or Net Climber
 - 3.2.8 Composite Structure
 - 3.2.9 Fall Height
 - 3.2.9.1 General
 - 3.2.9.2 Measuring Fall Height
 - 3.2.10 SIGNAGE
- 3.3 RESTORATION AND CLEAN UP
 - 3.3.1 Clean Up
 - 3.3.2 Protection
 - 3.3.3 Disposal of Materials
- 3.4 PLAYGROUND ACCEPTANCE
 - 3.4.1 Child Safety and Accessibility Evaluation
 - 3.4.2 Spare Parts
 - 3.4.3 Maintenance Instruction
- 3.5 RE-INSTALLATION

-- End of Section Table of Contents --

SECTION 02882

PLAYGROUND EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653 M	(1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM D 638	(1999) Tensile Properties of Plastics
ASTM D 648	(1998c) Deflection Temperature of Plastics Under Flexural Load
ASTM D 746	(1998) Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 790	(1999) Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 1248	(1998) Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1308	(1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1505	(1998) Density of Plastics by the Density-Gradient Technique
ASTM D 1907	(1997) Standard Test Method for Yarn Number by the Skein Method
ASTM D 2197	(1998) Adhesion of Organic Coatings by Scrape Adhesion

Grand Forks Phase 1 Levees

ASTM D 2794	(1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 3363	(1992a) Film Hardness by Pencil Test
ASTM F 1487	(1998) Standard Consumer Safety Performance Specification for Playground Equipment for Public Use

CONSUMER PRODUCT SAFETY COMMISSION (CPSC)

CPSC Pub No 325	(1994) Handbook for Public Playground Safety
-----------------	--

FEDERAL SPECIFICATIONS (FS)

FS-L-P 390C	(1971; R 1984) Plastic, Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium, and High Density)
-------------	---

1.2 DEFINITIONS

Age-Appropriate: A term that describes equipment scale to include platform height, fall height and maximum equipment height, that allows safe and successful use by children of a specific chronological age; mental and physical ability; and anthropometric measurement. Maximum equipment height and complexity will not exceed a child's ability in that age group.

Composite Structure: Also "Composite Play Structure; Linked Structure". Two or more play events attached, directly adjacent or functionally linked, to create one integral unit that provides more than one play activity.

Designated Play Surface: Any elevated surface for standing, walking, sitting, or climbing; or a flat surface a minimum 2 inches wide having up to a maximum 30 degree angle from horizontal. In some play events the platform surface will be the same as the designated play surface. However, the terms should not be interchanged as they do not define the same point of measurement per ASTM F 1487.

Maximum Equipment Height: The highest point on the equipment (i.e., roof ridge, top of support pole).

Play Event: A piece of manufactured playground equipment that supports one or more play activities.

Protective Surfacing: Material to be used within the use zone that meets the fall attenuation requirements of Section 02791 PLAYGROUND PROTECTIVE SURFACING.

Suspended Hazard: Cable, wire, rope or similar devices suspended up to a maximum 7 feet high between play events; or installed up to a maximum 45 degree angle from the ground to the play event.

Tot: A child under 4 years of age in the pre-toddler and toddler age group.

1.3 CHILD SAFETY AND ACCESSIBILITY STANDARDS

1.3.1 Child Safety

Play events shall meet the child safety performance requirements described in CPSC Pub No 325 and ASTM F 1487. The requirements include the following: Head and neck entrapment; sharp points, edges, and protrusions; entanglement; pinch, crush, and shear points; suspended hazards; play event access and egress points; play event use zone perimeter; and design criteria. Since ASTM F 1487 criteria is defined for the minimum user through the maximum user (2 through 12 years of age), the requirements for the infant or pre-toddler age group are not prescribed. This specification and Section 02791 PLAYGROUND PROTECTIVE SURFACING establish the requirements for the infant and pre-toddler age groups.

1.3.2 Child Accessibility

The accessibility requirement in accordance with ASTM F 1487 includes the following: When the play event use zone consists of a protective surfacing rated as unaccessible, at least one accessible route shall be provided from the use zone perimeter to the play event. When there is more than one of the same play activity provided, only one shall meet accessibility requirements (i.e., one swing seat or one spring rocking play event). When the access and egress points are not the same for a play event, an accessible route shall be provided to both. The accessible route shall access all accessible play events and elements. The protective surfacing performance requirements shall be in accordance with Section 02791 PLAYGROUND PROTECTIVE SURFACING.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; GA

Manufacturer's descriptive data; catalog cuts; references; and the latest edition of ASTM F 1487 and CPSC Pub No 325. Manufacturer's specifications, handling and storage requirements, installation procedures, and safety data sheets to include the following: bare or painted metal platform and slide bed orientation from the direct sun; warnings; and child safety performance standards.

Equipment Identification; GA

A list to include part numbers of furnished play event and equipment materials and components.

Delivery, Storage and Handling; GA

Delivery schedule and manufacturer's name.

Manufacturer Qualification; GA

Name of the owner or user; service or preventive maintenance

provider; date of the installation; point of contact and telephone number; and address for 10 sites.

SD-04 Drawings

Configuration; GA

Scale drawings defining the revised play event configuration.

Shop Drawings; GA

Scale drawings defining the revised use zone perimeters and play event layout.

Fall Height; GA

Scale drawings defining the revised depth or type of protective surfacing.

Finished Grade and Underground Utilities; GA

Finished grade, underground utilities, storm-drainage system and irrigation system status; and location of underground utilities and facilities.

SD-13 Certificates

Materials; GA

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include composition and tests to which the material has been subjected.

Manufacturer Qualification; GA

Certificate of Insurance AA rated for a minimum one million dollars.

Manufacturer's Representative; GA

The individual's name, company name and address, and playground safety training certificate.

Substitution; GA

Technical representative's written approval.

Play Event Modification; GA

Manufacturer's written approval.

Child Safety and Accessibility Evaluation; GA

Record of measurements and findings by the certified playground safety inspector. Verification the installed play events and equipment meet manufacturer's recommendations and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

Grand Forks Phase 1 Levees

SD-14 Samples

Color; GA

Two color charts displaying the colors and finishes.

SD-19 Operation and Maintenance Manuals

Maintenance Instruction; GA

Two bound copies of the manufacturer's operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery. Equipment shall be delivered, handled, and stored in accordance with the manufacturer's recommendations. The storage area shall be as designated. The materials shall be stored in a dry, covered area until installed.

1.6 EQUIPMENT IDENTIFICATION

Playground equipment shall be identified with attached and durable label stating the age-group that the equipment is designed to accommodate. There shall be permanent WARNING labels and manufacturer's identification labels, ASTM F 1487.

Provide the following playground equipment and play structure components:

<u>Qt</u>	<u>Part # & Descriptio</u>	<u>Weight</u>
1	10070 Five Ring Climber	104.0
1	10087 1-Level Chinning Bar	5.0
1	10089 3-Level Chinning Bar	14.0
2	10113 Rung Enclosure	78.0
2	10127 T Upright Ass'Y (Alum)	48.0
1	10128 8' Upright Ass'Y (Alum)	27.0
12	10129 9' Upright Ass'Y (Alum)	360.0
14	10131 11' Upright Ass'Y (Alum)	532.0
5	10132 12' Upright Ass'Y (Alum)	205.0
2	10172 Crunch Bar	16.0
1	10267 3' Transfer Platform	429.0
1	10284 Climbing Pole 6' Attach	61.0
2	10288 14' Upright Assmbly(Alum)	86.0
1	10312 3'-0" Dna Climber	79.0
2	10365 90Deg Loop Ladder Link 3'	172.0
1	10371 Rung Enclosure/Guardrail	16.0
1	10386 3' Wave Tot Slide	80.0
1	10498 Wishbone Double Slide	339.0
1	10550 3'-0"/3'-6"Clover Climber	83.0
1	10552 5'-0" & 5'-6"Clover Climber	103.0
1	10598 8'-0" Tunnel-Up 30"	213.0
1	10663 5'-0" Spiney. Arch Climber	93.0
1	10691 6'-0" Twister Climber	85.0
1	10815 Criss-Cross Loop Ladder	196.0
1	10847 Two-Place Swing Freestand	404.0
1	10848 Two-Place Swing Add-A-Bay	250.0
1	10928 90 Degr. Loop Climb	118.0

Grand Forks Phase 1 Levees

8	12023	3 1/2" Uprt Ass'Y Alum 8'	144.0
4	12026	3 1/2" Uprt Ass'Y Alum 11'	96.0
2	13300	36" Sq Deck Exp Mtl (Tot)	112.0
1	13302	Rectangular Exp Mtl Deck	72.0
1	13316	37ree Climb	57.0
1	13357	2'-6"/3'-0" Corkscrew	60.0
1	13364	36" Trans Platform 3' Deck	166.0
1	13369	3'-0" Zipper Attachment	75.0
1	13387	Gable Roof (Single)	141.0
1	13404	Mini-Arch Bdg W/Barrier	112.0
1	13424	2' Crawl Tube W/Spy Holes	66.0
2	13436	Barrier Enclosure	50.0
1	13497	Curved Tot Slide (Totttime)	64.0
1	13525	Rumble & Roll (Totttime)	180.0
2	1464	8521 Enclosed Tot Seat Pkg 5" Od	42.0
1	1468	2958 Belt Seat Pkg 5" Od	17.0
1	15026	Pentagonal Deck W/Climber	927.0
6	18000	49" Sq Punched Steel Deck	1,002.0
6	18001	49" Tri Punched Steel Deck	450.0
1	18012	Punched Steel Mini-Arch w/Barrier	216.0
1	18037	Punched Steel 90 Deg. Funnel w/Gdrail	239.0
1	18069	Punched Steel 6'0" Spiral Slide w/Can	528.0
1	18091	Punched Steel Suspension Bridge Link	392.0
1	18099	5'-6" Cyberslide	473.0
1	9803	Handi-Swing Pkg. 8' Ht. 3.5" Toprail	39.0

1.7 INSPECTION

Playground equipment shall be inspected upon arrival at the job site for meeting age-appropriate requirements for the age-group that the equipment is designated to accommodate and specified quality in accordance with paragraphs MATERIALS and CONFIGURATION. Prohibited or unacceptable equipment shall be removed from the job site.

1.8 PROHIBITED EQUIPMENT

Equipment that does not meet the Army's developmental play program requirements and are prohibited on outdoor play areas include the following: chain balance beams; rotating equipment, such as merry-go-rounds, log rolls, whirls and may poles; fulcrum seesaws (teeter totters); spring rocking equipment intended for standing; animal figure swings; rope swings; multiple occupancy swings; swinging exercise and trapeze bars; swinging platforms; tire climbers; swinging dual exercise rings; roller slides; trampolines; swinging gates or doors; and new or used vehicle tires. Play houses or enclosures made of horizontal posts or bars with space between them. Wood components treated with creosote, pentachlorophenol, and tributyl tin oxide. Wood components coated with a finish containing pesticide.

1.9 AGE GROUPS

Play areas are designed to provide challenging play activities by age group. Playground equipment shall be designed to be age appropriate for the age group designated to use it. The Army age groups are defined as follows:

1.9.1 Playground Areas

The age groups accommodated at these areas range from less than 12 months

through 12 years of age defined as the following: infant age group (less than 12 months); pre-toddler age group (12 through 24 months); composite toddler/pre-school age group (2 through 5 years of age); school-age age group (5 through 9 years of age); and pre-teen age group (9 through 12 years of age). A multi-age playground consists of the following age groups: infant, pre-toddler, and composite toddler/pre-school age groups.

1.10 MANUFACTURER QUALIFICATION

Play events and equipment similar to those furnished shall have been installed in a minimum 10 sites and been in successful service for a minimum 5 year calendar period. The manufacturer shall provide a Certificate of Insurance AA rated for a minimum one million dollars covering both product and general liability.

1.11 INSTALLER QUALIFICATION

The installer shall be certified by the manufacturer for training and experience installing the play events and equipment.

1.12 WARRANTY

Furnished play events and equipment shall have a minimum 1 year calendar period warranty.

1.13 MANUFACTURER'S REPRESENTATIVE

The manufacturer's certified playground safety inspector or the manufacturer's designated certified playground safety representative shall supervise the installation and adjustment of the play events and equipment to verify the installation meets the requirements of the manufacturer, this specification, and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Powder Coat Finish

Powder coat finish shall be an electrostatically applied custom formula of TGIC polyester powder. All components will be free of sharp edges and excess weld spatter and shall be cleaned in a six stage bath system with an iron phosphate wash, as a rust inhibitor, and a sealer to prevent flash rusting before coating. The coating shall have a super tough finish with maximum exterior durability and will have superior adhesion characteristics. Typical characteristics are 3.0 - 5.0 mil thickness and oven cured between 375 to 425 degrees Fahrenheit. Pencil Hardness H (ASTM D 3363), Abrasion (ASTM D 1907), Impact (ASTM D 2794), Wedge Bend (ASTM D 522), Adhesion (Cross Hatch ASTM D 3359 & Knife Scratch ASTM D 2197), Environmental (Stain Resistance ASTM D 1308, Salt Spray ASTM B 117 & Fadometer 300 hours with no loss of gloss), Over-bake Stability 100 percent at 400 degrees Fahrenheit.

2.1.2 Rotationally Molded Products

All polyethylene shall be linear low density material with UV-stabilized color and an anti-static compound additive. All rotationally molded products shall meet or exceed the following specifications: ASTM D 1248, type 2, class A and FS-L-P 390C, type 1, class M, grade 2, category 3;

Density (ASTM D 1505); Brittleness Temperature (ASTM D 746); Tensile Values (ASTM D 638); Flexural Modulus (ASTM D 790); Heat Distortion (ASTM D 648).

2.1.3 Steel Tubing

All tubing used to manufacture components shall be an electrical resistance welded, cold rolled, high strength steel tubing. The exterior coating will consist of an in line hot-dipped uniform zinc galvanizing, chromate conversion, and acrylic over-coating. The interior coating will consist of a special organic acrylic modified polyester.

2.1.4 Hardware

All nuts, bolts, screws, inserts, and lockwashers used in the assembly of all play equipment shall be stainless steel, yellow dichromate plated steel, blue-coat plated steel, mechanically galvanized or powder coated/yellow dichromate plated steel. All primary fasteners shall be Type 304 alloy stainless steel. Fasteners with yellow dichromate treatment have an electro-deposited, 99.9 percent pure zinc substrate applied from a specially formulated solution sealed with a yellow dichromate top coat designed to work in conjunction with the zinc plating. Yellow dichromate has a 320 percent longer life to white corrosion and 275 percent longer to red corrosion than does hot-dip galvanizing. PowerScape stainless steel fasteners shall be button-pin-in head, hex socket cap screws with a two-part epoxy locking patch added to the threads. The two-part locking patch shall consist of one part resin and one part catalyst which are activated during installation. After curing, the material shall require a minimum of 5 times the installation torque to remove the fastener. Manufacturer shall provide special installation tools for pinned fasteners.

2.1.5 Galvanneal Coating

All galvanneal coating shall meet or exceed the specifications of ASTM A 653/A 653 M.

2.1.6 Kickplates

2.1.6.1 12 Inch Powerscape Filler/Kickplate

12 inch powerscape filler/kickplate shall be fabricated from, at a minimum, 11 gauge (0.120 inch) hot rolled steel, and shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein to match the deck color.

2.1.6.2 18 Inch Powerscape Filler/Kickplate

18 inch powerscape filler/kickplate shall be fabricated from, at a minimum, 11 gauge (0.120 inch) hot rolled steel with 3/16 inch thick mounting tabs. The filler/kickplate shall be an all-welded, one-piece assembly and shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein and shall be finished to match the deck color.

2.1.6.3 24 Inch Powerscape Filler/Kickplate

24 inch powerscape filler/kickplate shall be fabricated from, at a minimum, 7 gauge (0.180 inch) hot rolled steel with 3/16 inch thick mounting tabs. The filler/kickplate shall be an all-welded, one-piece assembly and shall be coated with a custom formula TGIC polyester powder coating in

conformance with the specifications outlined herein and shall be finished to match the deck color.

2.1.7 Powerscape Handholds

All PowerScape handholds shall be fabricated from, at a minimum, 1-5/16 inches O.D., 14 gauge (0.083 inch) wall galvanized steel tubing. If vertical spacers are required, they shall be manufactured from 1-1/16 inches O.D., 15 gauge (0.075 inch) wall galvanized steel tubing. The handholds shall be a one-piece welded assembly and shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

2.1.8 TotTime Handholds

All PrimeTime/TotTime handholds shall be fabricated from, at a minimum, 1-1/16 inches O.D., 15 gauge (0.075 inch) wall galvanized steel tubing. The handholds shall be one-piece all welded and shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

2.1.9 Step Down Rungs

Step down rungs shall be fabricated from, at a minimum, 1-5/16 inches O.D., 14 gauge (0.083 inch) wall galvanized steel tubing with, at a minimum, 3/16 inch rounded edges and 3/16 inch thick mounting tabs. The step down rung shall be an all-welded assembly and shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

2.1.10 Powerscape Aluminum Uprights

Powerscape aluminum uprights shall be, at a minimum, 5 inches outside diameter tubing, 1/8 inch wall thickness, extruded from 6005-T5 aluminum alloy conforming to ASTM B 221. Minimum yield strength shall be 35,000 psi and minimum tensile strength shall be 38,000 psi.

2.1.11 TotTime Aluminum Uprights

TotTime aluminum uprights shall be, at a minimum, 3.5 inches outside diameter tubing, 1/8 inch wall thickness, extruded from 6005-T5 aluminum alloy conforming to ASTM B 221. Minimum yield strength shall be 35,000 psi and minimum tensile strength shall be 38,000 psi.

2.1.12 Powerscape and TotTime Uprights

All upright posts shall have a finished grade line marking to indicate the correct playground safety surface level. All upright posts shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

2.1.13 Upright Caps

The standard upright cap shall be an aluminum cap, cast from a 319 alloy, powder coated to match the upright. All upright caps are permanently installed at the factory using aluminum self-sealing rivets.

