

**SECTION 209****DRAIN BACKFILL**

## DESCRIPTION

**209.01.01 GENERAL**

- A. This work shall consist of furnishing, hauling, placing, and compacting drain backfill material around structures, pipes or perforated underdrains to the lines designated on the plans or established by the Engineer.

## MATERIALS

**209.02.01 GENERAL**

- A. Material shall conform to the requirements of Subsection 704.03.02, "Drain Backfill."

## CONSTRUCTION

**209.03.01 GENERAL**

- A. The trench shall be excavated and drain backfill placed in accordance with provisions of Section 607, "Underdrains."
- B. Where drain backfill is part of the structural section, it shall be compacted to not less than 90 percent maximum density. Test method to be determined by the Engineer.
- C. Compacting by ponding or jetting will not be permitted.

## METHOD OF MEASUREMENT

**209.04.01 MEASUREMENT**

- A. The quantity of drain backfill to be measured for payment will be the number of cubic yards measured in accordance with the dimensions shown on the plans or established by the Engineer complete and in place.
- B. All measurement will be made in accordance with Subsection 109.01, "Measurement of Quantities."

## BASIS OF PAYMENT

**209.05.01 PAYMENT**

- A. Payment for drain backfill will be made only when provided for in the Special Provisions or Proposal.
- B. The accepted quantities of drain backfill measured as provided in Subsection 209.04.01, "Measurement," will be paid for at the contract unit price bid per cubic yard of drain backfill.
- C. Full compensation for furnishing, hauling, placing, and compacting drain backfill shall be considered as included in the contract price paid for drain backfill.
- D. All payments will be made in accordance with Subsection 109.02, "Scope of Payment."
- E. Payment will be made under:

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DRAIN BACKFILL

**PAY ITEM**

**PAY UNIT**

Drain Backfill..... Cubic Yard

**SECTION 210****WATERING**

## DESCRIPTION

**210.01.01 GENERAL**

- A. This work shall consist of, but is not limited to furnishing, hauling, and applying all water required for compaction of embankment foundation areas, embankments, subgrade, mineral aggregate base and surfacing materials, structure backfill, processing lime treated base or subgrade material, or cement treated base, and for controlling dust caused by grading operations, traffic, and natural conditions.

## MATERIALS

**210.02.01 GENERAL**

- A. All materials shall conform to the requirements set forth in Section 722, "Water."

## CONSTRUCTION

**210.03.01 EQUIPMENT**

- A. Equipment used for applying water required for compacting embankment materials, subgrade, base and surfacing materials, and for controlling dust shall be pressure type distributors equipped with a spray system that will ensure uniform application of water. All the watering equipment used for the application of water shall be equipped with a positive means of shutoff and the use of equipment not so equipped will not be permitted. An approved pump, pipe, hose, and nozzle equipment may be used in embankment construction. Where the head is sufficient to provide enough pressure, the pump requirement may be eliminated.
- B. The Contracting Agency does not require that watering equipment be provided with measuring or metering devices.

**210.03.02 GENERAL**

- A. Water for dust control shall be applied in the amounts and on the areas designated by the Engineer.
- B. The Contractor shall apply water in the amount necessary to attain the compaction in those materials requiring a specified density. In certain areas of the base courses, water may be introduced into the aggregate at the plant and when necessary to attain the specified compaction, shall be supplemented by additional wetting as specified above.
- C. Excavation areas and borrow pits may be watered prior to excavating the material.
- D. When water is applied directly to the roadbed, the material shall be processed by suitable equipment until the layer is uniformly wet. Care shall be taken to avoid disturbing layers which have been previously placed and compacted.
- E. The Contractor shall make all arrangements for providing an adequate water supply. The Contractor shall negotiate with owners of supply and sign an agreement with each owner prior to removing the water. A copy of said agreement shall be furnished to the Engineer.

The Contractor shall pay all royalties occurring under such agreements and shall also obtain any necessary right-of-way.

#### METHOD OF MEASUREMENT

##### **210.04.01 MEASUREMENT**

- A. The developing of an adequate water supply, the furnishing of all necessary equipment for obtaining water from the source or sources, water, and the furnishing of equipment necessary to apply the water, will not be measured for payment.

#### BASIS OF PAYMENT

##### **210.05.01 PAYMENT**

- A. Full compensation for developing an adequate water supply, for furnishing all necessary equipment, for obtaining water from the source or sources, for water, and for furnishing of equipment necessary to apply the water, shall be considered as included in the contract unit price paid for other appropriate items and no separate payment will be made therefor.

**SECTION 211**  
**EROSION CONTROL**

DESCRIPTION

**211.01.01 GENERAL**

- A. This work shall consist of preparing slopes, placing and compacting top soil, seeding, fertilizing, jute matting, and mulching graded and disturbed areas in accordance with these specifications and the details shown in the contract documents.

MATERIALS

**211.02.01 GENERAL**

- A. The materials used shall be those prescribed for the several items which constitute the finished work and shall conform to the applicable requirements of Section 726, "Roadside Materials."

**211.02.02 PLANTING SOIL**

- A. Unless designated in the contract documents, the Contractor shall make the Contractor's own arrangements for obtaining soil at no additional cost to the Contracting Agency. Soil shall be transported directly from the source to final position unless otherwise permitted. Soil shall not be obtained from an area known to have noxious weeds growing in it.
- B. Prior to removal of planting soil from the source, the Contractor shall contact the County Weed Control Agency or the State Quarantine Officer for the inspection and destruction of injurious and noxious weeds. Soil that has been treated with herbicides or sterilizers shall be tested by the Nevada State Department of Agriculture to determine the residual in the soil.

**211.02.03 SEED**

- A. All seeds shall conform with all laws and regulations pertaining to the sale and shipment of seed required by the Nevada State Department of Agriculture and the Federal Seed Act. All shipments of seed shall be reported to the Nevada State Department of Agriculture for inspection. Seed shall be of the varieties and proportions specified in the contract documents.

**211.02.04 FERTILIZER AND AGRICULTURAL MINERALS**

- A. All fertilizer and agricultural minerals shall conform with all "Rules and regulations governing the registration, and collection of license tonnage fees for commercial fertilizer in the State of Nevada" as required by the Nevada State Department of Agriculture. Commercial fertilizer formulation and rate of application shall be as specified in the contract documents and subject to sampling for verification of analysis.

**211.02.05 MULCH**

- A. **Hay or Straw:** Hay or straw shall be acceptable to the Engineer. All shipments of hay or straw shall be free of noxious weeds as defined by Nevada State Department of Agriculture. Rate of application shall be as specified in the contract documents.
- B. **Wood Cellulose Fiber:** Wood cellulose fiber shall be manufactured in such a manner that after addition and agitation in slurry tanks with fertilizers, seeds, water, and other approved

additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry. When hydraulically sprayed on the ground, the material shall be uniformly impregnated with seed. Rate of application shall be as specified in the contract documents.

- C. **Wood Chips:** Wood chips shall be as specified in Subsection 726.03.04.D, "Wood Chips and Shavings."
- D. **Bark:** Bark shall be as specified in Subsection 726.03.04.E, "Bark."

#### **211.02.06 ASPHALT EMULSION**

- A. Asphalt emulsion used as a tie-down for mulch shall be as described in the contract documents.

### **CONSTRUCTION**

#### **211.03.01 PREPARATION**

- A. Excavation slopes shall be thoroughly cultivated to the depth shown in the contract documents, after which planting soil, if required by the contract, shall be uniformly spread to an approximate thickness of 4 inches, the exact thickness will be determined by the Engineer.
- B. Cultivation of embankment slopes shall be required before placing planting soil unless otherwise specified in the contract documents or ordered by the Engineer. Such cultivation shall be considered subsidiary to other portions of the work and no direct payment will be made for such work.
- C. Cultivation shall not be performed until all equipment is through working in the area, except equipment required to cultivate the area and spread planting soil.
- D. After cultivation and prior to seeding, all rocks 1 inch in smallest dimension and larger shall be removed from all slopes to be seeded and shall be disposed of as approved by the Engineer.