2.1.14 Powerscape Megaloy™ Bolt-Through Connection

The Patented MegaLoc assemblies shall incorporate two die cast aluminum parts, in a distinctive dual purpose mounting system that allows either a rung or a flat panel to mount to the same location. Each MegaLoc is bolted directly into the upright post and designed to eliminate exposed hardware and protrusions. Each MegaLoc shall be die cast of, at a minimum, 383 aluminum alloy, to resist corrosion. Minimum tensile strength shall be 45,000 psi, minimum yield strength shall be 22,000 psi. Clamps that wrap around the post or are field installed are not acceptable. The MegaLoc castings shall have a minimum wall thickness of 1/4 inch. All necessary MegaLoc connectors shall be engineered, manufactured and factory installed as an integral part of the upright post. A synthetic rubber gasket shall be placed between the MegaLoc and the upright post, to seal out moisture. For added protection against corrosion, cold galvanizing shall be applied to the edges of each drilled hole. MegaLoc mounting hardware shall not be exposed, virtually eliminating tampering by vandals. All MegaLoc connectors shall be coated with a custom formula of TGIC polyester powder coating, in conformance with the specifications outlined herein, before being attached to the upright posts.

2.1.15 TotTime Bolt-Through Connection

Each PrimeTime/TotTime component is bolted directly into the upright post and designed to eliminate exposed hardware and protrusions. Minimum tensile strength of the connection shall be 45,000 psi, minimum yield strength shall be 22,000 psi. All necessary connectors shall be engineered, manufactured and factory installed as an integral part of the upright post. For added protection against corrosion, cold galvanizing shall be applied to the edges of each drilled hole.

2.1.16 Powerscape Punched Steel Decks and PVC-Coated Components

All expanded metal products shall be fabricated from, at a minimum, 3/4 inch No. 9 regular carbon steel expanded metal; all punched steel products shall be fabricated from, at a minimum, 11 gauge punched steel with a protective p&o finish. Coated products shall consist of a welded assembly with an oven cured matte finish polyvinyl chloride (PVC) coating with a minimum coating thickness of, at a minimum, 0.125 inch. All decks shall be exclusively dipped utilizing the DuraWear process with an extra thick coating on the top of the deck. The PVC coating shall have a hardness of Shore A 83 +/-5 normal durometer range. This material is classed as "Self Extinguishing", meets or exceeds automotive specifications NVSS302, and contains ultraviolet inhibitors to help prolong the life of the coating.

2.1.17 Powerscape Square Decks

Powerscape square decks shall have a minimum surface area of 2,381 square inches, maintaining a full 49 inches center to center spacing on the upright posts. The 49 inch square deck shall be fabricated in conformance with the expanded metal/punched steel specifications outlined herein. The deck frame shall be fabricated from, at a minimum, 3/16 inch x 3-1/2 inches hot rolled steel with corner supports fabricated from, at a minimum, 1/4 inch x 3-1/2 inches hot rolled steel. Intermediate supports, fabricated from, at a minimum, 1/8 inch x 2-1/2 inches hot rolled steel, shall be notched and welded at the intersections forming a rigid 12 inch support grid underneath the entire deck surface. The deck shall be a one-piece welded assembly, coated after fabrication with an oven cured matte finish polyvinyl chloride (PVC) coating in accordance with the specifications herein. The square deck shall be directly bolted to the upright posts with eight 3/8 inch diameter button-pin-in-head, hex socket cap screws in

accordance with the hardware specifications herein.

2.1.18 Powerscape Triangular Decks

Powerscape triangular decks shall have a minimum surface area of 1,039 square inches, maintaining a full 49 inches center to center spacing on the upright posts. The triangular platform shall be fabricated in conformance with the expanded metal/punched steel specifications outlined herein. The deck frame shall be fabricated from, at a minimum, 3/16 inch x 3-1/2 inches hot rolled steel with corner supports fabricated from, at a minimum, 1/4 inch x 3-1/2 inches hot rolled steel. Intermediate supports, fabricated from, at a minimum, 1/8 inch x 2-1/2 inches hot rolled steel, shall be welded at the intersections forming a rigid support grid underneath the deck surface. The deck shall be a one-piece welded assembly, coated after fabrication with an oven cured matte finish polyvinyl chloride (PVC) coating in accordance with the specifications herein. Each triangular deck shall be directly bolted to the upright posts with six 3/8 inch diameter button-pin-in-head, hex socket cap screws in accordance with the hardware specifications herein.

2.1.19 Powerscape Stepped Platforms

Powerscape stepped platforms shall have a minimum surface area of 2,381 square inches, maintaining a full 49 inches center to center spacing on the upright posts. The 49 inch square stepped platform shall be fabricated in conformance with the expanded metal/punched steel specifications outlined herein. Stepped decks shall be available in both six-inch and twelve-inch height differentials. The deck frame shall be fabricated from, at a minimum, 3/16 inch x 3-1/2" hot rolled steel with corner supports fabricated from, at a minimum, 1/4" x 3-1/2 inches hot rolled steel. The diagonal brace shall be fabricated from 11 gauge steel with a protective p&o finish. Intermediate supports, fabricated from, at a minimum, 1/8 inch x 2-1/2 inches hot rolled steel, shall be notched and welded at the intersections forming a rigid 12 inch support grid underneath the entire deck surface. The deck shall be a one-piece welded assembly, coated after fabrication with an oven cured matte finish polyvinyl chloride (PVC) coating in accordance with the specifications herein. Each stepped deck shall be directly bolted to the upright posts with eight 3/8 inch diameter button-pin-in-head, hex socket cap screws in accordance with the hardware specifications herein.

2.1.20 TotTime Expanded Metal Decks and Components

All expanded metal products shall be fabricated from, at a minimum, 3/4 inch No. 9 regular carbon steel expanded metal and shall be an all welded assembly with an oven cured matte finish polyvinyl chloride plastisol coating with a minimum coating thickness of 0.080 inch. All decks shall be exclusively dipped utilizing the DuraWear process with an extra thick coating on the top of the deck. The plastisol coating shall have a hardness of Shore A 82-86 durometer range. This material is classed as "Self Extinguishing", meets or exceeds automotive specifications NVSS302, and contains ultraviolet inhibitors to help prolong the life of the coating.

2.1.21 Powerscape Pentagonal Deck with Internal Climber

The pentagonal deck shall be fabricated from formed 11 gauge perforated metal in accordance with the PowerScape punched steel deck and intermediate support specifications outlined herein. Uprights shall be a minimum 5 inches outside diameter tubing in accordance with the PowerScape aluminum

and steel upright specifications outlined herein. The 5 punched steel decks shall be directly bolted to the upright posts with ten 3/8 inch diameter button-pin-in-head, hex socket cap screws in accordance with the hardware specifications herein. The decks shall include, at a minimum, 1/8 inch PVC oven cured matte finish coating. The center climber assembly shall be an all welded one-piece construction from 1-5/16 inches O.D. galvanized steel tubing, and shall have a powdercoat finish applied after fabrication.

2.1.22 TotTime Square Decks

TotTime square decks shall have a minimum surface area of 1,286 square inches, maintaining a full 36 inches center to center spacing on the upright posts. The 36 inch square deck shall be fabricated from 3/4 inch No. 9 regular carbon steel expanded metal in conformance with the specifications outlined herein. The deck frame shall be fabricated from, at a minimum, 3/16 inch x 2-1/2 inches hot rolled steel with corner supports fabricated from, at a minimum, 1/4 inch x 2-1/2 inches hot rolled steel. Intermediate supports, fabricated from, at a minimum, 1/8 inch x 1 inch hot rolled steel, shall be notched and welded at the intersections forming a support grid underneath the entire deck surface. The deck shall be a one-piece welded assembly, coated after fabrication with an oven cured matte finish polyvinyl chloride (PVC) coating in accordance with the specifications herein. Each square deck shall be directly bolted to the upright posts with four 3/8 inch diameter button head cap screws in accordance with the hardware specifications herein.

2.1.23 TotTime Rectangular Decks

TotTime rectangular decks shall have a minimum surface area of 1,628 square inches, maintaining a standard 36 inches center to center spacing on the upright posts on two sides and 45.5 inch spacing on the remaining sides. The deck shall be fabricated utilizing the same materials set forth in the PrimeTime and TotTime square deck specification. Each rectangular deck shall be directly bolted to the upright posts with four 3/8 inch diameter button head cap screws in accordance with the hardware specifications herein.

2.1.24 TotTime Triangular Decks

TotTime triangular decks shall have a minimum surface area of 556 square inches, maintaining a full 36 inches center to center spacing on the upright posts. The 36 inch triangular deck shall be fabricated from, at a minimum, 3/4 inch No. 9 regular carbon steel expanded metal in conformance with the specifications outlined herein. The deck frame shall be fabricated from, at a minimum, 3/16 inch x 2-1/2 inches hot rolled steel with corner supports fabricated from, at a minimum, 1/4 inch x 2-1/2 inches hot rolled steel. Intermediate supports, fabricated from, at a minimum, 1/8 inch x 1 inch hot rolled steel, shall be welded at the intersections forming a support grid underneath the deck surface. The deck shall be a one-piece welded assembly, coated after fabrication with an oven cured matte finish polyvinyl chloride (PVC) coating in accordance with the specifications herein. Each triangular deck shall be directly bolted to the upright posts with three 3/8 inch diameter button head cap screws in accordance with the hardware specifications herein.

2.1.25 TotTime Transfer Platform

Platform and step shall be made from a minimum 3/4 inch No. 9 regular carbon steel expanded metal in conformance with the specifications outlined

herein. Platform and step shall each be a one-piece welded assembly. Platform frame shall be made from, at a minimum, 1/8 inch x 2-1/2 inches hot rolled steel with intermediate supports fabricated from, at a minimum, 1/8 inch x 2 inches hot rolled flat steel. Step shall be made from a minimum of 10 gauge (0.134 inch thick) hot rolled steel and 1/8 inch x 2-1/2 inches hot rolled flat steel. Platform handhold shall be fabricated from a single piece of 1-5/16 inch O.D. x 14 gauge (0.083 inch thick) galvanized steel tubing. Handrails shall be fabricated from 1-1/16 inches O.D. x 15 gauge (0.075 inch thick) galvanized steel tubing, 1-5/16 inches O.D. x 14 gauge (0.083 inch thick) galvanized tubing and 3/16 inch formed hot rolled flat steel mounting tab. Handrails shall be and all welded assembly. After fabrication, handrails and handhold shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein.

2.1.26 Powerscape Transition Step

Powerscape transition step shall be made from a minimum 3/4 inch No. 9 regular carbon steel expanded metal in conformance with the specifications outlined herein. Step frame shall be made from a minimum of 1/8 inch and 3/16 inch thick hot rolled flat steel. Transition step shall be an all welded assembly finished with the matte PVC coating per the specifications herein. The filler/kick plate shall be fabricated from a minimum of 3/16 inch hot rolled steel. The handhold shall be fabricated from, at a minimum, 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. The filler/kick plate and handhold shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

2.1.27 Powerscape Suspension Bridge

Expanded metal footboards shall be fabricated from a minimum of 3/4 inch No. 9 regular carbon steel expanded metal in conformance with the specifications outlined herein. The footboard frame shall be fabricated from a minimum of 3/16 inch x 2-1/2 inches hot rolled steel with the intermediate supports fabricated from a minimum of 3/16 inch x 1 inch hot rolled steel. Each footboard shall be a one-piece welded assembly finished with the matte PVC coating per the specifications herein. Suspension bridge guardrail shall be an all welded construction of a formed 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing rails and 1-1/16 inches O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing rungs. The guardrail assembly shall be coated with a custom formula of TGIC polyester powder, after fabrication in conformance with the specifications outlined herein.

2.1.28 Powerscape 90 Degree Funnel Bridge

The bridge shall be fabricated to form a smooth 90 degree bend. The bridge section shall be fabricated from a minimum of 3/4 inch No. 9 regular carbon steel expanded metal in conformance with the specifications outlined herein. The bridge section shall be a one-piece welded assembly finished with the matte PVC coating per the specifications herein. The bridge frame shall be fabricated from a minimum of 3/16 inch x 3-1/2 inches hot rolled steel with the intermediate supports fabricated from a minimum of 1/8 inch x 1 inch hot rolled steel. Funnel bridge protective barriers shall be an all welded construction of a formed a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing and 1-1/16 inches O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing vertical rungs. The protective barrier assembly shall be coated with a custom formula of TGIC polyester

powder, after fabrication in conformance with the specifications outlined herein. The PowerScape 90 degree funnel bridge shall include two entry archways in accordance with the specifications herein.

2.1.29 Powerscape Mini-Arch Bridge

Mini-Arch bridge shall have a minimum surface area of 1,982 square inches. The bridge section shall be fabricated from a minimum of 3/4 inch No. 9 regular carbon steel expanded metal in conformance with the specifications outlined herein. The bridge section shall be a one-piece welded assembly finished with the matte PVC coating per the specifications herein. The bridge frame shall be fabricated from a minimum of 3/16 inch x 3-1/2 inches and 1/4 inch x 3-1/2 inches hot rolled steel. Mini-Arch bridge protective or guardrail barriers shall be a minimum of all-welded construction of a formed 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing, 2 inches square x 3/16 inch wall tubing outer frame and 1-1/16 inches O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing vertical rungs. The protective barrier or guardrail assembly shall be coated with a custom formula of TGIC polyester powder, after fabrication in conformance with the specifications outlined herein.

2.1.30 TotTime Zipper Climber

Zipper climber shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing, and step rungs of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing and 3/16 inch formed steel mounting tab. Zipper climber shall be a one-piece welded assembly and shall be coated with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein, after fabrication.

2.1.31 Powerscape Clover Climber

Powerscape clover climber shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing upright and step rungs of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. The Clover climber shall have a minimum handhold of 1.029 inches x 0.083 inch (14 gauge) wall galvanized steel tubing. The Clover climber assembly shall be coated with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein, after fabrication. PowerScape clover climber shall include an entry archway in accordance with the specifications herein.

2.1.32 Powerscape Crazy-Eight Climber

The Powerscape crazy-eight climber shall be constructed to the following minimum standards: Powerscape crazy-eight climber shall be fabricated from 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing upright and step rungs of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. The climber assembly shall be coated with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein, after fabrication. PowerScape Crazy Eight climber shall include an entry archway in accordance with the specifications herein.

2.1.33 TotTime Crazy-Eight Climber

Crazy Eight climber shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing, and step rungs a

minimum of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing and 3/16 inch formed steel mounting tab. Crazy Eight climber shall be a one-piece welded assembly and shall be coated with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein, after fabrication.

2.1.34 Powerscape Rung Ladder

Powerscape rung ladder shall be fabricated from a minimum of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing with horizontal members fabricated of a minimum of 1-1/16 inches O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing. The ladder assembly shall be an all-welded construction and coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. PowerScape rung ladder shall include an entry archway in accordance with the specifications herein.

2.1.35 Powerscape Tree Climber

Powerscape tree climber shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing upright and step rungs of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. The climber assembly shall be coated with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein, after fabrication. PowerScape tree climber shall include an entry archway in accordance with the specifications herein.

2.1.36 TotTime Tree Climber

Tree climber shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing, 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing and 3/16 inch formed steel mounting tab. Tree climber shall be a one-piece welded assembly and shall be coated with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein, after fabrication.

2.1.37 TotTime Corkscrew Climber

The corkscrew, main upright and top bar shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. Mounting tabs shall be formed 3/16 inch hot rolled flat steel. The corkscrew climber assembly shall be an all welded assembly and shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

2.1.38 Powerscape Five Ring Climber

The corkscrew, main upright and top bar shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. Mounting tabs shall be formed 3/16 inch hot rolled flat steel. The corkscrew climber assembly shall be an all welded assembly and shall be coated with a custom formula TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

2.1.39 Powerscape DNA Climber

The DNA climber shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing with horizontal rails fabricated from a minimum of 1-1/16 inches O.D. x 0.075 inch (15 gauge)

wall galvanized steel tubing. The DNA climber assembly shall be an all welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. PowerScape DNA climber shall include an entry archway in accordance with the specifications herein.

2.1.1.40 Powerscape Spiney Arch Climber

The spiney arch climber shall be fabricated from a minimum of 2-3/8 inches O.D. x 0.095 inch (13 gauge) wall galvanized steel tubing arch rail with rolled spines fabricated from a minimum of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. The spiney arch climber assembly shall be an all welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. PowerScape spiney arch climber shall include an entry archway in accordance with the specifications herein.

2.1.1.41 Powerscape Twister Climber

The twister climber inner and outer rails shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. The rungs shall be fabricated from a minimum of 1-1/16 inches O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing. The twister climber assembly shall be an all welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. PowerScape twister climber shall include an entry archway in accordance with the specifications herein.

2.1.1.42 Powerscape Chinning Bars

The chinning bars shall be fabricated from a minimum of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

2.1.1.43 Powerscape Climbing Pole

Powerscape climbing pole shall be fabricated from a minimum of 1-5/8 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The PowerScape climbing pole shall include an entry archway in accordance with the specifications herein.

2.1.1.44 Powerscape Crunch Bar

Powerscape crunch bar shall be fabricated from a minimum of 1-1/16 inches O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

2.1.1.45 Powerscape Horizontal Ladders (Straight and Curved)

The horizontal ladder assembly shall be fabricated from a minimum of 2-3/8 inches O.D. x 0.095 inch (13 gauge) wall galvanized steel tubing and 3/16 inch formed hot rolled steel mounting tabs. The cross rungs shall be fabricated from a minimum of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. The ladder assemblies shall be an all welded

construction which bolts directly into the uprights and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

2.1.1.46 Powerscape Horizontal and Inclined Loop Ladders

The horizontal loop ladder assemblies shall be fabricated from a minimum 2-7/8 inches O.D. x 0.134 inch wall galvanized steel tubing rails with rung loops fabricated from a minimum 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. Each horizontal loop ladder assembly shall be an all welded construction. Support legs for the "S" horizontal loop ladder shall be fabricated using 2-3/8 inches O.D. x 0.095 inch (13 gauge) wall galvanized steel tubing. Access ladders for attachments shall be fabricated from a minimum 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing and rungs fabricated from a minimum 1-1/16 inches x 0.075 inch (15 gauge) wall galvanized steel tubing. The access ladder shall be an all welded construction. All ladder assemblies and legs shall be coated with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein, after fabrication.