#### **211.03.02 PLACEMENT OF PLANTING SOIL**

- A. Planting soil shall be evenly spread over the specified areas to the depth shown on the plans unless otherwise approved by the Engineer. After the planting soil has been spread, all large clods, hard lumps, rocks, and litter shall be raked up, removed, and disposed of by the Contractor.
- B. Planting soil shall not be placed when the ground is frozen, excessively wet, or, in the opinion of the Engineer, in a condition detrimental to the work.
- C. All damage occurring to existing roadbeds, shoulders, walks, curbs, or other existing adjacent structures or areas due to the Contractor's operation in hauling and placing the planting soil shall be repaired by the Contractor at no additional cost to the Contracting Agency.

#### **211.03.03 FIRING OF PLANTING SOIL**

- A. Planting soil shall be made firm by use of a heavy or weighted disk set at an acute angle. The entire planting area shall be firmed by a minimum of three passes of the disk. The planting soil surface shall be brought to finished grade by one pass of a toothed harrow with teeth set at a 45-degree angle or by one pass of a steel-wire mat. Soil firming operations shall be performed by traveling at right angle to the slope, except slopes

greater than 30 percent shall be firmed by equipment conveyed up and down the slope by means devised by the Contractor. After firming operations, the planting soil shall be 2 inches below the top of all structures.

#### **211.03.04 SEEDING AND FERTILIZING**

- A. The Contractor shall notify the Engineer not less than 24 hours in advance of any seeding operation and the Contractor shall not begin the work until areas prepared or designated for seeding have been approved. Following the Engineer's approval, seeding and fertilizing of the approved slopes shall begin immediately.
- B. Seeding shall not be done during windy weather or when the ground is frozen. Seed and fertilizer shall be uniformly spread over the area at the rate and mix specified in the contract documents. Seed and fertilizer may be sown by one of the following methods:
  1. An approved type hydro-seeder which utilizes water as the carrying agent and maintains a continuous agitator action that will keep seed and fertilizer mixed in uniform distribution until pumped from the tank. Pump pressure shall be such as to maintain a continuous, nonfluctuating stream of solution.
  2. Approved blower equipment with an adjustable disseminating device capable of maintaining a constant, measured rate of material discharge that will ensure an even distribution of seed and fertilizer at the rate herein specified.
  3. Helicopters properly equipped for aerial seeding and fertilizing. Helicopters so equipped shall have the following:
    - a. Two hoppers or seed compartments each capable of containing a minimum of 100 pounds of grass seed or granular fertilizer.
    - b. Power driven, readily adjustable disseminating mechanisms capable of maintaining a constant, measured rate of distribution of grass seed or granular fertilizer.
    - c. Where liquid fertilizer is furnished in lieu of dry granular fertilizer, the helicopter shall be equipped with two barrels or containers capable of containing a minimum of 15 gallons each. Distribution shall be a spray boom of sufficient size and length, fitted with proper nozzles to distribute uniformly, liquid fertilizer as herein specified.
  4. Approved power-drawn drills, with double-disc front delivery openers, and depth bands for positive depth control. Depth control shall be set at a depth of 3/4 inch for consistent furrow bottom placement.
    - a. An approved deep furrow drill may be used where it is determined the seedbed is firm and there is little danger of soil blowing. An approved spreader may be used for fertilizer placement. Drills and spreaders shall be calibrated before use on the project.
    - b. Areas inaccessible to above methods of application shall be seeded and fertilized by approved hand methods. Distribution of the material shall be uniform and at the rates specified.
    - c. The Contractor shall provide qualified personnel experienced in all phases of the seeding and fertilizing operation, equipment, and methods as herein specified.

**211.03.05 SPREADING MULCH:**

- A. **Hay or Straw:** Hay or straw mulch shall be furnished, hauled, and evenly applied at the rates indicated, and shall be spread by means of an approved type mulch spreader. The spreader shall produce a uniform distribution of the hay, without cutting or breaking it into short stalks. Areas beyond the range of the mulch spreader shall be mulched by approved hand methods. Distribution of the material shall be uniform and at the rate specified in the contract documents.
1. Unless otherwise specified, straw or hay shall be anchored into the soil by use of a heavy disc with flat serrated discs approximately 1/4 inch thick, having dull edges and spaced no more than 9 inches apart.
  2. Anchoring shall be to a depth of 2 inches across the slope, and with no more than one pass of the equipment on the same surface.
- B. **Wood Cellulose Fiber:** Wood cellulose fiber utilized as a mulch may be applied with seed and fertilizer in one operation by approved hydraulic equipment. The equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed, and water. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic discharge spray nozzles which will provide a uniform distribution of the slurry.
- C. **Wood Chips:** Wood chips utilized as a mulch may be applied by available mechanical chip spreaders or by approved hand methods. The wood chips shall be spread to an average depth of 3 inches.
- D. **Bark:** Bark utilized as a mulch may be applied by available mechanical spreaders or by approved hand methods. The bark shall be spread on open slope areas to an average depth of 3 inches. Bark applied as a mulch for tree and shrub rings shall be spread to an average depth of 4 inches.

**211.03.06 APPLYING ASPHALT EMULSION**

- A. When called for in the contract documents, mulch material shall be anchored in place with asphalt emulsion as herein specified. Asphalt emulsion shall be sprayed into the mulch as it leaves the blower pipe and shall be uniformly mixed with the mulch. Asphalt emulsion as specified shall be applied at the rate of 250 gallons per acre. Any mulch disturbed or displaced following application shall be removed, reseeded, and remulched as specified.

**211.03.07 PLACING JUTE MATTING**

- A. Jute matting shall be unrolled and placed parallel to the flow of water immediately following the bringing to finished grade the area specified in the plans or the placing of seed and fertilizer. Where more than one strip is required to cover the given areas, the strips shall overlap a minimum of 4 inches. Ends shall overlap at least 6 inches with the up-grade section on top. The up-slope end of each strip of matting shall be buried in 6-inch slots with the soil firmly tamped against it. The Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be buried in a similar manner. Check slots shall be placed between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as up-slope ends. Check slots shall be spaced so that one check slot or one end occurs within each 50 feet of slope.

- B. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting shall be spread evenly and smoothly and in contact with the soil at all points.
- C. Jute matting shall be held in place by approved wire staples, pins, spikes, or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in 3 rows for each strip of matting, with 1 row along each edge and 1 row alternately spaced in the middle. All ends of the matting and checks slots shall be fastened at 6-inch intervals across their width. Fastening devices shall anchor the matting against the soil and be driven flush with the finished grade.

METHOD OF MEASUREMENT

**211.04.01 MEASUREMENT**

- A. The quantity of planting soil measured for payment will be the number of cubic yards placed in the work. The quantity of seeding, fertilizing and mulching to be measured for payment will be the actual number of acres or square yards completed and measured along the ground slope. The quantity of jute matting to be measured for payment will be the number of square yards covered and measured along the ground slope.
- B. All measurements will be made in accordance with Subsection 109.01, "Measurement of Quantities."