2.1.1.47 Powerscape Criss Cross Overhead Loop Ladders

The horizontal loop ladder assemblies shall be fabricated from 2-7/8 inches O.D. x 0.203 inch wall galvanized steel tubing rails with rung loops fabricated from a minimum of 1-1/16 inches O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing. Each loop ladder assembly shall be an all welded construction. All ladder and end rail assemblies shall be coated with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein, after fabrication. The end rails shall be fabricated to a minimum of 2-3/8 inches O.D. x 0.095 inch (13 gauge) wall galvanized steel tubing and 3/16 inch formed hot rolled steel mounting tabs. The end rails shall be an all welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

2.1.1.48 Rotationally Molded Crawl Tubes

2.1.1.48.1 24 Inch Inside Diameter

The minimum 24 inch I.D. x 1/4 inch nominal wall thickness tube and 1-7/8 inches connecting panels shall be rotationally molded linear low-density polyethylene conforming to the roto-mold specifications outlined herein. Tube sections shall be molded so that all hardware connections are on the outside of the tube with an internal connection.

2.1.1.48.2 30 Inch Inside Diameter

The minimum 30 inch I.D. with 1/4 inch nominal wall thickness tube shall be rotationally molded linear low-density polyethylene conforming to the specifications outlined herein. Tube sections shall be molded so that all hardware connections are on the outside of the tube. The connection of multiple tube sections shall be an external overlap connection. The entrance panel shall allow access to the crawl tube at an accessible height of less than 8 inch as specified in the American with Disabilities Act (ADA).

2.1.1.49 Powerscape and TotTime Rotationally Molded Rung Enclosure

Powerscape & TotTime rotationally molded rung enclosure shall be a minimum

of 1-7/8 inches thick, color impregnated linear low density polyethylene and shall conform to the rotationally molded specifications outlined herein. Rung enclosure shall have 3 inch wide slots.

2.1.150 Powerscape and TotTime Metal Rung Enclosures

The rung enclosure shall be fabricated of a minimum of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing. The vertical rungs shall be fabricated of 1-1/16 inches O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing. The rung enclosure shall be an all welded assembly and shall be coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication.

2.1.151 Powerscape Metal Panel Enclosures

The enclosure panels shall be fabricated from a minimum of 11 gauge (0.120 inch) hot rolled steel. The enclosure panel frame shall be fabricated from a minimum of 1-5/16 inches x 14 gauge (0.083 inch) wall and 1-1/16 inches x 15 gauge (0.075 inch) wall galvanized steel tubing. The enclosure panels shall be an all welded assembly double powder coated with a custom formula of TGIC polyester in conformance with the specifications outlined herein, after fabrication.

2.1.152 Powerscape Ramps/Connecting Walks Without Incline

Powerscape ramps/connecting walks without incline shall have a minimum surface area of 2,861 square inches per six feet of ramp/connecting walk (available in 6 foot or 12 foot length). The ramp shall be fabricated from a minimum of 3/4 inch No. 9 regular carbon steel expanded metal in conformance with the specifications outlined herein. The ramp frame shall be fabricated from 3/8 inch x 3-1/4 inches hot rolled steel with the intermediate supports fabricated from 1/4 inches x 2-1/2 inches and 3/8 inch x 1 inch hot rolled steel. Each ramp section shall be a one-piece welded assembly. Handrails shall be fabricated from a minimum of 1-5/16 inches O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing and 2 inches square x 3/16 inch wall tubing outer frame, with vertical members fabricated of 1-1/16 inches O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing. The handrails shall be an all welded assembly and shall be coated with a custom formula of TGIC polyester powder in conformance with the specifications outlined herein, after fabrication.

2.1.153 Powerscape 360 Degree Spiral Slide

The slide shall be a double wall, one-piece construction of color impregnated rotationally molded linear low density polyethylene with a 1/4 inch nominal wall thickness, with a factory installed canopy of the same specifications. The slide shall have a 12 inch long, flat entrance, sit-down area. Sidewalls of the spiral slide shall be at least 16 inches high, when measured from the sliding surface. The outside diameter of the slide shall be 66 inches. The slide helix shall be a full 360 degree cycle and shall have a 20 inch long horizontal run out, to slow the user, before exiting the slide. The slide access shall be made from 3/4 inch No. 9 regular carbon steel expanded metal in conformance with the specifications outlined herein. Access stringers shall be made from a minimum of 11 gauge (0.120 inch thick) hot rolled flat steel. The access assembly shall be an all welded assembly. Handrails shall be fabricated from 1-5/16 inch O.D. x 0.083 inch (14 gauge) wall galvanized steel tubing with vertical members fabricated of 1-1/16 inch O.D. x 0.075 inch (15 gauge) wall galvanized steel tubing. The handrails shall be an all welded assembly and shall be

coated with a custom formula of TGIC polyester powder coating in conformance with the specifications outlined herein, after fabrication. The slide mast shall be aluminum and permanently molded into the slide during the molding process. The slide shall include a ground socket to receive the mast and an additional footbuck support. All rotationally molded polyethylene products shall conform to the rotationally molded specifications outlined herein.

2.1.54 Powerscape and TotTime Roatationally Molded Slides (Single and Double Wide, Tidal Wave and Rumble 'N Roll)

The slides shall be color impregnated linear low density polyethylene and shall conform to the rotationally molded specifications outlined herein. The bedway shall be at least 17-3/4 inches wide (inside) with sides that are 6 inches high when measured from the bedway surface. All slides shall be of double wall construction with a nominal 1/4 inch wall thickness. The entrance section shall have a flat "sit-down" area 17-3/4 inches wide x 12 inches long. The side walls in this area shall be 20 inches high (measured from the slide surface) and shall be molded into the entrance section. The exit section of the bedway shall have a 40 inch radius for a smooth transition from the slide chute to the run-out area. The flat run-out area shall be 20 inches long to slow the user for proper exit.

2.1.55 TotTime Rotationally Molded Curved Slide

The slide shall be color impregnated linear low density polyethylene and shall conform to the rotationally molded specifications outlined herein. The bedway shall be 17-3/4 inches wide (inside) with sides that are 6 inches high at the top of the slide, tapering to 4-1/2 inches high at the runout when measured from the bedway surface. All slides shall be of double wall construction with a 1/4 inch nominal wall thickness. The entrance section shall have a flat "sit-down" area 17-3/4 inches wide x 12 inches long. The side walls in this area shall be 20 inches high (measured from the slide surface) and shall be molded into the entrance section. The exit section of the bedway shall have a 40 inch radius for a smooth transition from the slide chute to the run-out area. The flat run-out area shall be 12 inches long to slow the user for proper exit.

2.1.56 Powerscape Rotationally Molded Wishbone Slide

The slides and cross bar shall be color impregnated linear low density polyethylene and shall conform to the rotationally molded specifications outlined herein. The Wishbone Slide shall be manufactured from 2 FlipSlides, one right exiting and one left exiting slide. The slides shall be connected at the entrance region by a filler piece, manufactured of linear low density polyethylene. The mounting bracket shall be 3/16 inch x 2-1/2 inches hot rolled steel, PVC coated in conformance with the specifications herein. The vertical bar shall be a one-piece welded assembly and shall be coated with a custom formula of TGIC polyester powder, after fabrication in conformance with the specifications outlined herein.

2.1.57 Powerscape Cyberslide™

This patent-pending one piece, rotationally molded slide shall feature double-wall construction and shall be manufactured from color-impregnated linear low density polyethylene and shall conform to the roto-mold specifications outlined herein. The overall nominal width of the one-piece slide is 21 inches with a nominal length of 163-1/2 inches. The exit region

shall be upheld by supports, which are molded into the slide. The exit height of the slide shall be no more than 14-3/4 inches. The platform height shall be 8 feet. A matching double-walled hood is provided at the entrance and shall be molded from the same material as the slide bedway. Both the molded slide and hood shall have images resembling the internal parts of a space ship molded into the outer surfaces for imaginative play. The underside of the slide shall have similar images molded into the surface to provide both imaginative play and tactile stimulation to users at ground level. The CyberSlide shall have a one-piece welded steel center support assembly; it shall be coated with a custom formula of TGIC polyester powder after fabrication, in conformance with the specifications outlined herein. An optional dual rotating game apparatus consists of nine roto-molded game pieces attached to a frame. The frame shall be a one-piece welded assembly and shall be coated with a custom formula of TGIC polyester powder, after fabrication in conformance with the specifications outlined herein. For 5 feet-6 inches deck applications, the platform assembly shall be an all welded assembly finished with the matte PVC coating per the specifications herein. The upper platform shall have a minimum of 890 square inches of surface area, and shall maintain a full 49 inches center to center spacing between the uprights. The upper platform frame shall be fabricated from 3/16 inch x 3-1/2 inches hot rolled steel with intermediate supports fabricated from 1/8 inch x 2-1/2 inches hot rolled steel. The corner supports shall be fabricated from 1/4 inch x 3-1/2 inches hot rolled steel. The 8 feet upper platform shall be bolted directly to the upright posts with four 3/8 inch diameter cap screws in accordance with the hardware specifications herein. The accessible steps shall have a minimum of 355 square inches of area per step and shall descend in increments of 8 inches or less, as specified by the Americans with Disabilities Act (ADA), down to a 5 feet-6 inch deck. Step stringers shall be made from a minimum of 11 gauge (0.120 inch thick) hot rolled flat steel. A barrier rail shall be provided along both sides of the deck/step assembly. Each barrier rail shall be a one-piece welded assembly and shall be coated with a custom formula of TGIC polyester powder, after fabrication in conformance with the specifications outlined herein.

2.1.58 Concrete

Concrete shall conform to Section 02770 CONCRETE SIDEWALKS AND CURBS AND GUTTERS.

2.1.59 Color

Color shall be provided as follows:

<u>Plasti</u>	<u>Meta</u>	<u>Deck</u>
Green	Dark Green	Blue
Yellow	Blue	Dark Green
	Green	

2.2 EQUIPMENT

2.2.1 Configuration

Play event configuration, platform height, fall height, and maximum equipment height shall be as indicated. When the configuration varies from the play event shown, shop drawings defining the configuration shall be provided to include the following: equipment layout with the use zone perimeter; designated play surface spot elevations; maximum equipment

height spot elevations; platform spot elevations; protective barriers; guardrails; bare or painted metal platform and slide bed orientation; and play events in relationship to the playground layout.

2.2.2 Substitution

Substitutions will not be allowed and play events will not be selected without written approval from the technical representative. Manufacturer substitutions which increase the play event platform height or maximum equipment height shall be evaluated. The increased height requires additional protective surfacing in accordance with paragraph FALL HEIGHT.

2.2.3 Platform Height

Platform height is used to define the age group for age appropriate play events and composite structures. To be age appropriate, the platform height shall meet the finished elevations of the age groups in the following paragraphs. For some play events platform height and paragraph FALL HEIGHT are the same.

2.2.3.1 Pre-Toddler Age Group

Platforms designed for children 12 through 24 months of age shall have a finished elevation a maximum 36 inches above the finished elevation of the protective surfacing.

2.2.3.2 Toddler Age Group

Platforms designed for children 2 through 3 years of age shall have a finished elevation a maximum 48 inches above the finished elevation of the protective surfacing.

2.2.3.3 Pre-School Age Group

Platforms designed for children 3 through 5 years of age shall have a finished elevation a maximum 48 inches above the finished elevation of the protective surfacing.

2.2.3.4 School-Age Age Group

Platforms designed for children 5 through 8 years of age shall have a finished elevation a maximum 72 inches above the finished elevation of the protective surfacing.

2.2.3.5 Pre-Teen Age Group

Platforms designed for children 8 through 12 years of age shall have a finished elevation a maximum 72 inches above the finished elevation of the protective surfacing.

2.2.4 Protective Barrier and Guardrail

Protective barriers and guardrails shall be provided in accordance with paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS. This specification establishes the protective barrier and guardrail requirements for the infant and pre-toddler age group.

2.2.4.1 Protective Barrier

A protective barrier is defined as an enclosing device around an elevated surface that prevents both inadvertent and deliberate attempts to pass through the device. The protective barrier for pre-toddler, toddler, and pre-school age groups shall be provided on elevated surfaces a minimum 30 inches above the protective surfacing. The protective barrier for school-age and pre-teen age groups shall be provided on elevated surfaces a minimum 48 inches above the protective surfacing. The protective barrier shall completely surround the elevated surface except for the access or egress route. As infants are not to be placed on an elevated surface, the protective barrier for the infant age group shall be the same as the crawl wall defined in paragraph MEASURING FALL HEIGHT.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Finished Grade and Underground Utilities

The Contractor shall verify that finished grades are as indicated; the smooth grading has been completed in accordance with Section 02300 EARTHWORK; installation of the underground utilities through the area has been completed in accordance with Section 02316 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS; installation of the storm-drainage system through the area has been completed in accordance with Section 02630 STORM-DRAINAGE SYSTEM. The location of underground utilities and facilities in the area of the operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.1.2 Layout

The layout of the entire outdoor play area shall be staked before excavation begins to include the following: all play event configuration access and egress points; use zone perimeters; hard surface areas and pathway widths; exterior plant material and planters; walls and fences; and structures. Sufficient space shall be provided between all adjacent play events and individual play events for play activities and circulation. Moving and rotating play events shall be located away from circulation to prevent collisions.

3.1.2.1 Use Zone

The use zone is defined as the area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around equipment; and on whose surface it is predicted that a user would land when falling from or exiting the equipment, (paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS). Also, the use zone is associated with the following terms; "Clear Area," and "Fall Zone". The use zone shall be free of hard surfaces, objects or obstacles that a child could run into or fall on top of and be injured. The use zone shall consist of protective surfacing in accordance with the requirements of Section 02791 PLAYGROUND PROTECTIVE SURFACING. Use zone perimeters shall not overlap hard surfaces. The use zone perimeter shall meet or exceed the requirements of paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS. Use zone perimeters shall not overlap except for certain play events as defined in ASTM F 1487.

3.1.2.2 Shop Drawings

When the use zone perimeter and play event configuration conflict with the

requirements and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS, shop drawings defining corrective measures shall be submitted to include the following: Adjustment to the play event with the use zone perimeter; use zone perimeter overlaps; hard surface area and pathway widths; structures; exterior plant material and planters; walls and fences; and bare or painted metal platform and slide bed orientation to the direct sun.

3.1.3 Orientation

Bare or painted metal platforms and slide beds shall be oriented from the direct sun; or shaded to reduce contact burn risk. Play events that require orientation to adjacent play events or to meet visibility requirements shall be properly oriented.

3.1.4 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments shall be submitted for approval.

3.2 INSTALLATION

Play events shall be installed according to the manufacturer's recommendations and as shown to meet the requirements of paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

3.2.1 Play Event Modification

Site modifications of play events affect the coverage provided in paragraph WARRANTY; therefore, play events and equipment shall not be modified without the written approval of the manufacturer.

3.2.2 Plastic Play Events

Plastic and recycled plastic components shall be connected by stainless steel hardware. The hardware shall be countersunk. Recycled plastic molded as lumber or wood-polymer lumber shall be installed in accordance with the manufacturer's recommendations.

3.2.3 Footings

The top elevation of play event footings will be installed at the subbase of the protective surfacing.

3.2.4 Multiple-Axis (Rotating) Swing

The multiple-axis (rotating) swing shall be located away from other play events and circulation. It shall not be attached to a composite structure.

3.2.5 Single-Axis (To-Fro) Swing

The single-axis (to-fro) swing shall be located on the perimeter of the outdoor play area. It shall not be attached to a composite structure.

3.2.6 Slide

The required exit region clear area shall be provided in accordance with ASTM F 1487.

3.2.7 Chain or Rope Ladder, Climber or Net Climber

A chain or rope ladder; climber; net climber; and similar components shall be installed in the vertical position. Angled or arch positions are not accepted.

3.2.8 Composite Structure

The composite structure use zone perimeter shall be composed of the use zone perimeters of the play events that, when joined together, comprise the composite structure.

3.2.9 Fall Height

3.2.9.1 General

The fall height is defined as the vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it. For some play events the fall height and paragraph PLATFORM HEIGHT are the same. For some play events the fall height and maximum equipment height are the same. When the furnished play event fall height varies from the play event shown, shop drawings defining the revised depth or type of protective surfacing to meet or exceed the requirements of Section 02791 PLAYGROUND PROTECTIVE SURFACING shall be provided.

3.2.9.2 Measuring Fall Height

EQUIPMENT	MEASURING FALL HEIGHT
Composite Structure:	For a platform surrounded by protective barriers, measure from the platform finished elevation. For a platform surrounded by guardrails, measure from the guardrail top elevation.
Infant Crawl Area:	A maximum 24 inch height, measured from the crawl wall or barrier finished elevation.
Playhouse, Nonclimbable:	Measure from the designated play surface finished elevation.
Spring Rocking Equipment:	Measure from the seat top elevation.
Stationary Equipment, Climbable:	Measure from the maximum equipment height finished elevation.
Stationary Equipment, Nonclimbable:	Measure from the designated play surface finished elevation.
Swing:	Measure from the bottom of the pivot point.

3.2.10 SIGNAGE

For playground areas other than CDC, durable permanent signage shall be provided to identify the age group the equipment is designed to accommodate. Signage shall be in accordance with Section 10430 EXTERIOR SIGNAGE.

3.3 RESTORATION AND CLEAN UP

When the operation has been completed, the Contractor shall clean up and protect the site. Existing areas that have been damaged from the operation shall be restored to original condition at the Contractor's expense.

3.3.1 Clean Up

The site and play events shall be cleaned of all materials associated with the operation. Play events and surfaces shall be cleaned of dirt, stains, filings, and other blemishes occurring from shipment and installation. Cleaning methods and agents shall be as recommended by the manufacturer. Required labeling shall be undamaged and visible in accordance with paragraph EQUIPMENT IDENTIFICATION.

3.3.2 Protection

The area shall be protected as required or directed by providing barricades and signage. Signage shall be in accordance with Section 10430 EXTERIOR SIGNAGE.

3.3.3 Disposal of Materials

Excess and waste material shall be removed and disposed off Government property.

3.4 PLAYGROUND ACCEPTANCE

3.4.1 Child Safety and Accessibility Evaluation

When the protective surfacing is installed the play events and protective surfacing shall be thoroughly inspected and measured to verify the playground meets manufacturer's recommendations, paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS, and paragraph FALL HEIGHT. The play events shall be age appropriate for the age group using them in accordance with paragraph PLATFORM HEIGHT. Determine 1) secure anchoring; 2) all hardware and connectors are tight; 3) all hardware and connectors require tools to loosen; 4) all hooks are closed; 5) head and neck entrapment; 6) sharp points, edges, and protrusions; 7) entanglement; 8) pinch, crush, and shear points; 9) suspended hazards; 10) all component holes are filled; and 11) recycled plastic components used as load bearing structural members. Use zone distances shall be measured to determine the area is free of hard surfaces, objects or obstacles. Determine exceptions to use zone overlaps occur in accordance with paragraph USE ZONE. Play event fall height shall be measured and compared to critical height value for thickness of installed protective surfacing. The slide exit region shall have the required clear zone. Play events and surfaces shall be properly oriented. Chain, rope, net climbers or similar components shall be installed in a vertical position. Swing seat clearances shall be measured while occupied by a maximum user for the age group using the equipment. Warning labels and manufacturer identification labels shall be visible in accordance with paragraph EQUIPMENT IDENTIFICATION. Play events that do not comply shall be reinstalled. Fasteners, anchors, hardware and labels that do not comply

shall be replaced. Ensure positive drainage for the area and the lowest elevation of protective surfacing subgrade has been provided. A written report describing the results of the evaluation shall be provided.