BASIS OF PAYMENT

**211.05.01 PAYMENT**

- A. The accepted quantity of planting soil measured as provided in Subsection 211.04.01, "Measurement," will be paid for at the contract unit price bid per cubic yard of planting soil which price shall include hauling and placing.
- B. The accepted quantities of seeding, fertilizing, mulching, and jute matting will be paid for at the contract unit price bid per acre or square yard as set forth in the proposal.
- C. The contract unit price bid for seeding shall also be considered due compensation for removing and disposing of rocks, 1 inch in smallest dimension and larger, from slopes as specified in Subsection 211.03.01, "Preparation."
- D. Water will be considered subsidiary to the major items of work and no further compensation will be allowed therefor.
- E. Asphalt emulsion will be considered subsidiary to the item "Mulching" and no further compensation will be allowed therefor.
- F. All payments will be made in accordance with Subsection 109.02, "Scope of Payment."
- G. Payment will be made under:

<b>PAY ITEM</b>	<b>PAY UNIT</b>
Planting Soil.....	Cubic Yard
Seeding (Type) .....	Acre, Square Yard
Mulching (Type) .....	Acre, Square Yard
Jute Matting .....	Square Yard
(Type) Matting.....	Square Yard

**SECTION 212**  
**LANDSCAPING**  
DESCRIPTION

**212.01.01 GENERAL**

- A. This work shall consist of furnishing and planting trees, shrubs, and ground covers where shown on the plans or as established by the Engineer, all in accordance with specifications and accepted horticultural practices.

**MATERIALS**

**212.02.01 GENERAL**

- A. The materials used shall be those prescribed for the several items which constitute the finished work and shall conform to the applicable requirements of Section 726, "Roadside Materials."

**212.02.02 NOMENCLATURE**

- A. Nomenclature for plant names and varieties shall be in accordance with the latest edition of "Standardized Plant Names" as prepared by the American Joint Committee on Horticultural Nomenclature.
- B. All plant material in these specifications will be classified by group as follows:
1. Plants, Group A: Denotes container plant material
  2. Plants, Group B: Denotes balled and burlapped plant material
  3. Plants, Group C: Denotes ground cover
  4. Plants, Group D: Denotes grass (turf)

**212.02.03 QUALITY OF PLANT MATERIALS**

- A. It is the intent of these Standard Specifications that all plant material meet the standards as set forth herein, throughout the life of the contract. During inspections, as set forth hereinafter, all plant material will be judged and rejections shall be based upon these standards.
- B. All plants shall conform to the applicable requirements as specified in Subsection 726.03.06, "Plants."
- C. In determining the quality of plant material, the following elements shall be evaluated:
1. Root condition.
  2. Plant size (above ground).
  3. Insect and disease free condition.
  4. General appearance (color, shape, prior pruning).
- D. All container grown plants specified in the plans shall be established in the container in which the plants are sold, and grown in that container sufficiently long for the new fibrous roots to have developed so that the root mass will retain its shape and hold together when removed from the container.

- E. Balled and burlapped plants shall be plants dug with the ball of earth in which the plants are growing. Ball sizes shall be of the diameter and depth specified in the plans and contain enough fibrous root system for the full recovery of the plant. Balled plants shall have the ball firm and unbroken.
- F. Pruning of plants shall not be done prior to delivery to the planting site except by approval of the Engineer. Plant pruning when found necessary to remove damaged branches and to improve the plant shape and form when approved by the Engineer shall be accomplished after completion of individual planting operations.
- G. A deficiency in any one or more of these areas shall be sufficient reason to reject selectively or by lot.
- H. Grass or legume seeds shall conform to the requirements of Subsection 211.02.03, "Seed."

#### **212.02.04 HANDLING AND SHIPPING**

- A. Plants shall be packed for shipment according to standard practice for the type of plant being shipped. The root system of plants shall not be permitted to dry out at any time. Plants shall be protected against heat and freezing temperatures, sun, wind, climatic, or seasonal conditions during transit. Plant material shall be furnished in containers unless otherwise specified. Plants specified balled and burlapped (B & B) shall be handled by the ball of earth and not the plant. Broken or "made" balls will not be acceptable. Container grown plants shall be well developed with sufficient root development to hold the earth intact after removal from the container without being root bound.

#### **212.02.05 INSPECTION OF PLANT MATERIAL**

- A. The Contractor shall inform the Engineer as soon as possible of the source of plant material for the project. At the Engineer's option an inspection of all plant materials at the source may be required prior to shipping of plants from the nursery. This inspection shall coordinate the judgment areas regarding size and quality of plant material between the Contracting Agency, the Contractor and the nursery. However, there will be no acceptance of any plant material during this inspection. All plant material shall meet the requirement specified in Subsection 726.02.01, "Certificates and Samples."
- B. All plant material will be inspected by the Engineer on arrival at the site or storage area for quality. These inspections shall determine the acceptance or rejection of the plant material based on quality as specified in Subsection 212.02.03, "Quality of Plant Materials." This inspection is for quality of plant material only and does not constitute final acceptance. Plants which are rejected shall be immediately removed from the holding area and replaced by acceptable plants at no additional cost to the Contracting Agency.
- C. All plant material will be continually inspected by the Engineer from the time of arrival at the holding area, during planting and through the plant establishment period. Plants may be individually rejected during this time based on mechanical damage, quality or physical change of the plant which is not normal to the plant or to the season of the year. Plants which are rejected shall be immediately removed from either the holding area or the project and replaced by the Contractor at no additional cost to the Contracting Agency.

#### **212.02.06 SUBSTITUTION OF PLANTS**

- A. No substitution of plant material will be permitted unless evidence is submitted in writing to the Engineer that a specified plant cannot be obtained and has been unobtainable since

the award of the contract. If substitution is permitted, it can be made only with written approval by the Engineer. The nearest variety, size, and grade as approved by the Engineer shall then be furnished.

#### **212.02.07 TEMPORARY STORAGE**

- A. Plant material delivered and accepted at the project site shall be planted immediately. Plants that cannot be planted within 1 day after arrival shall be "held" in accordance with accepted horticultural practice, and as follows:
  - 1. Balled and burlapped plants shall have the root ball protected by moist earth, sawdust, or other acceptable material.
  - 2. Container grown plants shall be placed under shelter and kept moist. Plants stored under temporary conditions shall be protected at all times from extreme weather conditions, and shall be kept moist.

#### **212.02.08 PLANTING SOIL**

- A. Planting soil shall conform to the applicable requirements of Section 726, "Roadside Materials."

#### **212.02.09 LUMBER**

- A. Lumber for header boards and planter boxes, as may be called for on the plans, shall conform to the requirements of Section 718, "Timber."

#### **212.02.10 MULCH**

- A. Hay or straw, wood cellulose fiber, wood chips and bark shall conform to the applicable requirements of Subsection 726.03.04, "Mulch."

### **CONSTRUCTION**

#### **212.03.01 SITE PREPARATION**

- A. This work shall consist of all work necessary, as set forth in the contract documents, such as roadway construction, drainage facilities, grading, cleaning, etc., to prepare the area for the actual landscaping work. All work as set forth herein shall be completed and approved by the Engineer prior to beginning any preparation of the planting areas.

#### **212.03.02 LAYOUT OF PLANTING**

- A. The Contractor will designate, by means of stakes or other approved markings, the ground location of each randomly placed plant. Areas of massed or uniform solid plantings shall be marked at their outer extremes only. The Engineer's approval of plant stakeout will be required prior to the commencement of the preparation of planting areas.
- B. In mixed planting areas, trees shall be planted first, followed by the larger shrubs, low shrubs, and the final planting or ground covers.

#### **212.03.03 PREPARATION OF PLANTING AREAS**

- A. During the preparation of planting areas, all clods, rocks, or other debris over 1 inch in dimension shall be removed from both cultivated areas and backfill material, and disposed of as directed by the Engineer. In addition thereto, the following requirements will apply:

1. **Planter Boxes:** Backfill material shall consist of 1 part organic matter to 3 parts soil by volume. This material shall be thoroughly and uniformly mixed before placing in the planter boxes. After placing in the planter box, the material shall be watered until it is completely saturated. Sufficient backfill mixture shall be added and adequately wet so that after settlement has taken place, the material is approximately 2 inches below the top of the box.
2. **Planting Beds:** The soil preparation shall not be initiated until all grading has been completed and the irrigation system has been installed, tested, adjusted, and accepted by the Engineer. The ground surface within the area shall then be loosened and thoroughly pulverized to a depth of 6 inches. When required, organic matter, commercial fertilizer, or agricultural minerals and other additives shall be incorporated at the rate specified in the contract documents, and shall be thoroughly and uniformly tilled into the soil to a depth of 6 inches. The area shall then be brought to a plane in conformance to the elevations shown on the plans.
3. **Seed Beds:** The soil preparation shall be the same as specified for planting beds.
4. **Planting Holes:** Prior to drilling holes, the proposed location of the irrigation lines shall be designated by means of stakes or other approved markings. In the event of conflict between individual planting holes and irrigation lines, the planting holes in question shall be relocated under the direction of the Engineer.
  - a. All holes shall be drilled with a power auger to the dimensions specified in the contract documents unless otherwise approved by the Engineer. Holes shall be drilled at the location of each individual plant, the stake or marking being considered the center of the hole. The holes shall have vertical walls and horizontal bottoms.
  - b. When required, organic matter, commercial fertilizer, or agricultural minerals and other additives shall be incorporated at the rates specified in the contract documents and shall be thoroughly and uniformly mixed with the material removed from the holes prior to backfilling. After backfilling the holes, the material shall be saturated with water to the full depth of the hole and until ponding appears in the basin. Sufficient backfill material shall be placed so that after planting and settlement has taken place, the basin will conform to the section as shown in the plans.
5. **Planting Trenches:** Trenches shall be excavated to the dimensions specified in the contract documents and shall be centered on the planting line as staked or otherwise marked. When required, organic matter, commercial fertilizer, or agricultural minerals and other additives shall be incorporated at the rates specified in the contract documents and shall be thoroughly and uniformly mixed with the material removed from the trenches prior to backfilling. After backfilling the trenches, the material shall be saturated with water to the full depth of the trench. Cross checks may be formed as necessary to permit ponding of water during the saturation period but must be removed prior to planting. Sufficient backfill material shall be placed so that after planting and settlement has taken place, the basin will conform to the section as shown in the plans.

#### 212.03.04 PLANTING

- A. No planting shall be done in any area until the Contractor has received the Engineer's approval that the area concerned has been satisfactorily prepared as provided in Subsection 212.03.03, "Preparation of Planting Areas."

- B. No more plants shall be distributed within the project area on any 1 day than can be planted and watered on that day.
- C. Any planting done in soil that is too wet or dry or not properly conditioned as provided herein will not be accepted. No payment will be made for such planting and any further planting work will be suspended until the Contractor has complied in every way with the specifications.
1. **Plants (Group A):** Nursery stakes supporting plants in containers shall be removed and the plants pruned, if necessary, as specified herein, after planting.
    - a. Containers shall be cut 3 times from top to bottom.
    - b. Plants shall be removed from the containers in such a manner that the ball of earth surrounding the roots is not broken, and the plants shall be planted and watered as hereinafter specified immediately after removal from the containers.
    - c. Containers shall not be cut prior to delivery of the plants to the planting areas.
  2. **Plants (Group B):** Balled and burlapped material shall have all strings or cords cut, and the burlap shall be laid back from the top half of the ball. This shall be done only after the plant is placed in its final position and before completion of the backfill.
  3. **Plants (Group C):** As soon as each plant is removed from its container, it shall be planted in the prepared planting bed, in a hole previously prepared with a broad, blunt end trowel. The plant shall be carefully lifted with the trowel, inserted in the hole, and the earth shall be gently firmed and watered around it to eliminate air pockets.
    - a. Plants brought to the jobsite in plastic or clay pots shall be tapped loose from their containers in such a manner that the ball of earth surrounding the roots is not broken, and then immediately planted. Plants which are brought to the jobsite in peat pots may be planted in the pots. No plants brought to the jobsite in pony pacs or bare root will be accepted.
    - b. Plants shall be watered as hereinafter specified immediately after planting.
    - c. Roots of plants not in containers shall be kept moist and covered at all times and shall not be exposed to the air except while actually being placed in the ground.
    - d. Plants shall be set in a plumb position in the backfill mixture material to such a depth that, after the soil has settled, the top of the plant ball will be 2 inches below finished grade.
    - e. Plants shall be planted in such a manner that the roots will not be restricted or distorted. Soil shall be firmed around the roots or ball of the plant during planting operations by foot tamping or saturation with water. Any plants which have settled deeper than specified in the above paragraph shall be raised back to the required level, or replaced, at the option of the Contractor.
  4. **Plants (Group D):** The seed bed shall be in a moist, friable condition when seeding is begun. Seeding shall be done as soon as soil conditions allow after the initial watering of the amended soil. Seeding done in soil that is too wet or too dry, or in a condition not generally accepted as satisfactory for lawn seeding will not be accepted. No payment will be made for seeding when the soil condition is considered unsatisfactory and any further seeding work will be suspended until the Contractor has complied in every way with these provisions.

- a. Seed shall be sown from standard mechanical grass seeding equipment with adjustable gate, as appropriate to the area, and at the rate shown on the plans. After sowing, the seed shall be embedded by light rolling. The Contractor shall exercise care to avoid leaving footprints or other depressions in the compacted seed bed.
- b. Organic mulch shall be evenly applied immediately after the seed bed has been firmed, with manure spreaders, mulch blowers or other approved equipment. The mulch shall be spread at the rate of 1 cubic yard per 1,000 square feet. As soon as mulch is in place, the surface of the seed bed shall be dampened with a fine spray from a nozzle until the mulch is thoroughly moist.

#### **212.03.05 STAKING AND GUYING**

- A. All staking and guying shall be done concurrently with the planting operation.
  1. **Staking:** Plants that are to be staked will be specified in the contract documents.
    - a. The size, number of stakes, and the depth to be driven shall be as specified in the contract documents, or as approved by the Engineer.
    - b. The stakes shall be placed against but not through the plant ball in the case of plants (Groups A and B).
  2. **Tree Ties:** The method of attaching the ties to stakes and trees shall provide firm connection, but the trunk loop shall be sufficiently loose to prevent damage to the bark. It may, on occasion, as determined by the Engineer, be considered necessary to use number 10 gage galvanized wire encased in at least 1/2-inch rubber hose as tree ties, in which case all connections shall be twisted.
  3. **Guying:** Plants that are to be guyed will be specified in the contract documents.
    - a. All guying shall be done as specified in the contract documents or as approved by the Engineer.

#### **212.03.06 PRUNING**

- A. Pruning shall be done as determined by the Engineer after plant materials are planted.
- B. Pruning of evergreen coniferous plants will not be permitted except under the direction of the Engineer.

#### **212.03.07 WATERING**

- A. The Contractor shall make arrangements for furnishing and applying water at no additional cost to the Contracting Agency.
- B. Valves at meters shall be kept closed at all times, except while the irrigation system is actually in use.
- C. Precautions shall be taken during times when the irrigation system is on to prevent water from wetting vehicles, pedestrians, and pavement. Any erosion, slippage, or settlement of the soil caused by watering shall be repaired by the Contractor at no additional cost to the Contracting Agency.
- D. Compliance with the provisions in this section shall not relieve the Contractor of responsibility for the replacement of plants as provided hereinafter.

**1. Plants (Groups A and B):**

- a. All plants shall be watered immediately after planting. Water shall be applied in a moderate stream until the backfill soil around and below the roots or ball, or earth around each plant, is thoroughly saturated. Where watering is done with a hose, a metal or plastic pressure reducing device approved by the Engineer shall be used. Under no circumstances shall the full force of the water from the open end of a hose be allowed to fall within the basin around any plant.
- b. After the first watering, water shall be applied to all plants as often and in sufficient amount as conditions may require to keep the soil moist, above, around, and below the root systems of the plants during the life of the contract. After the installed irrigation system has been accepted, it may be used to water the planted area.
- c. Any additional watering measures required to initially saturate the backfill, water the plants immediately after planting, or to maintain the plants in a satisfactory growing condition shall be anticipated and furnished by the Contractor at no additional cost to the Contracting Agency.