3.4.2 Spare Parts

Play event and equipment spare parts provided by the manufacturer shall be furnished.

3.4.3 Maintenance Instruction

The manufacturer's operation and maintenance manual describing the recommended preventive maintenance, inspection frequency and techniques, periodic adjustments, lubricants, and cleaning requirements shall be furnished.

3.5 RE-INSTALLATION

When re-installation is required, accomplish the following: Re-install the product as specified. Provide new replacement materials supplied by the manufacturer. Material acquisition of replacement parts is the responsibility of the Contractor. Damage caused by the failed installation shall be repaired at the Contractor's expense.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02915

TRANSPLANTING EXTERIOR PLANT MATERIAL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 TRANSPLANTING PLAN
- 1.4 PLANT MATERIAL SURVIVABILITY
- 1.5 DECIDUOUS TREES
 - 1.5.1 Single stem
 - 1.5.1.1 Specimen
 - 1.5.2 Protection During Transplanting
- 1.6 DELIVERY OF MATERIALS
 - 1.6.1 Delivered Topsoil
 - 1.6.2 Soil Amendments
 - 1.6.3 Pesticide Material
- 1.7 PLANT MATERIAL IDENTIFICATION
- 1.8 INSPECTION OF MATERIALS
- 1.9 STORAGE OF MATERIALS
- 1.10 HANDLING OF MATERIALS
- 1.11 TIME LIMITATION
- 1.12 WARRANTY

PART 2 PRODUCTS

- 2.1 TOPSOIL
- 2.2 SOIL AMENDMENTS
 - 2.2.1 pH Adjuster
 - 2.2.2 Limestone
 - 2.2.3 Hydrated Lime
 - 2.2.4 Burnt Lime
 - 2.2.5 Fertilizer
 - 2.2.6 Organic Material
 - 2.2.6.1 Bonemeal
 - 2.2.6.2 Rotted Manure
 - 2.2.6.3 Decomposed Wood Derivatives
 - 2.2.6.4 Recycled Compost
 - 2.2.6.5 Worm Castings
 - 2.2.7 Soil Conditioner
 - 2.2.7.1 Sand
 - 2.2.7.2 Super Absorbent Polymers
 - 2.2.7.3 Calcined Clay
 - 2.2.7.4 Gypsum
 - 2.2.7.5 Expanded Shale, Clay, or Slate (ESCS)
- 2.3 MULCH
 - 2.3.1 Shredded Bark
- 2.4 GEOSYNTHETICS
- 2.5 METAL STAKING AND GUYING MATERIAL

Grand Forks Phase 1 Levees

- 2.5.1 Bracing Stakes
- 2.5.2 Metal Ground Stakes
- 2.5.3 Earth Anchor
- 2.5.4 Guying Material
- 2.5.5 Turnbuckle
- 2.6 RUBBER GUYING MATERIAL
- 2.7 FLAG
- 2.8 MYCORRHIZAL FUNGI INOCULUM
- 2.9 WATER
- 2.10 PESTICIDE

PART 3 EXECUTION

- 3.1 TRANSPLANTED PLANT MATERIAL TIME AND CONDITIONS
 - 3.1.1 Deciduous Plant Material Time
 - 3.1.2 Transplanting Conditions
 - 3.1.3 Underground Utilities
 - 3.1.4 Protecting Existing Vegetation
 - 3.1.5 Installing Site Tests
 - 3.1.5.1 Percolation Test
 - 3.1.5.2 Soil Test
 - 3.1.6 Plant Material Preparation and Handling
 - 3.1.6.1 Root Pruning
 - 3.1.6.2 Plant Material Preparation
 - 3.1.6.3 Tree Spading
 - 3.1.6.4 Caliper
- 3.2 INSTALLING SITE PREPARATION
 - 3.2.1 Finished Grade and Topsoil
 - 3.2.2 Layout
- 3.3 INSTALLING SITE EXCAVATION
 - 3.3.1 Obstructions Below Ground
 - 3.3.2 Turf Removal and Replacement
 - 3.3.3 Plant Pits
- 3.4 INSTALLATION
 - 3.4.1 Setting Plant Material
 - 3.4.2 Root Barriers
 - 3.4.3 Backfill Soil Mixture
 - 3.4.4 Adding Mycorrhizal Fungi Inoculum
 - 3.4.5 Backfill Procedure
 - 3.4.5.1 Earth Berm
 - 3.4.6 Plant Bed
 - 3.4.7 Watering
 - 3.4.8 Staking and Guying
 - 3.4.8.1 One Bracing Stake
 - 3.4.8.2 Two Bracing Stakes
 - 3.4.8.3 Three Ground Stakes
 - 3.4.9 Deadmen or Earth Anchors
 - 3.4.10 Flags
- 3.5 FINISHING
 - 3.5.1 Plant Material
 - 3.5.2 Placing Geosynthetics
 - 3.5.3 Placing Mulch
 - 3.5.4 Pruning
- 3.6 MAINTENANCE DURING TRANSPLANTING OPERATION
- 3.7 RESTORATION AND CLEAN UP
 - 3.7.1 Restoration
 - 3.7.2 Backfill Removal Site Plant Pits
 - 3.7.3 Clean Up
- 3.8 PLANT ESTABLISHMENT PERIOD

Grand Forks Phase 1 Levees

- 3.8.1 Commencement
- 3.8.2 Maintenance During Establishment Period
 - 3.8.2.1 Weeding
 - 3.8.2.2 Post-Fertilization
 - 3.8.2.3 Plant Pit Settling
 - 3.8.2.4 Removal Site Settlement
 - 3.8.2.5 Maintenance Record
- 3.8.3 Acceptable Plant Material
- 3.8.4 Unhealthy Or Dead Plant Material
 - 3.8.4.1 Transplant Shock
 - 3.8.4.2 Dead Plant Material
 - 3.8.4.3 Replacement Plant Material
- 3.8.5 Maintenance Instructions
- 3.8.6 End of Establishment Period Clean Up

-- End of Section Table of Contents --

SECTION 02915

TRANSPLANTING EXTERIOR PLANT MATERIAL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA Z60.1 (1996) Nursery Stock

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300 (1995) Tree Care Operations - Trees, Shrubs and other Woody Plant Maintenance

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 3776 (1996) Mass per Unit Area (Weight) of Fabric

ASTM D 4491 (1999) Water Permeability of Geotextiles by Permittivity

ASTM D 4533 (1991; R 1996) Trapezoid Tearing Strength of Geotextiles

ASTM D 4632 (1991; R 1996) Grab Breaking Load and Elongation of Geotextiles

ASTM D 4751 (1999) Determining Apparent Opening Size of a Geotextile

ASTM D 4833 (1988; R 1996el) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

ASTM D 4873 (1997) Identification, Storage, and Handling of Geosynthetic Rolls

ASTM D 4972 (1995a) pH of Soils

ASTM D 5034 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM D 5035 (1995) Breaking Force and Elongation of Textile Fabrics (Strip Method)

ASTM D 5268	(1992; R 1996) Topsoil Used for Landscaping Purposes
ASTM D 5883	(1996e1) Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purpose

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Geosynthetics; GA

Manufacturer's literature including physical characteristics, application and installation instructions.

Equipment; GA

A listing of equipment to be used for the transplanting operation, including size model, year and type of mechanical tree transplanting equipment.

Transplanting Plan; GA

Methods to be used for each plant species to be transplanted ensuring survivability.

Plant Establishment Period; GA

Calendar time period for the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

Maintenance Record; GA

Maintenance work performed, quantity of plant losses, and replacements; and diagnosis of unhealthy plant material.

SD-04 Drawings

- Finished Grade and Topsoil; GA
- Underground Utilities; GA
- Delivered Topsoil; GA
- Obstructions Below Ground; GA

Finished grade status; location of underground utilities and facilities; and availability of topsoil from the stripping and stock piling operation.

SD-09 Reports

- Soil Test; GA
- Percolation Test; GA

Recycled Compost; GA

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-13 Certificates

Topsoil; GA
Fertilizer; GA
Soil Conditioner; GA
pH Adjuster; GA

Prior to delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following.

For items listed in this section:

- 1) Certification of recycled content or,
- 2) Statement of recycled content.
- 3) Certification of origin including the name, addresses and telephone number of manufacturer.
 - a. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
 - b. Fertilizer. Chemical analysis and composition percent.
 - c. Soil Conditioner. Composition and source.
 - d. pH Adjuster. Calcium carbonate equivalent and sieve analysis.
 - e. Pesticide. EPA registration number and registered uses.

SD-19 Operation and Maintenance Manuals

Maintenance Instructions; GA

Instruction for care of installed plant material during initial establishment period and long term care.

1.3 TRANSPLANTING PLAN

A transplanting plan shall be submitted and shall delineate methods and times for root pruning, digging, balling, removing, storing, transporting, planting, watering, and maintenance to ensure survivability. The plan shall also include equipment, anti-desiccant and pesticides to be used. A listing of the plant material to be transplanted shall be provided by common name and botanical name as listed under "Nomenclature" in ANLA Z60.1 ; classification; caliper; and height.

1.4 PLANT MATERIAL SURVIVABILITY

Plant material survivability shall be determined by growing condition; root

pruning and transplanting method to maintain a healthy root system; and recovery of leaves or needles with the crown in good balance with the trunk free from disfigurement or abrasion.

1.5 DECIDUOUS TREES

A "P1" height to caliper relationship shall be maintained in accordance with ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

1.5.1 Single stem

The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader. The form of growth desired shall be as indicated.

1.5.1.1 Specimen

The tree shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

1.5.2 Protection During Transplanting

Plant material shall be protected during transplanting to prevent desiccation and damage to the branches, trunk, and root system. Branches shall be protected by tying-in. Exposed branches shall be covered during transport. The root area shall be treated with gels containing mycorrhizal fungi inoculum. Plant material shall be undamaged, well shaped, vigorous and healthy with a well-branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion after transplanting. Plant material showing desiccation, abrasion, sun scald injury or structural branching damage shall be replaced at no cost to the government.

1.6 DELIVERY OF MATERIALS

1.6.1 Delivered Topsoil

Prior to the delivery of any topsoil, the availability of topsoil shall be verified in paragraph TOPSOIL. A soil test shall be provided for delivered topsoil.

1.6.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.6.3 Pesticide Material

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

1.7 PLANT MATERIAL IDENTIFICATION

Plant material to be transplanted shall be tagged and/or shown on drawings.

Grand Forks Phase 1 Levees

Transplanted plant material shall be delivered with attached, durable, waterproof labels and weather-resistant ink or imprinted tags, stating the correct botanical plant name and size.

1.8 INSPECTION OF MATERIALS

Materials shall be inspected for compliance with paragraph PRODUCTS, paragraph PLANT MATERIAL SURVIVABILITY and paragraph PLANT MATERIAL IDENTIFICATION. Open soil amendment containers or wet soil amendments shall be rejected. Topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than 1-1/2 inch diameter shall be rejected. Topsoil that contains viable plant material and plant parts shall be rejected. Unacceptable material shall be removed from the job site.

1.9 STORAGE OF MATERIALS

Storage of material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with planting operation material.

1.10 HANDLING OF MATERIALS

Materials shall not be dropped from vehicles. Plant material shall be transported without scarring trunks or deforming crown branching. Materials found to be in unacceptable condition shall be replaced at no additional cost to the Government.

1.11 TIME LIMITATION

The time limitation from digging, removing, transporting, to installing transplanted plant material shall be the same day. The time limitation between installing the plant material and placing the mulch shall be a maximum 48 hours.

1.12 WARRANTY

Transplanted plant material shall have a warranty for survivability as defined in paragraph PLANT MATERIAL SURVIVABILITY, and plant growth to be in a vigorous growing condition for a minimum 6 month period for plants other than specimen trees and a minimum 12 month calendar time period for specimen trees. The warranty of plant growth shall be provided regardless of the contract time period. When the transplanted plant material is determined to be unhealthy in accordance with paragraph PLANT ESTABLISHMENT PERIOD, it shall be replaced once under this warranty.

PART 2 PRODUCTS

2.1 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the plant material specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter. Topsoil shall be free from viable plants and

plant parts.

2.2 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite is not permitted.

2.2.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

2.2.2 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 55 percent shall pass through a No. 60 sieve. To raise soil pH, ground limestone shall be used.

2.2.3 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a No. 8 sieve and a minimum 97 percent shall pass through a No. 60 sieve.

2.2.4 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 35 percent shall pass through a No. 60 sieve.

2.2.5 Fertilizer

The nutrients ratio shall be 5 percent nitrogen, 10 percent phosphorus, and 5 percent potassium. Fertilizer shall be controlled release, commercial grade, suitable for use on newly transplanted plant material; free flowing, pellet or tablet form; uniform in composition; and consistent with a prescribed nitrogen-phosphorus-potassium ratio.

2.2.6 Organic Material

Organic material shall consist of either bonemeal, peat, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

2.2.6.1 Bonemeal

Bonemeal shall be a finely ground, steamed bone product containing from a minimum 2 to a maximum 4 percent nitrogen and a minimum 16 to a maximum 40 percent phosphoric acid.

2.2.6.2 Rotted Manure

Rotted manure shall be unleached horse, chicken, or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. Manure shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and

shall be free of stones, sticks, and soil.

2.2.6.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, or other wood waste material free of stones, sticks, and toxic substances harmful to plants, and stabilized with nitrogen.

2.2.6.4 Recycled Compost

Compost shall be a well-decomposed, stable, weed free organic matter source. It shall be derived from food, agricultural, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 3/8 inch screen, possess between a minimum 5.5 to a maximum 8.0 pH, and have a moisture content between a minimum 35 and a maximum 55 percent by weight. The material shall not contain more than a maximum 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials a minimum 2 inches in length.

2.2.6.5 Worm Castings

Worm castings shall be screened from worms and food source and shall be commercially packaged.

2.2.7 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for single use or in combination to meet topsoil requirements for the plant material specified.

2.2.7.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a No. 10 sieve and a minimum 10 percent by weight shall pass a No. 16 sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

2.2.7.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized at a maximum 1000 microns. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide with an absorption capacity of a minimum 250 to a maximum 400 times its weight.

2.2.7.3 Calcined Clay

Granular particles shall be produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent passing No. 8 sieve; a minimum 99 percent shall be retained on No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.2.7.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95

percent calcium sulfate by volume.

2.2.7.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

2.3 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure is not recommended to be used as a mulch because it would encourage surface rooting of the plant material and weeds.

2.3.1 Shredded Bark

Locally shredded material shall be treated to retard the growth of mold and fungi.

2.4 GEOSYNTHETICS

Geosynthetics shall be defined as a product manufactured in accordance with ASTM D 3776, ASTM D 4491, ASTM D 4533, ASTM D 4632, ASTM D 4751, ASTM D 4833 and ASTM D 4873, ASTM D 5034 or ASTM D 5035. It shall be referred to as products manufactured for use as weed barriers, drainage matting, root barriers, or soil enhancement systems.

2.5 METAL STAKING AND GUYING MATERIAL

Metal shall be aluminum or steel consisting of recycled content made for holding plant material in place.

2.5.1 Bracing Stakes

Metal bracing stakes may be hollow or solid and shall be a minimum 1 inch diameter and a minimum 8 feet long. Stake shall be set without damaging rootball and be capable of supporting the tree adequately.

2.5.2 Metal Ground Stakes

Metal ground stakes shall be a minimum 1/2 inch diameter and a minimum 3 feet long.

2.5.3 Earth Anchor

Metal earth anchors shall be a minimum 1/2 inch diameter and a minimum 2 feet long.

2.5.4 Guying Material

Metal guying material shall be a minimum 12 gauge wire. Multi-strand cable shall be woven wire. Guying material tensile strength shall conform to the size of tree to be held firmly in place.

2.5.5 Turnbuckle

Metal turnbuckles shall be galvanized or cadmium-plated steel, and shall be a minimum 3 inches long with closed screw eyes on each end. Screw thread tensile strength shall conform to the size of tree to be held firmly in place.

2.6 RUBBER GUYING MATERIAL

Rubber chafing guards, consisting of recycled material, shall be used to protect tree trunks and branches when metal guying material is applied. The material shall be the same color throughout the project. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

2.7 FLAG

Plastic flag material shall be used on guying material. It shall be a minimum 6 inches long. Tape color shall be consistent and visually complimentary to the entire project area. The tape color shall meet pedestrian visual safety requirements for day and night.

2.8 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

2.9 WATER

Unless otherwise directed, water shall be the responsibility of the Contractor. Water shall be potable or supplied by an existing irrigation system.

2.10 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

PART 3 EXECUTION

3.1 TRANSPLANTED PLANT MATERIAL TIME AND CONDITIONS

3.1.1 Deciduous Plant Material Time

Deciduous plant material shall be transplanted from April 1 to June 15 and August 15 to November 1.

3.1.2 Transplanting Conditions

All transplanting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, frozen ground or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to all transplanting operations, proposed transplanting times shall be submitted for approval. The installing site for the plant material shall be prepared and excavated in accordance with paragraph INSTALLING SITE PREPARATION and paragraph INSTALLING SITE EXCAVATION, prior to removing the plant material.

3.1.3 Underground Utilities

The location of underground utilities and facilities at both the removal and installing sites shall be verified and marked. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.1.4 Protecting Existing Vegetation

When there are established lawns at both the removal and installing sites, the turf shall be covered and/or protected during the operation. Existing trees, shrubs, and plant beds at both the removal and installing site that are to be preserved shall be barricaded along the dripline. The area shall be barricaded and protected from damage by a tree barricade or other measure. Damage to existing plant material shall be mitigated by the Contractor at no additional cost to the Government. Damage shall be assessed by a state certified arborist or other approved professional using the National Arborist Association's tree valuation guideline.