**2. Plants (Group C):**

- a. As soon as all the perennials in a given area have been planted, water shall be applied to that area in a fine mist from an atomizing nozzle until the entire planting bed is saturated. This initial watering shall not be done with the installed irrigation system.
- b. After the first watering, water shall be applied to the areas as often and in sufficient amount as conditions may require to keep the soil wet, above, around, and below the root systems of the plants during the life of the contract.

**3. Plants (Group D):**

- a. The seed bed shall be kept in moist but not soggy condition until after germination. After germination, water shall be applied to the areas as often and in sufficient amount as conditions may require during the life of the contract.
- b. The installed turf irrigation system may be used to water those areas as long as care is taken to prevent erosion or other damage to the area. However, should the irrigation system prove to be unsatisfactory, other means of watering, as approved by the Engineer, shall be used until germination is complete and all grass has attained a height of 1 inch. After a uniform stand of grass which has attained a height of 1 inch has been achieved over the entire turf area, the installed turf irrigation system may be used to keep the area moist.

**212.03.08 REPLACEMENTS****1. Plants (Groups A, B, and C):**

- a. During the planting and plant establishment period of the project, all plants that show signs of failure to grow normally or which are so injured or damaged as to render the plants unsuitable for the purpose intended, as determined by the Engineer, shall be removed and replaced in kind. The Engineer will

inspect the work on the first and second working day of each week during the planting and plant establishment periods, and will mark or otherwise indicate all plants to be replaced. The Contractor shall complete replacement of such plants as soon as possible, but in no case shall the Contractor take more than 2 weeks to complete the replacement.

- b. Replacement plants shall be furnished and planted by the Contractor at no additional cost to the Contracting Agency.
2. **Plants (Group D):** The Engineer will inspect the turf at the time of the first cutting and will designate any areas which need reseeding. Seed used for reseeding shall be the same types and amounts as specified for the initial planting and shall be planted in accordance with the contract documents or as directed by the Engineer. The cost of the seed and actual reseeding shall be borne by the Contractor.

#### **212.03.09 FERTILIZERS, AGRICULTURAL MINERALS AND ADDITIVES**

- A. When fertilizers or other agricultural minerals or additives are called for, the fertilizers, minerals, and additives shall be applied at the rates and as specified in the contract documents or as approved by the Engineer.

#### **212.03.10 PROTECTION OF EXISTING FACILITIES**

- A. Any existing buildings, equipment, piping, pipe covering, sprinkling systems, sewers, sidewalks, landscaping, utilities, roadways, or any other improvement of facilities damaged due to the Contractor's operations shall be repaired or replaced by the Contractor at no additional cost to the Contracting Agency as directed by the Engineer.

#### **212.03.11 PLANT ESTABLISHMENT WORK**

- A. This work shall consist of watering and caring for all of the plants and planting areas, the replacement of plants, the weeding and general maintenance as specified in the contract documents.
- B. The plant establishment period shall begin at such time as all planting has been accomplished and all other work has been completed and the project is in a neat and clean condition.
- C. The length of the plant establishment period shall be as specified in the contract documents.
- D. The Engineer will notify the Contractor in writing of the start of the plant establishment period and will furnish statements regarding days credited to the plant establishment period after said notification.
- E. The time required for plant establishment work shall be considered as included in the total time limit specified for the contract. Any day upon which no work is required, as determined by the Engineer, will be credited as one of the plant establishment days regardless of whether the Contractor performs plant establishment work.
- F. Any day when the Contractor fails to adequately water plants, replace unsuitable or damaged plants, do weed control, adjust or replace bracing and ties, or other work, as determined necessary by the Engineer, will not be credited as one of the plant establishment days. No extension of contract time will be granted beyond the final completion date by reason of failing to perform plant establishment work on days when such work is necessary.

- G. All plants shall be kept watered as provided in Section 210, "Watering."
- H. Surplus earth, papers, trash, and debris, which accumulate in the planted areas shall be removed and disposed of in accordance with the provisions in Subsection 107.14, "Disposal of Material Outside Project Right-of-Way," and the planted areas shall be so cared for as to present a neat and clean condition at all times. During the plant establishment period, trees and shrubs shall be pruned or headed back by the Contractor at no additional cost to the Contracting Agency, when and as directed by the Engineer.
- I. In order to carry out the plant establishment work, the Contractor shall furnish sufficient men and adequate equipment to perform the work during the plant establishment period.

#### METHOD OF MEASUREMENT

##### **212.04.01 MEASUREMENT**

- A. The quantity of materials and work measured for payment will be materials and work complete and in place. The various items will be measured in the manner and in the units as follows:
  - 1. Site preparation will be measured by the acre or square foot.
  - 2. Planting soil will be measured by the cubic yard.
  - 3. Preparing soil (plant boxes) will be measured by the cubic foot.
  - 4. Preparing soil (plant bed) will be measured by the square foot.
  - 5. Fertilizer or agricultural minerals will be measured by the pound determined by marked quantities and sack count, by the ton, by each stick or pellet, or by the gallon, all as designated in the proposal.
  - 6. Organic matter will be measured by the cubic yard, or determined by marked quantities and sack count.
  - 7. Mulch will be measured by the cubic yard or determined by marked quantities and sack count.
  - 8. Hole preparation will be measured by the actual number of holes prepared.
  - 9. Trench preparation will be measured by the linear foot and the depth and width of the trench will be designated in the contract documents.
  - 10. Tree rings will be considered incidental to "Hole Preparation" and there will be no measurement or payment therefor.
  - 11. Mowing strips will be measured by the number of linear feet along the top of the strip.
  - 12. Planter boxes will be measured by the number of boxes placed on the project that conform to the sizes specified in the contract documents.
  - 13. Header boards will be measured by the thousand foot board measure (Mfbm).
  - 14. Plants in Groups A through C will be measured by the number of plants in each group.
  - 15. Plants in Group D will be measured by the square foot in place.
  - 16. The unit of measure for Plant Establishment Work will be lump sum.

- B. All measurements will be made in accordance with Subsection 109.01, "Measurement of Quantities."

**BASIS OF PAYMENT**

**212.05.01 PAYMENT**

- A. The accepted quantities for items of this section measured as provided in Subsection 212.04.01, "Measurement," will be paid for at the contract unit price bid for the type, size, group, or whatever information is necessary for identification, and so identified in the proposal. Such payment shall be full compensation for all the labor, materials, and incidentals necessary to complete the work.
- B. Water will be considered subsidiary to the major items of work and no further compensation will be allowed therefor.
- C. All payments will be made in accordance with Subsection 109.02, "Scope of Payment."
- D. Payment will be made under:

<b>PAY ITEM</b>	<b>PAY UNIT</b>
Site Preparation including removal of excess soil .....	Acre, Square Foot
Planting Soil .....	Cubic Yard
Preparing Soil (plant boxes) .....	Cubic Foot
Preparing Soil (planting bed) .....	Square Foot
Fertilizer (type and class).....	Pounds, Ton, Each, Gallons
Organic Matter (type).....	Cubic Yard
Mulch (type) .....	Cubic Yard
Hole Preparation.....	Each
Trench Preparation .....	Linear Foot
Mowing Strips .....	Linear Foot
Planter Boxes (type, size).....	Each
Header Boards (type, lumber, size).....	Mfbm
Plants (Group A - C) .....	Each
Plants (Group D).....	Square Foot
Plant Establishment Work . . . . .	Lump Sum

## SECTION 213

### IRRIGATION SYSTEMS

#### DESCRIPTION

##### 213.01.01 GENERAL

- A. This work shall consist of furnishing all materials and labor required to install an irrigation system in accordance with these specifications and the details shown on the plans. The irrigation system as shown on the plans is diagrammatic only, the various components of the system shall be installed so as to provide complete and adequate coverage of the areas to be irrigated.
- B. This work may also consist of furnishing and installing pipe conduit for future irrigation systems as shown on the plans and as specified herein.