3.1.5 Installing Site Tests

3.1.5.1 Percolation Test

Test for percolation shall be done to determine positive drainage of plant pits and beds at the installing site. A positive percolation shall consist of a minimum 1 inch per 3 hours; when a negative percolation test occurs, a shop drawing shall be submitted indicating the corrective measures.

3.1.5.2 Soil Test

Delivered topsoil, excavated plant pit soil, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection onsite shall be random over the entire installing site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the plant material to be transplanted.

3.1.6 Plant Material Preparation and Handling

3.1.6.1 Root Pruning

Large canopy and specimen plant material shall be root pruned a minimum of one year before transplanting. Minimum root ball sizes shall be in accordance with ANLA Z60.1. Medium sized plant material shall be spaded or hand dug prior to removal. A sharp spade shall be used to cut straight down a minimum of 18 inches deep.

3.1.6.2 Plant Material Preparation

Plant material designated for transplanting shall be watered thoroughly several days before root pruning, digging or moving. Broken or interfering growth shall be pruned. Large canopy and specimen plant material shall be wire balled and burlapped. Trees shall be lifted by the use of tree straps. Canopy and evergreen trees up to a maximum 12 inches caliper shall be transplanted by the largest available tree spade in order to reduce shock. The installing site for the plant material shall be prepared and excavated in accordance with paragraphs: Transplanting Plant Material Time and Conditions, Installing Site Preparation, and Installing Site Excavation, prior to moving the plant material.

3.1.6.3 Tree Spading

The following minimum size spades shall be used for trees sized as measured at caliper; 6 inches above the ground for trees 4 inches in diameter or smaller, 12 inches above the ground for trees with a larger diameter.

Tree Spade Size	Deciduous Tree
Minimum 44 inch	Minimum 2 inch to Maximum 3 inch caliper
Minimum 66 inch	Minimum 3 inch to Maximum 5 inch caliper
Minimum 85 inch	Minimum 6 inch to Maximum 8 inch caliper

3.1.6.4 Caliper

The caliper shall be measured at a minimum 6 inch height above the ground surface for trees up to a maximum 4 inch caliper. The caliper shall be measured at a minimum 12 inch height above the ground surface for trees with a larger caliper.

3.2 INSTALLING SITE PREPARATION

3.2.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the transplanting operation.

3.2.2 Layout

Plant material installing sites and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted to meet field conditions.

3.3 INSTALLING SITE EXCAVATION

3.3.1 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments to plant material location, and planting method shall be submitted for approval.

3.3.2 Turf Removal and Replacement

Where the installation operation occurs in an existing lawn area, the turf shall be removed from the excavation area to a depth that will ensure the removal of the entire root system.

3.3.3 Plant Pits

Plant pits shall be dug to a depth equal to the height of the root ball as measured from the base of the ball to the base of the plant trunk. Plant pits shall be dug a minimum of 3 to a maximum 5 times the diameter of the root system to allow for root expansion. The pit shall be constructed with sides sloping towards the base as a cone, to encourage well-aerated soil to

be available to the root system for favorable root growth. Cylindrical pits with vertical sides shall not be used. Pits shall be dug immediately before plants are placed in the pit.

3.4 INSTALLATION

3.4.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. In relation to the surrounding grade, the plant material shall be set even with the grade at which it was grown. The root system shall be spread out and arranged in its natural position. Damaged or girdled roots shall be removed with a clean cut. The beginning of the root flare shall be visible at soil level when the tree is planted, since it is critical not to plant the tree too deep. The following shall be performed:

- a. Plumb tree and backfill half of the hole.
- b. Water the hole to collapse air pockets and form a soupy mixture.
- c. Backfill and gently firm soil.
- d. Clear soil mounded against trunk.

3.4.2 Root Barriers

Tree root barriers shall be installed as indicated in the contract documents and as recommended by the manufacturer. Tree root barriers shall be used for trees located up to a maximum 6 feet from paved surfaces or structures.

3.4.3 Backfill Soil Mixture

The backfill soil mixture may be a mix of topsoil and soil amendments suitable for the plant material specified. When practical, the excavated soil from the plant pit that is not amended provides the best backfill and shall be used. Fertilizer shall not be used in the backfill soil mixture.

3.4.4 Adding Mycorrhizal Fungi Inoculum

Mycorrhizal fungi inoculum shall be added as recommended by the manufacturer for the plant material specified.

3.4.5 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Biodegradable burlap and tying material shall be carefully opened and folded back from the top a minimum 1/3 depth from the top of the root ball. For plant material in biodegradable containers the container shall be split prior to setting the plant with container. The plant material shall be carefully removed from containers that are not biodegradable.

3.4.5.1 Earth Berm

An earth berm, consisting of backfill soil mixture, shall be formed with a minimum 4 inch height around the edge of the plant pit to aid in water retention and to provide soil for settling adjustments.

3.4.6 Plant Bed

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas. Earth berms shall be provided. Polymers shall be spread uniformly over the plant bed and in the planting pit as recommended by the manufacturer and thoroughly incorporated into the soil to a maximum 4 inch depth.

3.4.7 Watering

A regular watering schedule shall be established. Slow deep watering shall be used. Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated. Run-off and puddling shall be prevented. Watering of other plant material or adjacent areas shall be prevented.

3.4.8 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity.

3.4.8.1 One Bracing Stake

Trees 4 to 6 feet high shall be firmly anchored in place with one bracing stake. The bracing stake shall be placed on the side of the tree facing the prevailing wind. The bracing stake shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly to the stake with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. A chafing guard shall be used when metal is the guying material.

3.4.8.2 Two Bracing Stakes

Trees from 6 to 8 feet height shall be firmly anchored in place with 2 bracing stakes placed on opposite sides. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly between the stakes with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Chafing guards shall be used when metal is the guying material.

3.4.8.3 Three Ground Stakes

Trees over a minimum 8 feet height and less than a maximum 6 inch caliper shall be held firmly in place with 3 bracing or ground stakes spaced at equal intervals around the tree. Ground stakes shall be avoided in areas to be mowed. Stakes shall be driven into firm ground outside the earth berm. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. For trees over a minimum 3 inch diameter at breast height, turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used when metal is the guying material.

3.4.9 Deadmen or Earth Anchors

Trees over a minimum 6 inch caliper shall be held firmly in place with wood

deadmen buried a minimum 3 feet in the ground or metal earth anchors. Multi-strand cable guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used.

3.4.10 Flags

A flag shall be securely fastened to each guy line between the tree, stake, deadmen, or earth anchor. The flag shall be visible to pedestrians.

3.5 FINISHING

3.5.1 Plant Material

Prior to placing mulch, the installed area shall be uniformly edged to provide a clear division line between the planted area and the adjacent turf area, shaped as indicated. The installed area shall be raked and smoothed while maintaining the earth berms.

3.5.2 Placing Geosynthetics

Prior to placing mulch, geosynthetics shall be placed as indicated in the construction documents and in accordance with the manufacturer's recommendations.

3.5.3 Placing Mulch

The placement of mulch shall occur a maximum of 48 hours after planting. Mulch, used to reduce soil water loss, regulate soil temperature and prevent weed growth, shall be spread to cover the installed area with a minimum 4 inch uniform thickness. Mulch shall be kept out of the crowns of shrubs, ground cover, and vines and shall be kept off buildings, sidewalks and other facilities.

3.5.4 Pruning

Pruning shall be accomplished by trained and experienced personnel. The pruning of trees and palms shall be in accordance with ANSI A300. Only dead or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

3.6 MAINTENANCE DURING TRANSPLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. Installed areas shall be kept free of weeds, grass, and other undesired vegetation. The maintenance includes maintaining the mulch, watering, and adjusting settling.

3.7 RESTORATION AND CLEAN UP

3.7.1 Restoration

Grand Forks Phase 1 Levees

Turf areas containing ruts or dead turf, as a result of work under this contract, shall be graded smooth and sodded with the same species. All pavements and facilities that have been damaged from the transplanting operation shall be restored to original condition at the Contractor's expense.

3.7.2 Backfill Removal Site Plant Pits

The Contractor shall ensure that all remaining holes from the removal site have been backfilled, tamped and finished to meet existing grade after settling. Turf shall be installed in accordance with Section 02920 SEEDING, SODDING, and TOPSOIL.

3.7.3 Clean Up

Excess and waste material shall be removed from both removal site and the installed site and shall be disposed offsite at an approved landfill or recycling center. Adjacent paved areas shall be cleared.

3.8 PLANT ESTABLISHMENT PERIOD

3.8.1 Commencement

Upon completion of the last day of the installing operation, the plant establishment period for maintaining installed plant material in a healthy growing condition shall commence and shall be in effect for the remaining contract time period, not to exceed 12 months. Written calendar time period shall be furnished for the plant establishment period. When there is more than one plant establishment period, the boundaries of the planted area covered for each period shall be described. The plant establishment period shall be coordinated with Sections 02920 SEEDING, SODDING, and TOPSOIL; 02923 SOIL BIOENGINEERING; and 02930 EXTERIOR PLANTING. The plant establishment period shall be modified for separate completion dates for areas.

3.8.2 Maintenance During Establishment Period

Maintenance of plant material shall include straightening plant material, straightening stakes; tightening guying material; correcting girdling; supplementing mulch; pruning dead or broken branch tips; maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; and removing and replacing unhealthy plants. The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of 1 inch absorbed water per week, delivered in the form of rain or augmented by watering. Run-off, puddling and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or existing plant material shall be prevented.

3.8.2.1 Weeding

Grass and weeds in the installed areas shall not be allowed to reach a maximum 3 inches height before being completely removed, including the root system.

3.8.2.2 Post-Fertilization

The plant material shall be top dressed at least once during the period of

establishment with controlled release fertilizer (paragraph SOIL AMENDMENTS) applied at the rate of 2 pounds per 100 square feet of plant pit or bed area. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

3.8.2.3 Plant Pit Settling

When settling occurs to the backfill soil mixture, additional backfill soil shall be added to the plant pit or plant bed until the backfill level is equal to the surrounding grade. Serious settling that affects the setting of the plant in relation to the maximum depth at which it was grown requires replanting in accordance with paragraph INSTALLATION. The earth berm shall be maintained.

3.8.2.4 Removal Site Settlement

All plant pits at the removal site shall meet existing grade after settling. Correction shall be provided as required and in accordance with paragraph BACKFILL REMOVAL SITE PLANT PITS.

3.8.2.5 Maintenance Record

A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, and the quantity of replacements made on each site visit.

3.8.3 Acceptable Plant Material

Plant material shall be undamaged, well shaped, vigorous and healthy with a well branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion after transplanting and in accordance with paragraph PLANT MATERIAL SURVIVABILITY. Plant material showing desiccation, abrasion, sun-scald injury or structural branching damage shall be replaced at no cost to the Government.

3.8.4 Unhealthy Or Dead Plant Material

3.8.4.1 Transplant Shock

Deciduous plants showing symptoms of leaf scorch, a yellowing or bronzing of the tissue between the veins or along the margins of leaves or wilting; leaf rolling or curling may be need to be replaced, if required by the Contracting Officer. Evergreen plant stress is exhibited by overall grey-green color followed by light tan. The Contractor shall evaluate the severity of the symptom and shall provide recommendations.

3.8.4.2 Dead Plant Material

A tree shall be considered dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for dead plant material and shall provide recommendations for replacement. Dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

3.8.4.3 Replacement Plant Material

Replacement plant material shall be installed in accordance with paragraph INSTALLATION. Plant material shall be replaced in accordance with paragraph WARRANTY. An extended plant establishment period shall not be required for replacement plant material.

3.8.5 Maintenance Instructions

Written instructions shall be furnished containing drawings and other necessary information for year-round care of the installed plant material; including, when and where maintenance should occur, and the procedures for plant material replacement.

3.8.6 End of Establishment Period Clean Up

The Contractor shall remove all guying, bracing and staking at the end the establishment period with the approval of the Contracting Officer. All materials removed as a result of this operation shall be disposed offsite at an approved landfill. Any damage resulting from this operation shall be restored to its original condition at the Contractor's expense.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02920

SEEDING, SODDING, and TOPSOIL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SOURCE INSPECTION
- 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING
 - 1.4.1 Inspection
 - 1.4.2 Storage
 - 1.4.3 Handling
 - 1.4.4 Soil Amendments

PART 2 PRODUCTS

- 2.1 SEED
 - 2.1.1 Seed Classification
 - 2.1.2 Permanent Seed Species and Mixtures
 - 2.1.3 Temporary Seed Species
 - 2.1.4 Quality
- 2.2 SOD
 - 2.2.1 Quality
 - 2.2.2 Harvesting
 - 2.2.3 Delivery
- 2.3 TOPSOIL
- 2.4 SOIL AMENDMENTS
 - 2.4.1 Fertilizer
 - 2.4.2 Organic Material
 - 2.4.2.1 Rotted Manure
 - 2.4.2.2 Recycled Compost
- 2.5 MULCH
 - 2.5.1 Straw Mulch
 - 2.5.2 Paper Fiber
- 2.6 WATER
- 2.7 PESTICIDE
- 2.8 HERBICIDE

PART 3 EXECUTION

- 3.1 INSTALLING SEED TIME AND CONDITIONS
 - 3.1.1 Notification
 - 3.1.2 Seeding Time
 - 3.1.3 Seeding Conditions
- 3.2 SOIL TEST
- 3.3 SITE PREPARATION
 - 3.3.1 Finished Grade and Topsoil
 - 3.3.2 Spreading Topsoil
 - 3.3.2.1 Equipment

Grand Forks Phase 1 Levees

- 3.3.2.2 Stripped Materials
- 3.3.3 Tillage
- 3.3.4 Treatments
- 3.3.5 Prepared Surface
- 3.4 SEEDING
 - 3.4.1 Equipment
 - 3.4.2 Broadcast Seeding
 - 3.4.3 Drill Seeding
 - 3.4.4 Hydroseeding (Optional)
 - 3.4.5 Mulching
 - 3.4.5.1 Hay or Straw Mulch
 - 3.4.5.2 Mechanical Anchor
 - 3.4.5.3 Wood Cellulose Fiber, Paper Fiber, and Recycled Paper
 - 3.4.6 Initial Watering
 - 3.4.7 Native Grasses
- 3.5 SODDING
 - 3.5.1 Placement
 - 3.5.2 Rolling and Watering
- 3.6 RESTORATION AND CLEAN UP
- 3.7 MAINTENANCE
 - 3.7.1 Maintenance Watering
 - 3.7.2 Mowing
 - 3.7.3 General Maintenance
 - 3.7.3.1 Repair or Reinstall
 - 3.7.4 Maintenance Record
- 3.8 ACCEPTANCE
- 3.9 SURFACE EROSION CONTROL

-- End of Section Table of Contents --

SECTION 02920

SEEDING, SODDING, and TOPSOIL

PART 1 GENERAL

Wherever possible, all seed shall be drilled. Other seeding methods are subject to approval. Existing turf areas which have been damaged during the contract operations, and which are outside of the limits designated to be seeded, shall be restored following the requirements in this section, at no additional cost to the Government.

1.1 REFERENCES

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

AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01 (Aug 95) Federal Seed Act Regulations Part 201

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4972 (1995a) pH of Soils

ASTM D 5268 (1992; R 1996) Topsoil Used for Landscaping Purposes

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION (NDDOT)

NDDOT SS Section 708 (1997) Standard Specifications for Road and Bridge Construction - Erosion Contro

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Literature; FIO

The Contractor shall submit manufacturer's literature discussing physical characteristics, applications, guarantees, and installation of the seed, mulch, and fertilizer. The Contractor shall submit manufacturer's literature for equipment showing application and installation instructions.

SD-09 Reports

Soil Test; FIO

Grand Forks Phase 1 Levees

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

Seed Test; FIO

The Contractor shall submit test reports for a purity and germination test following the Association of Official Seed Analysts (AOSA) rules for each seed mixture. The test reports shall indicate the purity percentage, germination percentage, and amount of Pure Live Seed (PLS) per bag for each species.

Water Test; FIO

Water from sources other than municipal water supply shall be tested for salinity and pH.

SD-13 Certificates

Experience for Native Grasses; FIO

The Contractor shall submit a statement indicating that the work to establish the turf will be supervised by an individual with a minimum of 5 years experience with establishment and restoration of native plant communities.

Certificates of Compliance; FIO

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

- a. Seed. Mixture percentage, percent pure live seed, percent germination, weed seed content, and date tested.
- b. Topsoil. Gradation, pH, organic matter content, textural class, soluble salts.
- d. Fertilizer. Chemical analysis and composition percent.
- e. Organic Material: Composition and source.
- f. Mulch: Composition and source.

SD-14 Samples

Samples; FIO

Samples shall be provided for the following:

- a. A 5 pound sample for each source of topsoil brought from off-site.
- b. A 2 pound sample for each type of soil amendment proposed for use.
- c. A 2 pound sample for each type of mulch proposed for use.

SD-19 Records

Quantity Check; FIO

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Maintenance Record; FIO

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Seed Order for Native Grasses; FIO

Contractor shall submit proof of seed order for native grass seed mixes as specified within this section within 30 days of notice to proceed.

1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed materials shall be delivered in manufacturer's original, unopened containers with labels and tags intact and legible. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site.

1.4.2 Storage

Materials shall be stored on-site in areas provided by the Contractor. The storage areas shall be made accessible to the Contracting Officer so that application rates can be verified. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall be stored according to manufacturer's instructions and not with seed.

1.4.3 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

PART 2 PRODUCTS

2.1 SEED

Grand Forks Phase 1 Levees

Substitutions will not be allowed without written request and approval from the Contracting Officer. The mixing of seed may be done by the seed supplier prior to delivery, or on site in the presence of the Contracting Officer. Seed for native grass and forbe species shall be gathered from within 500 miles of the jobsite.

2.1.1 Seed Classification

State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for mixture percentage, purity, germination, weed seed content, and inert material. Labels shall be in conformance with AMS-01 and applicable state seed laws.

2.1.2 Permanent Seed Species and Mixtures

Permanent grass seed species and mixtures shall be proportioned by weight as follows:

GRASS SPECIES

Class I (Low Maintenance Turf

COMMON NAME	BOTANICAL NAME	% OF MIX
Fescue, creeping-red "Cindy"	Festuca rubra	10.0
Rye-grass, perennial "Elf"	Lolium perene	14.0
Bluegrass, Canada	Poa compressa	12.0
Bluegrass, fowl	Poa palustris	10.0
Bluegrass, common "98/85"	Poa pratensis	12.0
Bluegrass, Kentucky "Park"	Poa pratensis	12.0
Bluegrass, Kentucky "Caliber"	Poa pratensis	10.0
Alkali grass, "Salty"	Puccinella distans	19.0
White clover	Trifolium repens	1.0
		Total: 100.0

Rate: 100 lbs/acre (110 kg/ha).