#### MATERIALS

##### 213.02.01 GENERAL

- A. All materials and equipment incorporated in the irrigation system shall be new, undamaged, of standard quality and shall be subject to testing as specified herein. The materials shall be those prescribed for the several items which constitute the finished work and shall conform to the applicable requirements of Section 726, "Roadside Materials."
- B. The Contractor shall submit 3 sets of brochures or shop drawings for each accessory or fixture, and each item of hardware or equipment the Contractor intends to use, prior to ordering these items. Brochures shall contain pertinent dimension, finish, installation and maintenance data necessary for the proper placement or use of each item. If approved as appearing to meet specification and building requirements, one set of brochures for the item will be returned to the Contractor stamped "Approved." Installation of items noted above will not be allowed if pertinent brochures have not been approved. The approval of a brochure does not constitute final approval of the item. The Engineer reserves the right to reject any work, material or item that does not conform to the requirements of the plans or specifications as set forth herein even though the pertinent brochure may have been approved.

##### 213.02.02 PIPE AND FITTINGS

- A. Pipe and fittings shall conform to the requirements of Subsection 726.03.09, "Pipe and Fittings."
- B. Pipe conduit shall be bedded and backfilled with sandy material as shown on the plans. Material used for bedding and backfilling of pipe conduit shall consist of natural sand or a mixture of sand with gravel, crushed gravel, crushed stone, or other broken or fragmented material to fill the voids in the coarser material. In addition thereto, the material shall conform to the following requirements:

Sieve Sizes	Percentage By Weight Passing Sieve
3/8 Inch	100
No. 200	0-15

**213.02.03 CONTROL TUBING**

- A. Tubing and fittings shall be capable of withstanding a 300 psi operating pressure, shall be of the size indicated on the plans, and shall conform to the requirements of Subsection 726.03.10, "Control Tubing."

**213.02.04 AUTOMATIC CONTROLLERS**

- A. When called for on the plans, the Contractor shall furnish and install, on a concrete base, automatic controllers as herein specified. There shall be an electrically timed device for automatically opening and closing control valves for predetermined periods of time and mounted so that all normal adjustments will be conveniently located for use by the operator. Controllers shall be enclosed in a weatherproof metal housing with hasp and lock or locking device. All locks or locking devices shall be master keyed and 3 sets of keys provided. Operating features shall include the following:
1. Each valve in the circuit shall be adjustable for setting to remain open for any desired period of time from 1 minute or less to at least 60 minutes.
  2. The controller shall operate on 110-117 volts and shall be equipped with a circuit breaker or fusible connection to protect the controller from overloads.
  3. The controller shall have a master on off switch to turn all stations off without disturbing the clock settings or automatic timing sequences.
  4. Controllers shall allow any station to be operated manually both on or off whenever desired.
  5. Controls shall provide for resetting the start of the irrigation cycle at any time and advancing from one position to another.

**213.02.05 SPRINKLER HEADS**

- A. Sprinkler heads shall be of the type, pattern and coverage shown on the plans.
- B. Soaker valves shall be constructed of polyvinyl chloride (PVC) and shall be of the configuration and dimension shown on the plans. Soaker valves shall be of a make and type of construction so that the soaker valves may be installed directly in the flexible plastic pipe supply line, and shall have no external working parts. Each soaker valve shall be capable of being adjusted to deliver 1 to 3 gallons per hour at 10 to 20 psi; final adjustment shall be as determined by the Engineer. Adjustment shall be accomplished with a 7/16-inch socket wrench.

**213.02.06 BLANK****213.02.07 GATE VALVES**

- A. Valves 2-1/2 inches and smaller shall be of the same size as the pipes on which the valves are placed unless otherwise indicated on the plans. Service rating for non-shock cold water shall be 200 psi. These valves shall be all bronze, split wedge type, with rising stem and union bonnet. Packing shall be teflon impregnated asbestos and the valve shall be capable of being repacked under pressure. Handwheels shall be malleable iron. Valves 2-1/2 inches and smaller shall be the threaded type and installed with a union on either side of the valve.
- B. Gate valves 3 inches and larger shall be iron body bronze, mounted, double disc, parallel seat type with "O" ring seal and shall comply with AWWA standards. Gate valves shall

have a working pressure of 200 psi and a test pressure of 400 psi. A shut-off rod, 6 feet in length that will fit a 2-inch wrench nut, shall be furnished by the Contractor.

#### **213.02.08 CONTROL VALVES**

- A. Manual control valves shall be straight or angle pattern globe valves of all brass or bronze construction with replaceable compression disks. Manual control valves shall be of the same size as the pipes on which the valves are placed unless otherwise indicated on the plans, and shall be provided with a union connection. Manual control valves shall be capable of withstanding a cold water working pressure of 150 psi except for valves of 1-1/2-inch and larger where 200 psi valves will be required.
- B. Electric control valves shall be of the diaphragm type, normally closed, 24-volt, 60-cycle. The valve solenoids shall operate with 18-30 volts of power. Solenoids shall be completely encapsulated for positive waterproofing. The valve body and bonnet shall be of cast brass or bronze, flanged or threaded type. If threaded type is used it shall be provided with a union connection. The time interval between opening and closing the valve shall not be less than 5 seconds. The solenoid plunger shall be spring loaded so the valve may operate when installed in any position and shall be constructed of stainless steel with neoprene seat. Valve bonnet shall have a bleed screw for manual operation and a manual flow control adjustment. Electric control valves shall be capable of withstanding a non-shock cold water working pressure of 150 psi.

#### **213.02.09 QUICK-COUPLER VALVES**

- A. The quick-coupler valve shall be of brass or bronze construction with 1-inch F.I.P. bottom connection. The valve shall be of 2-piece construction with removable upper body. The valve body shall be designed with a single slot to receive a single slot coupler. The 1-inch male and 3/4-inch female I.P.S. coupler for the quick coupler valve shall be single slot of bronze construction.

#### **213.02.10 VALVE BOXES**

- A. Valve boxes shall be reinforced precast Portland cement concrete boxes of the general dimensions shown on the plans with a steel lid. Concrete made of Type V Portland cement shall be used. Valve boxes shall have extensions as necessary to reach the depth indicated.

#### **213.02.11 BACKFLOW PREVENTERS**

- A. Backflow preventers shall meet the requirements of the governing agency concerned. Each backflow preventer shall be equipped with a gate valve at each end of the backflow prevention unit. Valves 3-inch and larger shall be flanged type, iron body, brass trimmed, wedge gate valves with non-rising stem, and shall be capable of withstanding a cold water working pressure of 200 psi. Valves 2-1/2-inch and smaller shall be as specified above, except that the valves shall be screw type and shall be installed with a union between each valve and the backflow prevention unit. Backflow preventers and valves shall be the size shown on the plans.
- B. The Contractor shall determine the requirements of the governing agency in regard to the type and detail of backflow prevention required.
- C. For purpose of payment, the valves required to be installed at each end of the backflow prevention unit and all fittings between such valves required for proper installation shall be considered as a part of the backflow preventer.

**213.02.12 DRAIN VALVES**

- A. Automatic ball check drain valves shall be of precision machined brass with a threaded keeper rather than a crimped type at the inlet end. Ball checks shall be spring loaded and shall close under a pressure of 2 to 4 psi. Valves shall be installed with a gravel sump as shown on the plans.
- B. The gravel to be used in gravel sumps for ball check drain valves shall conform to the requirements for Size No. 67 as specified in Subsection 706.03.01, "Coarse Aggregate."

**213.02.13 HOSE BIBBS**

- A. The hose bibb shall be a no-freeze burial type hydrant with a self-closing handle and shall have 3/4-inch male I.P.S. threads at the supply line end.

**213.02.14 VACUUM BREAKERS**

- A. When called for in the contract documents or as required by local ordinances, vacuum breakers meeting the following requirements shall be furnished and installed. All vacuum breaker installations are subject to inspection by authorized county or municipal authorities.
- B. Atmospheric vacuum breakers shall have all bronze bodies and be of the same dimension as the pipe on which it is attached. Design shall permit free flow of water under pressure. When vacuum conditions exist, it shall automatically close the check valve stopping all flow of water and admit air into the main line. Upon restoration of water pressure, the air intake shall be shut off and the check valve reopened without spillage. Unless otherwise specified, the vacuum breaker shall be installed on the discharge side of the control valve 6 inches above the highest sprinkler head on the line. Vacuum breakers shall not be required on sprinkler lines when all sprinkler heads on the line are elevated to a minimum of 6 inches above the finished grade, such as sprinkler lines irrigating shrub beds. Atmospheric vacuum breakers shall have a service rating of 150 psi for non-shock cold water and shall be designed for operation up to temperatures of 140 degrees F.
- C. Pressure type vacuum breakers shall be installed on the discharge side of the meter or service connection as shown on the plans. Vacuum breakers shall be of heavy duty construction with all bronze bodies, check valves, and test cocks. Pressure type vacuum breakers shall be designed to operate under continuous pressure permitting the free flow of water at all times. Air intake shall be spring loaded to ensure positive opening upon release of pressure or vacuum created in the supply lines. Vacuum breakers shall be furnished with approved check valves, inlet and discharge shut off valves and field testing cocks. Assembly for various pipe sizes shall be according to local requirements or as specified in the contract documents. Unless otherwise specified, pressure type vacuum breakers shall have a service rating of 300 psi for non-shock cold water.
- D. All vacuum breaker installations shall meet local ordinances and plumbing requirements.

**213.02.15 AIR RELIEF VALVE**

- A. The air relief valve shall be designed to release air entrapped in a pipeline until liquid reaches the float which will rise to the seat and close the valve. The float shall be stainless steel resting within a stainless steel or bronze cup. The valve body and flange shall be gray iron casting. The valve shall be 1-inch size with screwed inlet, and shall be capable of withstanding pressures up to 300 psi. The valve shall be fitted with a galvanized steel return elbow as indicated on the plans.

## CONSTRUCTION

**213.03.01 GENERAL**

- A. The Contractor shall not alter or change the location of pipes, valves, sprinklers, or other equipment as shown on the plans unless so authorized by the Engineer. All necessary arrangements for connecting to mains shall be made by the Contractor with the agency supplying the water, and such installations and equipment shall conform to the requirements set forth by the supplying agency.

**213.03.02 EXCAVATION**

- A. Trenches shall be of sufficient width to permit snaking of all plastic pipe not connected by rubber ring type fittings. Pipe connected with rubber ring type fittings shall not be snaked. The top 6 inches of planting soil, when such exists, shall be kept separate from subsoil and shall be replaced as the top layer when backfill is made. Trenches shall be excavated with vertical sides and provided with bracing and shoring to be placed as designated by the Engineer. Trenches in rock or like material shall be excavated 2 inches below the required depth and shall be backfilled to required depth with sand or other suitable material free from rock or stones.

**213.03.03 EXCAVATION ADJACENT TO TREES**

- A. Care shall be exercised by the Contractor when excavating trenches near existing trees. Where roots are 2 inches and greater in diameter, except in the direct path of the pipe, the pipe trench shall be hand excavated and tunneled. When large roots are exposed, the roots shall be wrapped with heavy burlap for protection and to prevent excessive drying. Trenches dug by machines adjacent to trees having roots 2 inches and less in diameter shall have the sides hand trimmed making a clean cut of the roots. All roots 1/2-inch or greater in diameter that are cut and trimmed shall be treated with an approved tree wound dressing. Trenches having exposed tree roots shall be backfilled within 24 hours unless adequately protected by moist burlap or canvas.

**213.03.04 PIPING**

- A. Live main lines shall have a minimum cover of 24 inches. Other lines shall have a minimum cover of 18 inches below finish grade except flexible soaker lines which shall be 4 inches below finish grade.
- B. All water lines, except soaker lines, with less than 18 inches of cover depth shall be provided a means for drainage to prevent freezing. Pipe shall be sloped to drain without sags. Unless otherwise specified, drain valves shall be placed only at the low point of all lateral or section lines. All live mains located under existing pavement shall be placed in conduits jacked under pavement unless otherwise noted on the plans or approved by the Engineer. Conduits shall be no larger than necessary to conveniently accommodate the pipe and fittings. Where necessary, live mains and control tubing may be placed in separate conduits laid adjacent and parallel. All jacking operations shall be performed in a manner approved by the Engineer and conduit run at a depth below the pavement as may be ordered. Where possible, mains and laterals or section piping shall be placed in the same trench.

**213.03.05 JOINTING**

- A. All galvanized steel pipe shall have sound, clean-cut, well-fitted standard pipe threads. All pipe shall be well reamed to the full diameter and burrs removed before assembly.

Threaded joints shall be made up with the best quality pure lead paste, applied smoothly and evenly to the male thread only. All screwed joints shall be made tight with tongs and wrenches without the use of handle extensions. Any joints that leak shall be cleaned and remade with new material. Caulking or thread cement to make joints tight will not be permitted.

### **213.03.06 CONTROL TUBING**

- A. Control tubing shall be joined as specified in Subsection 213.03.07, "Installation," for PVC pipe.

### **213.03.07 INSTALLATION**

- A. Conduit shall be installed not less than 18 inches below the curb grade in sidewalk areas and not less than 24 inches below the finished grade in all other areas. Conduit shall be installed under existing pavement by approved jacking or drilling methods. Pavement shall not be disturbed without the approval of the Engineer, and then only in the event obstructions are encountered. When permitted by the Engineer, small test holes may be cut in the pavement to locate obstructions. Jacking or drilling pits shall be kept at least 2 feet from pavement edge wherever possible. Excessive use of water that will soften subgrade or undermine the pavement will not be permitted.
- B. Where conduit is installed in an open trench, excavation and backfill shall conform to the provisions of Section 208, "Trench Excavation and Backfill." The conduit shall be laid in the trench to the lines and grades established by the Engineer. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the conduit. During backfilling operations, the conduit shall be rigidly supported so that no movement of or damage to the conduit or joints will result.
- C. After the conduit is installed, if shown on the plans or specified in the special provisions, galvanized steel pipe shall be placed therein.
- D. Pipe conduit shall be installed as shown on the plans and the ends of the conduit shall be marked with "T" post markers and shall be capped by a nonpermanent cap that will prevent the conduit from being filled.
- E. Where connection is made to existing supply lines, compression type fittings may be used.
- F. A backflow preventer shall be installed at each meter if called for on the plans.
- G. Where supply lines or conduits are to be installed through existing paved areas, the sub base, base, and paving removed shall be replaced with material of equal quality.
- H. All pipe shall be cut straight and true. After cutting, the ends shall be reamed out to the full inside diameter of the pipe.
- I. Foreign material shall be prevented from entering the irrigation system during installation. Immediately prior to assembly, all pipes, valves, and fittings and control tubes shall be cleaned. All unattached ends of pipe, fittings, and valves shall be plugged or capped pending attachment of additional pipe or fittings. All lines shall be thoroughly flushed out prior to attachment of terminal fittings.
- J. Before any portion of the pipeline is backfilled, water shall be turned into that portion of the line and maintained at full pressure for a period of not less than 8 consecutive hours after all air has been expelled from the line. Any leaks that develop in the portion of the system installed by the Contractor shall be repaired and all defective materials shall be replaced