Description: Low maintenance turf mix. General purpose seed mix for park areas and dry-side of levee.

Class II (Upland Grasses)

COMMON NAME	BOTANICAL NAME	% OF MIX
Gramma, sideoats	Bouteloua curtipendula	8.0
Gramma, blue	Bouteloua gracilis	6.0
Prairie clover, purple	Dalea purpureum	2.0
Wild rye, Canada	Elymus canadensis	4.0
Wheat grass, slender	Elymus trachycaulus	6.0
Rye grass, annual	Lolium italicum	8.0
ReGreen	NA	26.0
Blue grass, Canada	Poa compressa	12.0
Alkali grass	Puccinella distans	16.0
Bluestem, little	Schizachyrium scoparium	10.0
Dropseed, sand	Sporobolus cryptandrus	2.0
		Total: 100.0

Rate: 60 lbs/acre (66 kg/ha).

Description: Combination native and turf mix. General purpose seed mix for wet-side of levee except where noted in park areas.

Class II (Upland Grasses with forbs)

COMMON NAME	BOTANICAL NAME	% OF MIX
Gramma, sideoats	Bouteloua curtipendula	8.0
Gramma, blue	Bouteloua gracilis	6.0

Grand Forks Phase 1 Levees

Wild rye, Canada	<i>Elymus canadensis</i>	4.0
Wheat grass, slender	<i>Elymus trachycaulus</i>	8.0
Rye grass, annual	<i>Lolium italicum</i>	8.0
Forbs (see table below)	NA	8.0
ReGreen	NA	26.0
Blue grass, Canada	<i>Poa compressa</i>	10.0
Alkali grass	<i>Puccinella distans</i>	10.0
Bluestem, little	<i>Schizachyrium scoparium</i>	10.0
Dropseed, sand	<i>Sporobolus cryptandrus</i>	2.0
	Total:	100.0

Rate: 60 lbs/acre (66 kg/ha).

Description: Combination native and turf mix. General purpose seed mix for wet-side of levee except where noted in park areas.

Class II (Forbs)

COMMON NAME	BOTANICAL NAME
Onion, prairie	<i>Allium stellatum</i>
Aster, heath	<i>Aster ericoides</i>
Aster, smooth-blue	<i>Aster laevis</i>
Milkvetch, Canada	<i>Astragalus canadensis</i>
Prairie clover, white	<i>Dalea candidum</i>
Prairie clover, purple	<i>Dalea purpureurn</i>
Tick-trefoil, showy	<i>Desmodium canadense</i>
Coneflower, narrow-leaved	<i>Echinacea angustifolia</i>
Ox-eye, common	<i>Heliopsis helianthoides</i>
Bushclover, round-headed	<i>Lespedeza cupitata</i>
Blazingstar, rough	<i>Liatris aspera</i>
Blazingstar, tall	<i>Liatris pycnostachya</i>
Bergamot, wild	<i>Monarda fistulosa</i>
Penstemon, showy	<i>Penstemon grandiflorum</i>
Coneflower, columnar	<i>Ratibida columnifera</i>
Black-eyed Susan	<i>Rudbeckia hirta</i>
Goldenrod, stiff	<i>Solidago rigida</i>
Vervain, blue	<i>Verbena hastata</i>
Vervain, hoary	<i>Verbena stricta</i>
Alexanders, golden	<i>Zizia aurea</i>

Rate: As specified in the seed mix tabulation shown above.

Description: Native forbs to be added to native grass mixtures in Eastern North Dakota.

Class III (Moist Condition Grasses)

COMMON NAME	BOTANICAL NAME	% OF MIX
Bluestein, big	<i>Andropogon gerardi</i>	5.0
Canada anemone	<i>Anemone canadensis</i>	0.1
Marsh Milkweed	<i>Asclepias incarnata</i>	0.5
New England aster	<i>Aster novae-angliae</i>	0.6
Swamp aster	<i>Aster puniceus</i>	0.6
Fringed brome	<i>Bromus ciliata</i>	5.0
Blue joint grass	<i>Calamagrostis canadensis</i>	0.1
Bottlebrush sedge	<i>Carex comosa</i>	1.0
Tussock sedge	<i>Carex stricta</i>	0.5
Fox sedge	<i>Carex Vulpinoidea</i>	0.4
Showy tic-trefoil	<i>Desmodium canadense</i>	0.4
Wheat grass, slender	<i>Elymus trachycaulus</i>	6.0
Virginia wild-rye	<i>Elymus virginicus</i>	6.0
Joe-pye weed	<i>Eupatorium maculatum</i>	0.4
Boneset	<i>Eupatorium perfoliatum</i>	0.3
Reed manna grass	<i>Glyceria grandis</i>	0.3

Grand Forks Phase 1 Levees

Fowl manna grass	Glyceria striata	0.2
Early sunflower	Heliopsis helianthoides	0.7
Blue-flag iris	Iris virginica-shrevii	0.5
Common rush	Juncus effusus	0.2
Meadow blazingstar	Liatris ligulistylis	0.4
Tall blazingstar	Liatris pycnostachya	0.4
Great blue lobelia	Lobelia siphilitica	0.1
Rye grass, annual	Lolium italicum	10.0
Monkey flower	Mimulus ringens	0.1
Wild Bergamot	Monarda fistulosa	0.6
ReGreen	NA	42.0
Switch grass	Panicum virgatum	1.0
Fowl bluegrass	Poa palustris	5.0
Black-eyed Susans	Rudbeckia hirta	0.6
Green bulrush	Scirpus atrovirens	0.3
Wool grass	Scirpus cyperinus	0.3
Soft-stem bulrush	Scirpus vallisidus	1.0
Grass-leaved goldenrod	Solidago graminifolia	0.2
Indian grass	Sorghastrum nutans	6.0
Prairie cord grass	Spartina pectinata	2.0
Blue vervain	Verbena hastata	0.5
Ironweed	Veronica fasciculata	0.2
Culver's root	Veronicastrum virginianum	0.1
Golden Alexander's	Zizia aurea	0.4

Total: 100.0

Rate: 30 lbs/acre (33 kg/ha).

Description: Combination native sedge/prairie meadow mix. Seed mix designed for hydric soils and wetland restoration.

Class IV (Bank Stabilization Grasses and Forbs)

Shoreline Zone

BOTANICAL NAME	COMMON NAME	OUNCES/ ACRE	PLANTS/ 100 LF or 4,000 SF
Andropogon gerardii	Big Bluestem grass	80.00	
Asclepias incarnata	Swamp milkweed	0.50	5
Aster novae-angliae	New England aster	1.00	
Salix discolorAster puniceus	Marsh aster	0.50	
Bidens fondose	Beggarsticks	4.00	
Carex scoparia	Pointed broom sedge	6.00	
Carex hystericina	Bottlebrush sedge	4.00	
Carex tricornis	River Sedge		20
Cicuta maculata	Water hemlock	0.10	
Desmodium canadense	Showy tick trefoil	2.00	
Elymus canadensis	Canada wild rye	16.00	
Epilobium glandulosum	Northern willow herb	0.10	
Glyceria striata	Fowl manna grass	1.00	
Helenium autumnale	Sneezeweed	1.00	
Juncus effusus	Common spike rush	1.00	
Leersia oryzoides	Rice cutgrass	2.00	
Lobelia siphilitica	Great blue lobelia	0.20	
Lycopus americanus	Water horehound	0.10	
Mimulus ringens	Monkey flower	0.05	
Manarde fistulosa	Wild bergamot	2.0	
Panicum virgatum	Switch grass	20.00	20
Rudbeckia laciniata	Wild golden glow	0.25	5
Scirpus fluviatilis	River bulrush	1.00	20
Scirpus lineatus	Red bulrush	0.50	

Grand Forks Phase 1 Levees

Scirpus validus creber	Great bulrush	1.00	
Spartina pectinata	Cord grass		50
Verbena hastata	Blue vervain	2.00	
Echinochloa crusgalli	Barnyard grass	16.00	
Avena sativa	Oats	640.0	
Phleum pratense	Timothy	6.00	
Upland Zone			
BOTANICAL NAME	COMMON NAME	OUNCES/ ACRE	PLANTS/ 100 LF or 3,000 SF
Andropogon gerardil	Big bluestem grass	32.00	
Andropogon scoparius	Little Bluestem	80.00	
Aster nova angliae	New England aster	1.00	2
Aster azureus	Sky blue aster		5
Asclepias syriaca	Common milkweed	0.50	
Asclepias tuberosa	Butterfly milkweed		15
Aster novae-angliae	New England aster	1.50	
Carex scoparia	Sedge	5.00	
Desmodium canadense	Showy tick trefoil	2.00	
Echinacea angustifolium	Purple coneflower		10
Elymus canadensis	Canada wild rye	80.00	
Heliopsis helianthoides	False sunflower	1.00	
Monarda fistulosa	Wald bergamot	2.00	
Oenothera biennis	Common evening primrose	1.00	
Panicum virgatum	Switch grass	48.00	
Penstemon digitalis	Brearded foxglove	1.00	
Ratibida pinnata	Yellow coneflower	4.00	
Rudbeckia hirta	Black-eyed susan	8.00	
Solidago rigida	Stiff golden rod	5.00	
Sorghastrum nutans	Indian grass	24.00	
Vernonia fasciculata	Ironweed	0.25	
Echinochloa crusgalli	Barnyard grass	16.00	
Avena sativa	Seed Oats	800.00	

Rate: As shown above.

Description: Seed mix for slope stabilization. See Section 02923 SLOPE STABILIZATION for installation instructions.

2.1.3 Temporary Seed Species

Seed species for winter erosion protection, temporary surface erosion control, or overseeding shall consist of 10 pounds of oats per acre.

2.1.4 Quality

Weed seed shall be a maximum 1/2 of 1 percent by weight of the total mixture. Inoculant shall consist of the proper bacteria applied in the amount and manner recommended by the manufacturer to all legumes in the seed mix.

2.2 SOD

Sod shall be nursery grown as classified in the ASPA Guideline Specifications to Sodding. Sod shall be 100 percent mineral sod. Sod grown in peat soils will not be accepted. Sod shall consist of at least 75 percent Kentucky Blue Grass (*Poa pratensis*). Acceptable varieties include park, newport, glade, nugget, touch down, rugby, and parade.

2.2.1 Quality

Sod shall be machine cut at a uniform soil thickness of 5/8 inch, plus or minus 1/4 inch, at the time of cutting. Measurement of thickness shall exclude top growth and thatch. Standard size sections of sod shall be strong enough that when grasped at one end, can be picked up and handled without damage. Sod shall not be harvested or transplanted when moisture content, either excessively dry or wet, may adversely affect its survival. Broken pads and pads with torn or uneven ends will not be accepted. The pieces of sod shall not vary more than 1/2 inch in width.

2.2.2 Harvesting

Before harvesting, the turf shall be mowed uniformly at a height of 1 to 1-1/2 inches. Sod shall be harvested, delivered and transplanted within a period of 36 hours. Sod not transplanted within this time period shall not be installed without the inspection and approval of the Contracting Officer.

2.2.3 Delivery

Sod Pallets shall be sprinkled with water and covered with moist burlap, straw, or other approved covering and protected from exposure to wind and direct sunlight. Covering shall be such that air can circulate and heating will not develop.

2.3 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

2.4 SOIL AMENDMENTS

Soil amendments required under this contract consist of fertilizer. Soil amendments consisting of pH adjuster, organic material and soil conditioners may be added at the Contractors option if approved by the Contracting Officer, or shall be added if directed by the Contracting Officer and will be negotiated in accordance with contract clause: CHANGES.

2.4.1 Fertilizer

The nutrients ratio shall be 20 percent nitrogen, 20 percent phosphorus, and 20 percent potassium. Fertilizer shall be controlled release commercial grade, free flowing, and uniform in composition.

2.4.2 Organic Material

Organic material shall consist of either rotted manure, recycled compost, or worm castings. Bonemeal and decomposed wood derivatives shall not be used.

2.4.2.1 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones,

sticks, and soil.

2.4.2.2 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from vegetable food products; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 3/8 inch screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 2 inches in length.

2.5 MULCH

2.5.1 Straw Mulch

Straw mulch materials shall consist of wheat, oat, or rye straw, hay, grass, or other plants approved by the Contracting Officer. Mulch materials shall be native to the region. The mulch material shall be air dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The mulch shall be seed free or fumigated to prevent introduction of weeds. The use of mulch that contains noxious weeds will not be accepted. Dry mulching material which breaks and does not bend is unacceptable. Mulch shall have a consistency for placing with commercial mulch blowing equipment.

2.5.2 Paper Fiber

Paper fiber mulch shall be recycled news print that is shredded for the purpose of mulching seed.

2.6 WATER

Water shall be the responsibility of the Contractor, unless otherwise noted. Water shall not contain elements toxic to plant life.

2.7 PESTICIDE

Pesticide shall not be applied without written approval of the Contracting Officer.

2.8 HERBICIDE

Herbicide shall be broad spectrum that leaves no lasting harmful residues and allows planting within 10 to 14 days after application. The herbicide shall be glyphosate based. Herbicide shall be applied per manufacturer's recommendations.

PART 3 EXECUTION

3.1 INSTALLING SEED TIME AND CONDITIONS

3.1.1 Notification

The Contractor shall notify the Contracting Officer 24 hours in advance of

beginning seeding or any changes in turf establishment operations.

3.1.2 Seeding Time

Seed shall be installed before June 15 and after September 1, per NDDOT SS Section 708. No finished construction area shall be left untopsoiled and unseeded during the winter months. When substantially complete areas are not seeded within the specified seeding times for fall planting, a temporary winter cover shall be placed.

3.1.3 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for approval.

3.2 SOIL TEST

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, and organic matter content. The samples shall be taken at locations directed by the Contracting Officer, unless waived. The tests shall determine the quantities and type of soil amendments required to meet local growing conditions for the seed species specified.

3.3 SITE PREPARATION

3.3.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed prior to the commencement of the seeding operation. All vegetation, including live roots, shall be completely removed or treated with herbicide prior to spreading topsoil or placing sod.

3.3.2 Spreading Topsoil

Topsoil shall be distributed and spread uniformly to one half the thickness shown on the plans and tilled to a depth of 2 inches into the subgrade. The remaining half of the topsoil shall then be placed. Surface irregularities resulting from topsoiling or other operations shall be leveled to prevent depressions.

3.3.2.1 Equipment

Topsoil shall be spread using a bladed dozer having ground pressure less than 4.5 psi and operating weight less than 35,000 pounds, or with rubber tired equipment having operating weight less than 10,000 pounds. The work shall be coordinated such that equipment for hauling the topsoil does not travel over the topsoil in place. Areas compacted by construction operations shall be completely pulverized by tillage.

3.3.2.2 Stripped Materials.

Topsoil obtained from stripping operations shall be kept separate from other unusable excavated materials, brush, litter, objectionable weeds,

roots, stones, and other materials that would interfere with planting and maintenance operations. Unusable material shall be removed and properly disposed of.

3.3.3 Tillage

Topsoil on slopes up to a maximum 3H:1V slope shall be tilled to a nominal 3 inch depth by plowing, disking, harrowing, rototilling or other approved method. On slopes between 3H:1V and 1:1, the soil shall be tilled to a minimum 2 inch depth by scarifying with heavy rakes, or other method.

3.3.4 Treatments

Fertilizers shall be applied per manufacturer's directions. The fertilizer shall be applied at the rate recommended by the soil test. Fertilizer may be incorporated as part of the tillage operation. The Contractor shall assume full responsibility for any loss or damage to seed or sod arising from improper use of herbicides or other chemicals or due to failure to allow sufficient time to permit dissipation of toxic residues, whether or not such materials are specified herein.

3.3.5 Prepared Surface

The prepared surface shall be 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris. Debris and stones over a minimum 1-1/2 inches in any dimension shall be removed from the surface. Drainage patterns shall be maintained as indicated on drawings. Tolerance for prepared surfaces shall be within 1 inch of the plan elevation. The prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

3.4 SEEDING

Prior to installing seed, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

3.4.1 Equipment

Gravity feed applicators, which drop seed directly from a hopper onto the prepared soil, shall not be used because of the difficulty in achieving even coverage, unless otherwise approved.

3.4.2 Broadcast Seeding

In areas inaccessible to drill seeding, seed shall be broadcast by hand. Seed shall be uniformly broadcast at the rate specified for the mix. Half the total rate of seed application shall be sown with sower moving in one direction, and the remainder with sower moving at right angles to first sowing. Seed shall be covered a maximum 1/4 inch depth by disk harrow, steel mat drag, cultipacker, or other approved device. Seed shall not be broadcast when wind speed exceeds 5 miles per hour.

3.4.3 Drill Seeding

Seed shall be uniformly drilled to a depth of 1/2 to 3/4 inches at the rate specified for the mix. Equipment shall have drills a maximum 6 inches

distance apart. Row markers shall be used with the drill seeder. Seed shall be drilled in two directions, applying approximately half the seed in each direction. The drilling equipment shall be maintained with half full seed boxes during the seeding operations. When slopes exceed 1 vertical on 5 horizontal, baffle plates spaced not more than 6 inches apart shall be installed in the seed box.

3.4.4 Hydroseeding (Optional)

The hydroseeding operation shall apply the seed, mulch, and fertilizer simultaneously. The seed shall be applied at the rate indicated in the Seed Mixture Table. The fertilizer shall be applied at a rate proposed by the Contractor and agreed to by the Contracting Officer. The mulch shall be applied at a rate of about 1 ton per acre. During application, the spray shall be directed to obtain a uniform material distribution as evidenced by a formation of a "blotter-like" cover, with about 5% void area. The mulch shall permit percolation of water to the underlying soil. The seed mixed with water and fertilizer shall be applied within 1 hour after adding to the tank.

3.4.5 Mulching

3.4.5.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre, except as modified for native grasses. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.4.5.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.4.5.3 Wood Cellulose Fiber, Paper Fiber, and Recycled Paper

Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. The mulch shall be mixed and applied in accordance with the manufacturer's recommendations.

3.4.6 Initial Watering

Watering shall be started immediately after completing the seeding of an area. Water shall be applied to supplement rainfall at a rate sufficient to ensure moist soil conditions to a minimum 3 inch depth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed by Contracting Officer.

3.4.7 Native Grasses

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Areas seeded with native grasses, except slopes steeper than 3H:1V, shall be firmed with a roller not exceeding 90 pounds per foot roller

width. Seed drills equipped with rollers are acceptable.

3.5 SODDING

3.5.1 Placement

Sod shall be carefully placed with the first row laid in a straight line and subsequent rows placed parallel to and abutted tightly against each other. Sod shall be placed with staggered end joints and without stretching or overlapping. On slope areas sodding shall be started at the bottom of the slope. On 1:3 or steeper slopes, sod shall be laid across the angle of the slope and secured by tamping, pegging or other approved methods of temporarily securing each piece. In areas where concentrated flow of water is expected, sod shall be laid at right angles to the flow. After the sodding operation has been completed, the edges of the sodded area shall blend smoothly into the surrounding area.

3.5.2 Rolling and Watering

After completion of the sod placement in each area, the Contractor shall water the sod immediately, and the entire area shall be lightly rolled. The sod shall be watered to a depth sufficient such that the underside of the sod pad and the soil immediately below the pad are thoroughly wet. Watering operations shall be properly supervised to prevent run-off. The Contractor shall arrange for an adequate water supply and all equipment necessary for water application shall be supplied including all pumps, hoses, pipelines, and sprinkling equipment until final acceptance is made.

3.6 RESTORATION AND CLEAN UP

Immediately upon completion of the seeding operation in an area, the area shall be protected against traffic or other use by erecting barricades, providing signage, or as directed by Contracting Officer. Existing turf areas, pavements, riprap areas and other project features that have been damaged from the seeding operation shall be restored to original condition at Contractor's expense. Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

3.7 MAINTENANCE

3.7.1 Maintenance Watering

The Contractor shall be responsible for watering after planting to promote adequate growth and development. Water shall be distributed with equipment that does not erode or disturb the mulch. If the grass wilts, or if the soil becomes crusted and desiccated during germination, the Contracting Officer may direct watering. Watering directed by the Contracting Officer shall be performed within 48 hours after notice by the Contracting Officer to the Contractor; and shall place about 10,000 gallons per acre.

3.7.2 Mowing

- a. Bluegrass predominant seed mixes: Mowing shall be done as needed to maintain lawn areas at a nominal height of 3 inches until final acceptance, except not more than 1/3 of the grass leaf shall be removed by the initial cutting. Clippings shall be removed when the amount of cut turf is heavy enough to damage the turfed areas. Seeded areas shall be mowed immediately prior to final inspection.

- b. Native Grasses: Areas seeded with native grasses shall be mowed during the first growing season to control pioneering weeds and other competition. For the purposes of this project a weed is defined as any plant not included in the seed mix. Mowing should be done before the general height is 6 to 10 inches, or when the weedy foliar cover reaches 50 percent of the seeded area, or when the weed species begin to flower. The first mowing shall be set at a height of 3 inches with the following mowings to be set at a height of 4 to 8 inches. Rotary, flail, or sickle bar type mowing equipment is acceptable.

3.7.3 General Maintenance

Maintenance of the seeded areas shall include eradicating weeds, protecting embankments and ditches from surface erosion, maintaining erosion control materials and mulch, protecting installed areas from traffic, mowing, watering, and post-fertilization. If any portion of the surface becomes rilled, gullied, damaged, or destroyed, that portion shall be repaired to re-establish the area without additional cost to the government. The Contractor shall control erosion during the maintenance period by using ditch checks, sod swales, silt fences or other methods until a proper stand of turf is established.

3.7.3.1 Repair or Reinstall

Unsatisfactory stand of grass plants and mulch shall be repaired or reinstalled, and eroded areas shall be properly filled. Mulch material that has been removed by wind or other causes shall be replaced and secured. Maintenance shall include protecting embankments and ditches from erosion and maintaining erosion control material.

3.7.4 Maintenance Record

A record of each site visit shall be furnished, describing the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

3.8 ACCEPTANCE

Turf establishment after seeding shall extend for 12 months after completion of the seeding on the entire project, unless desired growth is established, and shortening the period of the Contractor's responsibility for acceptably established areas is authorized by the Contracting Officer. Grass plants shall be evaluated for species and health when the grass plants are a minimum 1 inch high.

- a. Bluegrass predominant seed mixes. A stand of turf is defined as a uniform stand of grass that is at least 2 inches tall with a minimum of 100 grass plants per square foot and reasonably free of weeds and visual imperfections as assessed by the Contracting Officer.
- b. Native Grasses. A proper stand of turf from the seeding of native grasses is defined as a minimum of 2 to 4 plants per square foot and where no gaps larger than 6 inches in diameter occur anywhere in the turfed area. Only plants specified in the seed mix table will be considered.

3.9 SURFACE EROSION CONTROL

Where directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to installed material and deviation to finished grade. When directed by Contracting Officer and during contract delays affecting the seeding operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded with a temporary seed crop.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02923

SLOPE STABILIZATION

PART 1 GENERAL

- 1.1 QUALITY ASSURANCE
 - 1.1.1 Qualifications of Workmen
 - 1.1.2 Standards
- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS
- 2.2 Erosion Control Blankets Type VIII

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Levee Installation
 - 3.1.2 Storm Water Pond Installation
- 3.2 CLEAN-UP, REMOVAL AND REPAIR
 - 3.2.1 Clean Up
 - 3.2.2 Removal
 - 3.2.3 Repair
- 3.3 INSPECTION
- 3.4 ACCEPTANCE AND GUARANTEE
 - 3.4.1 Provisional Acceptance
 - 3.4.2 Final Acceptance
 - 3.4.3 Guarantee

-- End of Section Table of Contents --

SECTION 02923

SLOPE STABILIZATION

PART 1 GENERAL

1.1 QUALITY ASSURANCE

1.1.1 Qualifications of Workmen

provide at least one person who shall be present at all times during execution of this portion of the work, who shall be thoroughly familiar with the type and operation of equipment being used. Said person shall direct all work performed under this section.

1.1.2 Standards

All materials used during this portion of the work shall meet or exceed applicable federal, state, county and local laws and regulations. All plant materials shall be free from insects and disease. Species shall be true to their scientific name as specified.

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Materials; GA.

Prior to delivery of any materials to the site, submit to the Contracting Officer a complete list of all plant materials to be used during this portion of the work. Include complete data on source, quantity and quality. This submittal shall in no way be construed as permitting substitution for specific items described on the plans or in these specifications unless approved in writing by the Contracting Officer.

Equipment; FIO.

Prior to commencement of any work, submit to the Contracting Officer a written description of all mechanical equipment and its intended use during the execution of the work.

Erosion Control Blankets; GA.

Manufacturer's literature including physical characteristics, application and installation instructions.

SD-18 Records

Grand Forks Phase 1 Levees

As-Built Plans; FIO.

After the work is complete submit to the Contracting Officer "as-built" plans including a listing of all species installed, and quantities installed. Mark in red ink on the original planting plan any field changes or deviations from the original plans.

PART 2 PRODUCTS

2.1 MATERIALS

Seeds shall be from within a 200 mile radius of the project site. See Section 02920 SEEDING, SODDING, and TOPSOIL for seed mix.

2.2 Erosion Control Blankets Type VIII

Erosion control blanket shall be a machine-produced 100 percent biodegradable mat with a 70 percent herbaceous straw and 30 percent coconut fiber blend matrix. The blanket shall be of consistent thickness with the straw and coconut fiber evenly distributed over the entire area of the mat. The blanket shall be covered on the top and bottom sides with 100 percent biodegradable woven natural organic fiber netting. The netting shall consist of machine directional strands formed from two intertwined yarns with cross directional strands interwoven through the twisted machine strands (commonly referred to as a Leno weave) to form an approximate 1/2 by 1/2 inch mesh. The blanket shall be sewn together with biodegradable thread on 1.5 inch centers. Straw/Coconut fiber erosion control blanket shall have the following properties:

Material Content

Matrix	70 percent straw fiber with approximately .35 lb/yd ² weight. 30 percent coconut fiber cured in fresh water with approximately .15 lb/yd ² weight.
Netting	Both sides woven 100% biodegradable natural organic fiber with approximately 9.3 lbs/1,000 ft ² weight.
Thread	Biodegradable

NOTE: Photodegradable life a minimum of 24 months with a minimum 90 percent light penetration. Apply to slopes up to a maximum 1.5:1 gradient.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Levee Installation

Clear and Grub shoreline to remove existing vegetation, except that flagged by the Government. Scarify grade with toothed bucket or other implement. Apply Enkamat (7020) or approved equal per manufacturer's recommendation and cover bottom 5 feet with 12-18 inch limestone rip-rap. Spread topsoil in an even layer. Install seed per specification and above list. Apply Bonterra S-2 or approved equal per manufacturer's recommendation. Install

live plugs per above list.

3.1.2 Storm Water Pond Installation

The Contractor shall verify that finished grades are as indicated on the drawings; finish grading and compaction shall be completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the work. The location of underground utilities and facilities in the area of the work shall be verified and marked. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

Spread topsoil in an even layer as indicated on drawings. Place seed in accordance with Section 02920 SEEDING, SODDING, and TOPSOIL, using the seeding mix presented and shown on the drawings. Prior to planting the emergent zone live plants, draw down any water 2 days prior to planting. Place erosion control blanket in accordance with manufacturer's recommendations. Place mulch in accordance with Section 02920 SEEDING, SODDING, and TOPSOIL.

3.2 CLEAN-UP, REMOVAL AND REPAIR

3.2.1 Clean Up

The Contractor shall keep the work area free of debris. After the work is complete, clean up any remaining materials, debris, trash, etc. Avoid driving or walking over bank stabilization areas to minimize disturbance.

3.2.2 Removal

After work has been completed remove any tools, equipment, empty containers, and all other debris generated by the Contractor.

3.2.3 Repair

Repair any damages caused by the Contractor during completion of the work described in this Section.

3.3 INSPECTION

After completion of the work, the Contractor shall schedule with the Government a provisional acceptance inspection of the work.

3.4 ACCEPTANCE AND GUARANTEE

3.4.1 Provisional Acceptance

The work shall be considered 90 percent complete after initial installation of seeding and plugs, and after the Contractor has completed all required clean up, removal, and repair as described in paragraph CLEAN-UP, REMOVAL AND REPAIR.

3.4.2 Final Acceptance

The work shall be considered 100 percent complete after the Contractor has met or exceeded the performance standards specified in paragraph GUARANTEE, and has completed all required clean up, removal, and repair as described in paragraph CLEAN-UP, REMOVAL AND REPAIR.

3.4.3 Guarantee

Grand Forks Phase 1 Levees

The Contractor shall guarantee bank stabilization work will meet or exceed the following performance criteria one full growing season after provisional acceptance: 50 percent survivorship of all plugs and seeded areas provide 100 percent cover.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02930

EXTERIOR PLANTING

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
 - 1.3.1 Delivery
 - 1.3.1.1 Plant Material Identification
 - 1.3.1.2 Protection During Delivery
 - 1.3.1.3 Conditioners and Amendments
 - 1.3.1.4 Pesticide Material
 - 1.3.2 Storage
 - 1.3.3 Handling
- 1.4 SCHEDULE
- 1.5 INSPECTION

PART 2 PRODUCTS

- 2.1 PLANT MATERIAL
 - 2.1.1 Quality
 - 2.1.2 Method of Shipment to Maintain Health of Root System
 - 2.1.2.1 Balled and Burlapped (BB) Plant Material
 - 2.1.2.2 Bare-Root (BR) Plant Material
 - 2.1.2.3 Container-Grown (C) Plant Material
 - 2.1.3 Growth of Trunk and Crown
 - 2.1.3.1 Deciduous Trees
 - 2.1.3.2 Deciduous Shrubs
 - 2.1.3.3 Coniferous Evergreen Plant Material
 - 2.1.3.4 Ground Cover and Vine Plant Material
- 2.2 TOPSOIL
- 2.3 MULCH
- 2.4 WEED BARRIERS
- 2.5 TREE ROOT BARRIERS
- 2.6 MYCORRHIZAL FUNGI INOCULUM
- 2.7 PESTICIDE
- 2.8 TRUNK WRAPPING MATERIAL

PART 3 EXECUTION

- 3.1 PROTECTION OF EXISTING VEGETATION
- 3.2 PERCOLATION TEST
- 3.3 SITE PREPARATION
 - 3.3.1 Layout
- 3.4 INSTALLATION
 - 3.4.1 Setting Plant Material
 - 3.4.2 Backfill Soil Mixture
 - 3.4.3 Backfill Procedure

Grand Forks Phase 1 Levees

- 3.4.3.1 Bare-Root Plant Material
- 3.4.4 Staking and Guying
- 3.5 FINISHING
 - 3.5.1 Placing Mulch
 - 3.5.2 Pruning
 - 3.5.3 Wrapping
- 3.6 MAINTENANCE DURING PLANTING OPERATION
- 3.7 APPLICATION OF PESTICIDE
- 3.8 RESTORATION AND CLEAN UP
- 3.9 MAINTENANCE

-- End of Section Table of Contents --

SECTION 02930

EXTERIOR PLANTING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA ANSI/ANLA Z60.1 (1996) American Standard for Nursery Stock

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300 (1995) Tree Care Operations - Trees, Shrubs and other Woody Plant Maintenance

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 5268 (1992; R 1996) Topsoil Used for Landscaping Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Schedules

Plant Installation Schedule; GA

Plant installation schedule shall be submitted a minimum of 30 days before beginning plant installation. Schedule shall specify planting season (spring or fall), dates, locations, and plant materials to be installed.

SD-08 Statements

Plant Establishment Period; FIO

Upon completion of the last day of the planting operation, the plant establishment period for maintaining installed plant material in a healthy growing condition shall commence and shall be in effect for the remaining contract time period, not to exceed 12 months. Written calendar time period shall be furnished for the plant establishment period. When there is more than one plant establishment period, the boundaries of the planted area covered for each period shall be described.

SD-09 Reports

Percolation Test; FIO

Test reports, prepared by an independent testing agency.

SD-18 Records

Maintenance Record; FIO

A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, the quantity and date of replacements made, and pesticide application.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

1.3.1.1 Plant Material Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the common name, correct botanical plant name and size.

1.3.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

1.3.1.3 Conditioners and Amendments

Soil conditioners and amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis and name. In lieu of containers, soil conditioners and amendments may be furnished in bulk and a certificate from the manufacturer indicating the above information shall accompany each delivery.

1.3.1.4 Pesticide Material

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

1.3.2 Storage

Plants stored on the work site shall be protected from any drying at all times by covering the balls or roots with moist sawdust, wood chips, shredded bark, peat moss, or other similar mulching material. Plants, including those in containers, shall be kept in a moist condition by watering with a fine mist spray until planted.

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with plants or other materials.

1.3.3 Handling

Grand Forks Phase 1 Levees

Plant material shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped plant material shall be avoided. Plant material shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles.

1.4 SCHEDULE

Planting shall be scheduled within the dates in the Optimal Planting Date table shown on the drawings. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted for approval. Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, frozen ground or other unsatisfactory conditions prevail, the work shall be stopped when directed.

1.5 INSPECTION

Plants shall be subject to inspection at any time prior to planting. Plants may be inspected at the nursery prior to shipment, but such inspection shall not be considered as acceptance. Upon request of the Contracting Officer, the contractor shall accompany the government inspector to the nursery and identify plant material to be furnished. Unacceptable material shall be promptly removed from the job site.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

Trees shall be delivered to the jobsite without wrapping (bark shall be visible for inspection).

2.1.1 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA ANSI/ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment. Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system. Plant material shall be checked for unauthorized substitution and to establish nursery grown status. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container.

2.1.2 Method of Shipment to Maintain Health of Root System

2.1.2.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing

mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine. Plant material with broken or cracked balls; or broken containers shall be rejected.

2.1.2.2 Bare-Root (BR) Plant Material

Minimum root spread shall be in accordance with ANLA ANSI/ANLA Z60.1. A well branched root system characteristic of the species specified shall be provided. Roots shall not be pulled from the ground. Bare-root plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. Bare-root plant material shall be dormant. The root system shall be protected from drying out.

2.1.2.3 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA ANSI/ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

2.1.3 Growth of Trunk and Crown

2.1.3.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA ANSI/ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.
- c. Specimen: The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.3.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANLA ANSI/ANLA Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

2.1.3.3 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANLA ANSI/ANLA Z60.1. The coniferous evergreen trees shall

not be "poled". The leader shall be whole and unpruned, including the tip.

2.1.3.4 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall have the minimum number of runners and length of runner recommended by ANLA ANSI/ANLA Z60.1. Plant material shall have heavy, well developed and balanced crown with vigorous, well developed root system and shall be furnished in containers.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. Additional topsoil required beyond that available from stripping operations shall be imported. Topsoil for planting trees and shrubs shall be imported from an off site source. Topsoil shall meet the physical requirements of, and shall be tested, amended, fertilized and treated in accordance with Section 02920 SEEDING, SODDING, AND TOPSOIL.

2.3 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Rotted manure and recycled mulch including compost, plastics, or pine needles is not acceptable. Wood chips and shredded or ground bark shall be treated to retard the growth of mold and fungi.

2.4 WEED BARRIERS

Weed barrier shall be an inert membrane specifically manufactured and marketed for landscaping. Weed barrier shall consist of a heat bonded non-woven geotextile composed of fiberglass, polyester, or polypropylene fibers. Polymers shall be stabilized for ultraviolet light degradation

2.5 TREE ROOT BARRIERS

Tree root barriers shall be metal or plastic consisting of recycled content. Barriers shall utilize vertical stabilizing members to encourage downward tree root growth. Barriers shall limit, by a minimum 90 percent, the occurrence of surface roots. Tree root barriers which are designed to be used as plant pit liners will be rejected.

2.6 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

2.7 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

2.8 TRUNK WRAPPING MATERIAL

Tree wrap shall be two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 4 inches in width and shall stretch 33 percent without breakage. Waterproof

tape shall be used to bind wrapping to tree.

PART 3 EXECUTION

3.1 PROTECTION OF EXISTING VEGETATION

If turf areas have been established prior to planting operations, the surrounding turf shall be covered before excavations are made in a manner that will protect turf areas. Existing trees, shrubbery, and beds that are to be preserved shall be protected in accordance with the approved Environmental Protection Plan and SECTION 01000 GENERAL.