- by the Contractor. The pipe shall be plugged or capped where sprinklers are to be installed while making this test. The entire system shall then be checked for uniform and complete coverage after installing sprinklers.
- K. Nozzle lines shown on the plans immediately adjacent to a fence or guard railing shall be installed on the fence or guard railing, and those immediately adjacent to a curb or shoulder shall be installed 3 feet from the curb or paved shoulder unless otherwise noted on the plans.
  - L. All nozzle lines, except those installed on a fence or guard railing, shall be installed on 3/4-inch pipe anchor posts unless otherwise shown on the plans.
  - M. Sprinkler connections shall be installed on swing joints as detailed on the plans.
  - N. All plastic irrigation pipe shall be installed and laid according to the manufacturer's instructions and as directed by the Engineer. Before joints of PVC plastic pipe are made up, the plastic pipe fittings shall be exposed to the same temperature for a reasonable length of time. Pipe shall be cut with a fine tooth hacksaw and any burrs shall be removed. The outside surface of the pipe and the inside surface of the fittings shall be cleaned and softened with an approved primer, using a dauber, brush top applicator, or paint brush about one half the pipe diameter. A light second coat of primer shall be applied to the fitting socket. Primer shall not be allowed to run down the inside of the pipe.
  - O. The cement solution shall be applied to the pipe and fitting socket with an applicator having a width of approximately one half the diameter of the pipe, using the proper cement for the size of pipe. Apply a full, even layer of cement on the pipe equal to the depth of socket. Flow the cement on with the applicator, do not brush it out to a thin paint type layer. Apply a medium layer of cement to the fitting socket, avoid puddling cement in the socket. On bell end pipe do not coat beyond the socket depth or allow cement to run down in the pipe beyond the bell. Apply a second full even layer of cement on the pipe. Assemble the pipe and fitting without delay, making certain cement is wet. Use sufficient force to ensure that the pipe bottoms are in the fitting socket. Twist the pipe 1/8 to 1/4 turn as it is inserted. Hold the fitting and the pipe together until cement takes its initial set. After assembly, a joint shall have a ring or bead of cement completely around the junction of the pipe and fitting. If voids in this ring are present, sufficient cement was not applied and the joint will be considered defective. Using a rag, remove all the excess cement from the pipe and fitting including the ring or bead. Avoid disturbing or moving the joint. Handle newly assembled joints carefully until initial set has taken place. Recommended setting time allowed before handling or moving is related to temperature, type of cement, and size of pipe, and shall be according to manufacturer's recommendations. Old or thickened cement shall be discarded and replaced. The male pipe thread of all threaded connections on PVC plastic pipe shall be coated with a joint compound or tape suitable for use on plastic pipe.
  - P. Cement solution for flexible PVC shall be an approved type for joining flexible PVC to itself or to rigid PVC.
  - Q. All pipe shall be cut straight and true. After cutting, the ends shall be reamed out to the full inside diameter of the pipe. Polyvinyl chloride pipe trenches shall be partially backfilled between joints with small amounts of backfill material to prevent movement during the pressure test.

**213.03.08 CONTROL TUBING PLACEMENT**

- A. Control tubing shall be placed with the main supply line. Tubing shall be bundled together by 4 wraps of friction tape at 6-foot intervals. Location of the bundle of control tubing shall be 6 inches to one side of the pipe, and a minimum of 2 inches from any galvanized pipe.

**213.03.09 FLUSHING AND TESTING**

- A. All main supply lines shall be flushed completely of foreign particles before placing section control valves, quick-coupler valves and hose bibbs. After flushing and when valves are in place, all main supply lines shall be tested at 150 psi with valves closed. Pressure shall be maintained for a period of 8 consecutive hours. All joints showing leaks shall be cleaned, remade, and tested.
- B. After installation of section lines, the piping shall be completely flushed of foreign particles before attaching sprinkler heads and drain valves. After flushing, section lines shall be tested with risers capped and drain valves closed. The test shall be made at maximum operating pressure for a period of 1 hour. Any pipe, fittings or joints showing leaks will not be accepted. All joints showing leaks shall be cleaned, remade and tested. Control tubing shall be tested in the manner specified above for the main supply lines. Tubing shall be flushed for 5 minutes before connection with the control valves.
- C. Automatic controllers shall be tested by actual operation for a period of 2 weeks under normal operating conditions. Should adjustments be required, the Contractor shall do so according to manufacturer's direction and test until operation is satisfactory.

**213.03.10 ADJUSTING SYSTEM**

- A. Before final inspection the Contractor shall adjust and balance all sprinklers to provide adequate and uniform coverage. Spray patterns shall be balanced by adjusting individual sprinkler heads with the adjustment screws or replacing nozzles to produce a uniform pattern. Unless otherwise specified, sprinkler spray patterns will not be permitted on pavement, walks, or structures.

**213.03.11 BACKFILL**

- A. Backfill shall not be started until all piping has been inspected, tested, and approved by the Engineer, after which backfilling shall be completed as soon as possible. Upon completion of all piping in the same trench, backfill shall be completed as specified. Trenches containing control tubing shall have a 3-inch sand or sandy loam cushion free from rocks or stones larger than 3/8 inch in diameter placed over all control tubing. Backfill from the bottom of the trench to approximately 6 inches above the pipe shall be by continuous tamping in such a manner that will not damage pipe or control tubing and shall proceed evenly on both sides of the pipe. The remainder of the backfill shall be thoroughly tamped, except that heavy equipment shall not be used within 18 inches of any pipe. All backfill material shall be free from rocks, roots, or other objectionable material. The top 6 inches of the backfill shall be of top soil material or the first 6 inches of material removed in the excavation.

**213.03.12 AS-BUILT RECORD DRAWINGS**

- A. The Contractor shall provide and keep up to date a complete set of as-built drawings which shall be corrected daily to show changes in sprinkler locations, controller locations, pump locations, piping locations, and other deviations from the original irrigation design

drawings as provided to the Contractor. All isolation valve locations shall be shown with actual measurements to reference points so the valves may be located easily in the field.

- B. Upon completion of the work, the Contractor shall furnish the Engineer with a complete set of as-built drawings showing the sprinkler system as installed. This is the responsibility of the Contractor and shall not be construed to be the responsibility of any other party.

METHOD OF MEASUREMENT

**213.04.01 MEASUREMENT**

- A. The materials to be measured for payment under these specifications will be listed in the contract items by size, class, type, gage, or whatever information is necessary for identification.
- B. The quantity of pipe and tubing to be measured for payment will be the actual number of linear feet of the type specified complete and in place. Pipe bends, wyes, tees, and other branches will be measured along center lines to the point of intersection.
- C. The quantity of sprinklers, couplers, heads, valves, vacuum breakers, hose, bibbs, concrete valve boxes, valve assemblies, riser assemblies, and faucets will be measured per each of the type and size specified complete and in place.
- D. All measurements will be made in accordance with Subsection 109.01, "Measurement of Quantities."

BASIS OF PAYMENT

**213.05.01 PAYMENT**

- A. The accepted quantities of pipe and tubing measured as specified in Subsection 213.04.01, "Measurement," will be paid for at the contract unit price bid per linear foot for the types and sizes specified.
- B. The accepted quantity of all other attachments measured as specified in Subsection 213.04.01, "Measurement," will be paid for at the contract unit price bid per each for the types and sizes specified.
- C. Payment per linear foot of conduit involved shall be full compensation for furnishing and installing pipe conduit, bedding and backfilling, caps, markers, and incidentals necessary to install the conduit complete in place including as-built drawings.
- D. The above payment will be full compensation for furnishing all the material and labor necessary to install the system. Such payment shall include excavation, backfill, restoring sidewalk, curb, gutter, pavement, and appurtenances damaged or destroyed by construction, and making all required tests.
- E. All payments will be made in accordance with Subsection 109.02, "Scope of Payment."

**PAY ITEM**

**PAY UNIT**

(size) (type) Pipe.....Linear Foot  
 (size) (type) (name of attachment) ..... Each