3.2 PERCOLATION TEST

Test for percolation shall be done to determine positive drainage of plant pits and beds. A positive percolation shall consist of a minimum 1 inch per 3 hours. If a negative percolation test occurs, no planting shall be continued in the area represented by the test until changes are directed by the Contracting Officer.

3.3 SITE PREPARATION

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the planting operation. The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.3.1 Layout

Tree locations and bed outlines shall be staked by the Contractor on the project site and approved by the Contracting Officer before any plant pits or beds are dug.

3.4 INSTALLATION

3.4.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. Balled and burlapped and container grown plants shall be handled and moved only by the ball or container. Plastic wrap and metal baskets shall be completely removed before the placement of backfill. Container grown stock shall be removed from containers without damaging plant or root systems. After centering the plant in pit, all ropes secured to the trunk shall be removed and burlap opened on the top 1/3 of the root ball.

3.4.2 Backfill Soil Mixture

The backfill soil mixture may be a mix of topsoil and soil amendments suitable for the plant material specified. When practical, the excavated soil from the plant pit that is not amended provides the best backfill and shall be used. Mycorrhizal fungi inoculum shall be added as recommended by the manufacturer for the plant material specified.

3.4.3 Backfill Procedure

Grand Forks Phase 1 Levees

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated.

3.4.3.1 Bare-Root Plant Material

The root system shall be spread out and arranged in its natural position. Damaged roots shall be removed with a clean cut. The backfill soil mixture shall be carefully worked in amongst the roots and watered to form a soupy mixture. Air pockets shall be removed from around the root system, and root to soil contact shall be provided.

3.4.4 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity. Trees that are staked and guyed shall be completed as shown.

3.5 FINISHING

3.5.1 Placing Mulch

Care shall be taken to avoid contaminating the mulch with the planting soil. Mulch shall be kept out of the crowns of shrubs, and shall be kept off buildings, sidewalks, fences, and other facilities.

3.5.2 Pruning

New plant material shall be pruned in accordance with recommended dates for each species in the following manner: prune dead and broken branches, cross branches, weak branches, and for shape. Typical growth habit of individual plants shall be retained with as much height and spread as is practicable. The pruning of trees shall be in accordance with ANSI A300. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off". Trimmings shall be disposed of as specified for clearing and grubbing debris in Section 01000 GENERAL.

3.5.3 Wrapping

The trunks of deciduous trees, planted during the fall, shall be wrapped within 24 hours after planting. Trees planted during the spring shall not be wrapped until October of the year when planted. Wrap shall be removed in the following spring. The wrapping shall be securely tied at the top and bottom and at 18-inch maximum intervals with waterproof tape.

3.6 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. Installed areas shall be kept free of weeds, grass, and other undesired vegetation. The maintenance includes maintaining the mulch, watering, and adjusting settling.

3.7 APPLICATION OF PESTICIDE

Herbicides, insecticides, and fungicides shall be applied as needed and in accordance with approved written manufacturer's recommendations. When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted. A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. The pesticide shall be prevented from coming into contact with the applicator or other persons.

3.8 RESTORATION AND CLEAN UP

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense. Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared.

3.9 MAINTENANCE

Maintenance of plant material shall include straightening plant material, straightening stakes; tightening guying material; correcting girdling; supplementing mulch; pruning dead or broken branch tips; maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; and removing and replacing unhealthy plants.

a. Watering Plant Material. The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. All watering shall be done in a manner which will provide uniform coverage but which will not cause erosion or damage to the finished surface. Water shall not be applied with a force sufficient to displace mulch and shall not be applied at such a rate that it cannot be absorbed by the mulch and plants.

b. Weeding. Grass and weeds in the installed areas shall not be allowed to reach a maximum 3 inches height before being completely removed, including the root system.

c. Post-Fertilization. The plant material shall be topdressed at least once during the period of establishment with controlled release fertilizer. Apply at the rate of 2 pounds per 100 square feet of plant pit or bed area. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy. Fertilizer in packet or tablet form shall be placed prior to backfilling and in accordance with the approved manufacturer's written recommendations.

d. Unhealthy Plant Material. A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement. Unhealthy or dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02935

EXTERIOR PLANT MATERIAL MAINTENANCE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, INSPECTION, STORAGE, AND HANDLING
 - 1.3.1 Delivery Schedule
 - 1.3.2 Delivery of Pesticides
 - 1.3.3 Storage
 - 1.3.4 Handling

PART 2 PRODUCTS

- 2.1 SOIL AMENDMENTS
 - 2.1.1 pH Adjuster
 - 2.1.1.1 Limestone
 - 2.1.1.2 Hydrated Lime
 - 2.1.1.3 Burnt Lime
 - 2.1.2 Fertilizer
 - 2.1.3 Nitrogen Carrier Fertilizer
 - 2.1.4 Organic Material
 - 2.1.4.1 Bonemeal
 - 2.1.4.2 Rotted Manure
 - 2.1.4.3 Decomposed Wood Derivatives
 - 2.1.4.4 Recycled Compost
 - 2.1.4.5 Worm Castings
 - 2.1.5 Soil Conditioner
 - 2.1.5.1 Sand
 - 2.1.5.2 Calcined Clay
 - 2.1.5.3 Gypsum
 - 2.1.5.4 Expanded Shale, Clay, or Slate (ESCS)
- 2.2 MULCH
 - 2.2.1 Organic Mulch
 - 2.2.1.1 Shredded Bark
- 2.3 WATER
- 2.4 PESTICIDE
- 2.5 HERBICIDE

PART 3 EXECUTION

- 3.1 SOIL TESTS
- 3.2 MULCHING
- 3.3 WATERING
- 3.4 APPLICATION OF PESTICIDE
 - 3.4.1 Technical Representative
 - 3.4.2 Application
- 3.5 GENERAL MAINTENANCE REQUIREMENTS

Grand Forks Phase 1 Levees

- 3.5.1 Pesticide Treatment
- 3.5.2 Maintenance Record
- 3.6 GRASS PLANT QUALITY
 - 3.6.1 Lawn Area
 - 3.6.2 Field Area
- 3.7 LAWN AND FIELD AREAS MAINTENANCE
 - 3.7.1 Mowing
 - 3.7.1.1 Lawn Areas
 - 3.7.1.2 Field Areas
 - 3.7.2 Turf Trimming
 - 3.7.3 Aeration
 - 3.7.4 Lime
 - 3.7.5 Herbicide Weed Control
 - 3.7.6 Turf Fertilization Program
- 3.8 PLANTING BEDS MAINTENANCE
 - 3.8.1 Trimming
 - 3.8.2 Weed Control
- 3.9 PLANT MATERIAL QUALITY
 - 3.9.1 General Requirements
 - 3.9.2 Growth of Trunk and Crown
 - 3.9.2.1 Deciduous Trees
 - 3.9.2.2 Deciduous Shrubs
 - 3.9.2.3 Coniferous Evergreen Plant Material
 - 3.9.2.4 Broadleaf Evergreen Plant Material
 - 3.9.2.5 Ground Cover and Vine Plant Material
- 3.10 SHRUB AND HEDGE MAINTENANCE
 - 3.10.1 Trimming and Pruning
 - 3.10.2 Shrub Fertilization Program
- 3.11 TREE MAINTENANCE
 - 3.11.1 Trimming and Pruning of Trees
 - 3.11.2 Tree Fertilization Program
 - 3.11.3 Unhealthy Plant Material
- 3.12 RESTORATION AND CLEAN UP
 - 3.12.1 Restoration
 - 3.12.2 Clean Up
- 3.13 CLEANING OF PAVED AREAS

-- End of Section Table of Contents --

SECTION 02935

EXTERIOR PLANT MATERIAL MAINTENANCE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300 (1995) Tree Care Operations - Trees, Shrubs and other Woody Plant Maintenance

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 4972 (1995a) pH of Soils

ASTM D 5883 (1996e1) Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purpose

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Chemical Treatment Material; GA

Manufacturer's literature including physical characteristics, application and installation instructions for chemical treatment material.

Work Plan and Schedule; GA
Delivery Schedule; GA

Contractor's work plan and schedules.

Maintenance Record; GA

Contractor's record of each site visit.

Application of Pesticide; GA

Grand Forks Phase 1 Levees

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-13 Certificates

pH Adjuster; GA
Fertilizer; GA
Mulch; GA
Pesticide; GA

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

- a. pH Adjuster. Calcium carbonate equivalent and sieve analysis.
- b. Fertilizer. Chemical analysis and composition percent.
- c. Mulch: Composition and source.
- d. Pesticide. EPA registration number and registered uses.

1.3 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.3.1 Delivery Schedule

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.3.2 Delivery of Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

1.3.3 Storage

Materials shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with seeding operation materials.

1.3.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

PART 2 PRODUCTS

2.1 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite shall not be used.

2.1.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, sulfur, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified or in place.

2.1.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 55 percent shall pass through a No. 60 sieve. To raise soil pH, ground limestone shall be used.

2.1.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a No. 8 sieve and a minimum 97 percent shall pass through a No. 60 sieve.

2.1.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 35 percent shall pass through a No. 60 sieve.

2.1.2 Fertilizer

Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The nutrients ratio shall be 5 percent nitrogen, 10 percent phosphorus, and 5 percent potassium. The fertilizer shall be derived from sulfur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.1.3 Nitrogen Carrier Fertilizer

Nitrogen carrier fertilizer shall be commercial grade, free flowing, and uniform in composition. The nutrients ratio shall be 5 percent nitrogen, 10 percent phosphorus, and 5 percent potassium. The fertilizer may be a liquid nitrogen solution.

2.1.4 Organic Material

Organic material shall consist of bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

2.1.4.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.1.4.2 Rotted Manure

Grand Forks Phase 1 Levees

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds.

2.1.4.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall consist of ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen.

2.1.4.4 Recycled Compost

Recycled compost shall be well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 3/8 inch screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 2 inches in length.

2.1.4.5 Worm Castings

Worm castings shall be screened from worms and food source, commercially packaged.

2.1.5 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for use singly or in combination.

2.1.5.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a No. 10 sieve and a minimum 10 percent by weight shall pass a No. 16 sieve. Green sand shall be balanced with the inclusion of trace minerals and nutrients.

2.1.5.2 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.1.5.3 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

2.1.5.4 Expanded Shale, Clay, or Slate (ESCS)

Grand Forks Phase 1 Levees

Rotary kiln produced ESCS material shall conform to ASTM D 5883.

2.2 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure shall not be used.

2.2.1 Organic Mulch

Organic mulch materials shall be native to the project site and consist of shredded bark for use when remulching trees, shrubs, and ground covers.

2.2.1.1 Shredded Bark

Locally shredded material shall be treated to retard the growth of mold and fungi.

2.3 WATER

Water shall be the responsibility of the Contractor. Water shall not contain elements toxic to plant life.

2.4 PESTICIDE

Pesticide shall be an insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

2.5 HERBICIDE

Herbicide shall be EPA registered and approved; furnished for preemergence and postemergence application for crabgrass control and broad leaf weed control and complying with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on Contractor's licensing, certification, and record keeping. Contractor shall keep records of all pesticide applications and forward data monthly to Contracting Officer. Record keeping format shall be submitted to Contracting Officer for approval.

PART 3 EXECUTION

3.1 SOIL TESTS

Contractor shall perform soil tests in accordance with ASTM D 4972.

3.2 MULCHING

Mulch shall be mixed and applied in accordance with the manufacturer's recommendations.

3.3 WATERING

Water to supplement rainfall shall be applied at a rate sufficient to ensure plant growth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

3.4 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

3.4.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control.

3.4.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended to prevent the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A pesticide plan shall be submitted.

3.5 GENERAL MAINTENANCE REQUIREMENTS

3.5.1 Pesticide Treatment

Pesticide treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.5.2 Maintenance Record

A record of each site visit shall be furnished, describing:

- a. Maintenance work performed.
- b. Areas repaired or reinstalled.
- c. Diagnosis for unsatisfactory stand of grass.
- d. Diagnosis for unsatisfactory stand of plant material in planting bed.
- e. Condition of trees.
- f. Condition of shrubs.
- g. Quantity and diagnosis of plant loss.

3.6 GRASS PLANT QUALITY

Grass plants shall be evaluated for species and health when the grass plants are a minimum 1 inch high. The living grass area shall be maintained to be uniform in color and leaf texture; and free from weeds and other undesirable growth. The living grass area shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable

plants, stones larger than 1 inch in diameter, woody plant roots, and other materials detrimental to a healthy stand of grass plants. Broadleaf weeds and patches of foreign grasses shall be a maximum 2 percent of the total area.

3.6.1 Lawn Area

A satisfactory stand of grass plants for a lawn area shall be a minimum 20 grass plants per square foot. Bare spots shall be a maximum 6 9 inches square. The total bare spots shall be a maximum 2 percent of the total area.

3.6.2 Field Area

A satisfactory stand of grass plants for a field area shall be a minimum 10 grass plants per square foot. The total bare spots shall not exceed 2 percent of the total seeded area.

3.7 LAWN AND FIELD AREAS MAINTENANCE

3.7.1 Mowing

Lawn and field areas shall be mowed throughout the growing season to meet the requirements of paragraph GRASS PLANT QUALITY. Cutting height shall be adjusted according to type of grass. Frequency of mowing shall be adjusted so that no more than 1/4 of leaf length is removed during a cutting.

3.7.1.1 Lawn Areas

Lawn areas shall be mowed to a minimum 3 inch height when the turf is a maximum 4-1/2 inches high. Remove clippings when the amount cut prevents sunlight from reaching the ground surface.

3.7.1.2 Field Areas

Field areas shall be mowed 3 times during the season to a minimum 3 inch height. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

3.7.2 Turf Trimming

Turf adjoining paved areas, planting beds and trees shall be kept neatly trimmed at all times, essentially after each mowing. String trimmers at trees and shrubs will be prohibited.

3.7.3 Aeration

Turf areas shall be aerated once per year using approved devices. Coring shall be performed by pulling soil plugs to minimum of 4 inches. Soil plugs produced in turf areas shall be left in place.

3.7.4 Lime

Lime for pH modification shall be applied as required to meet the requirements of paragraph GRASS PLANT QUALITY.

3.7.5 Herbicide Weed Control

Two or more applications of a pre-emergent herbicide and of a post-emergent herbicide shall be performed to meet the requirements of paragraph GRASS

PLANT QUALITY.

3.7.6 Turf Fertilization Program

A regular program of fertilization shall be established to include a spring feeding and early summer feeding to meet the requirements of paragraph GRASS PLANT QUALITY. A total of four pounds of Nitrogen per 1000 square feet shall be applied annually. Additional one pound Nitrogen applications shall be provided as grass color warrants.

3.8 PLANTING BEDS MAINTENANCE

3.8.1 Trimming

Spent flower heads shall be removed. Seasonal succession of bloom requires removal for new plant or trimming back bulb foliage.

3.8.2 Weed Control

Grass and weeds in planting beds shall be completely removed before reaching 3 inches in height.

3.9 PLANT MATERIAL QUALITY

3.9.1 General Requirements

Plant material shall be identified as native to the region of the site or as a specimen. Plant material shall be maintained as well shaped, well grown, vigorous plant material having healthy root systems. The plant material shall be maintained as free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems. Plant quality is determined by the growing conditions; climate and microclimate of the site for maintaining a healthy root system; and growth of the trunk and crown as follows.

3.9.2 Growth of Trunk and Crown

3.9.2.1 Deciduous Trees

Deciduous tree height to caliper relationship shall be maintained. Height of branching shall bear a relationship to the size and species of the tree and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.
- c. Specimen: The tree shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be indicated.

3.9.2.2 Deciduous Shrubs

Deciduous shrub height to number of primary stems shall be maintained. Shrubs shall be maintained as well shaped, with sufficient well-spaced side

branches, and recognized by the trade as typical for the species grown in the region of the site.

3.9.2.3 Coniferous Evergreen Plant Material

Coniferous evergreen plant material height-to-spread ratio shall be maintained. The coniferous evergreen trees shall not be "poled" or the leader removed. The plant material shall be maintained to be well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be indicated.

3.9.2.4 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material height-to-spread ratio shall be maintained. The plant material shall be shaped to be recognized by the trade as typical for the variety grown in the region of the site.

3.9.2.5 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall be maintained to have a heavy, well developed, and balanced crown with vigorous, well developed root system.

3.10 SHRUB AND HEDGE MAINTENANCE

3.10.1 Trimming and Pruning

Trimming shall be performed to ensure the following:

- a. Safety.
- b. Quality (size, height, and shape).
- c. Health (removing broken, diseased branches).
- d. Rejuvenation (removing one third to one half of the older stems or branches).
- e. Visibility (signs, building entrances, motorist line of sight).

Shrubs shall be pruned to the requirements of paragraph PLANT MATERIAL QUALITY. Pruning shall be accomplished by trained and experienced personnel in accordance with ANSI A300. The typical growth habit of individual plant material or the theme shape of the hedge shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed.

3.10.2 Shrub Fertilization Program

A regular program of fertilization shall be established to include a fall feeding to meet the requirements of paragraph PLANT MATERIAL QUALITY. Use industry standards for foliage and root fertilizing the plant material inventoried.

3.11 TREE MAINTENANCE

3.11.1 Trimming and Pruning of Trees

Trimming shall be performed to ensure the following:

- a. Safety.
- b. Quality (size, height).
- c. Health (removing broken, diseased wood branches).
- d. Rejuvenation (removing one third to one half of the older stems or branches).
- e. Visibility (signs, building entrances, motorist line of sight).

Trees shall be pruned to meet the requirements of paragraph PLANT MATERIAL QUALITY. Pruning shall be accomplished by trained and experienced personnel in accordance with ANSI A300. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

3.11.2 Tree Fertilization Program

A regular program of fertilization shall be established to include a fall feeding to meet the requirements of paragraph PLANT MATERIAL QUALITY. Use industry standards for foliage and root fertilizing the plant material inventoried.

3.11.3 Unhealthy Plant Material

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement. Unhealthy or dead plant material shall be removed immediately.

3.12 RESTORATION AND CLEAN UP

3.12.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the maintenance operations shall be restored to original condition at Contractor's expense.

3.12.2 Clean Up

Excess and waste material shall be removed from the maintenance areas and dispose off site. Adjacent paved areas shall be cleaned as determined by the Contracting Officer.

3.13 CLEANING OF PAVED AREAS

Grass, weeds, leaves, and debris from mowing, clipping, and pruning shall be removed immediately. Excess and waste material shall be removed from paved areas and disposed off site. Debris, leaves shall be removed monthly.

-- End of Section --