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SECTION 14 - VEGETATION AND IRRIGATION

14.1 VEGETATION REQUIREMENTS

All vegetated detention facilities shall have permanent underground irrigation systems and shall be seeded or sodded. In addition, native grass mix and soil amendments shall be approved by one of the following: a Certified Professional Agronomist (CPAg), a Certified Horticulturist, a Colorado State University Certified Master Gardener, a Local Seed Company, or a combination of the above. This approval shall be submitted to the City in report or letter form. Before the two year warranty on seeding or sodding has elapsed one of the above listed professionals shall certify that at least 85% of the surface area throughout the detention facility is covered by approved grasses. No noxious weeds shall be allowed. Until these requirements are met, the detention facility will remain the developer's responsibility and maintenance shall not be transferred to the City or any HOA, POA or other entity.

The requirements for soil amendments, seeding and sodding are as follows:

14.1.1 GENERAL

14.1.1.A DELIVERY, STORAGE AND HANDLING

1. General

Handle and transport in a safe manner in compliance with local state, and federal regulations. Comply with Material Safety Data Sheets requirements.

2. Fertilizer

Deliver inorganic or chemical fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to state law, bearing name and warranty of producer.

3. Soil Amendments

Do not stockpile for more than seven (7) days. Distribute and till immediately upon arrival at site (same day, if possible, but within 7 days maximum).

4. Seed

Deliver seed in original sealed, labeled, and undamaged containers. All material shall be furnished in original manufacturer's shipping bags or containers, and remain in these bags or containers until used. All materials shall be stored in a manner which will prevent them from coming into contact with precipitation, surface water, or other contaminating substances. All materials which have become wet, moldy or otherwise damaged in transit, or stored improperly shall not be used.

5. Sod

Time delivery so that sod will be placed within 24 hours after shipping.

6. Sod Delivery

Deliver sod properly loaded on vehicles and protected from exposure to sun, wind, and heat in accordance with standard practice and labeled in accordance with the Federal Seed Act. Do not drop sod from loading carts, trucks, or pallets.

14.1.1.B PROJECT/SITE CONDITIONS

1. General

Do not perform work when climate and existing site conditions will not provide satisfactory results.

- a. Install seed between spring and fall; March 15 - September 30.

- b. Install sod only when air temperature is above freezing and below 85°F.
- c. Do not install seed or sod on saturated or frozen soil.
- d. Do not install seed or sod until soil preparations have been approved by the City.
- e. Do not install seed or sod until irrigation system is installed and tested.
- f. Proceed with planting only when existing and forecast weather conditions are suitable for work.

2. Site Information

The Contractor shall be required to have examined the site, to ascertain the state thereof and the conditions under which the work is to be done. Note: Drawings typically indicate the physical dimensions of the site, but do not show the extent of all obstructions and subsurface conditions.

3. Existing Site Features

Protect from damage as noted herein or on drawings.

14.1.2 MATERIALS

14.1.2.A TOP SOIL FOR SEEDING

(Note that all percentages are by weight and **not** by volume.)

1. Topsoil for Seeding

ASTM D 5268, PH range of 6.3 to 8.2, three percent (3%) organic material minimum, free of extraneous materials harmful to plant growth.

a. Topsoil Source (Seeding)

a.1. Topsoil shall be fertile, friable, sandy loam or loam. Topsoil shall be of any admixture of subsoil or slag and shall be free of stones, lumps, refuse, plants or their roots, sticks, noxious weeds, salts, soil sterilant or other material detrimental to plant growth. Topsoil shall not be delivered or used onsite in any manner while in a frozen or muddy condition.

a.2. All imported topsoil shall be from an approved point of origin satisfactory to the City prior to delivery or placement in planting areas. Should noxious weeds be present at the topsoil source, the City will make recommendations to the Contractor as to appropriate treatment of the topsoil prior to delivery to the project site.

2. Soil Amendments (Seeding and Sod)

- a. Compost: One hundred percent (100%) humus rich organic matter. The compost shall be a well decomposed, stable, weed free organic matter derived from agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings, or source-separated or mixed solid waste. Product must be certified as fully composted at a permitted solid waste processing facility. Product to be registered with the Colorado Department of Agriculture and approved for use on Colorado Certified Organic Farms by the Division of Plant Industry of the State of Colorado. Product shall contain no solid particle greater than one-half inch (½") in length or diameter and be free from uncomposted or non-stabilized wood bulking agents. Product shall contain no substances toxic to plants and shall be reasonably free (<1% by dry weight) of man-made foreign matter. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived.

- b. Provide analysis for the following:
 - Organic Matter Content: 30 - 70% (dry basis)
 - Soluble Salt Concentration (EC paste test): 5 dS (mmhols/cm) or less (as received)
 - PH range: 5.5 to 8.0 (as received)
 - Final carbon to nitrogen ratio: 20:1 or less.
 - Nutrient Content (dry weight basis): N 1% or above, P 1% or above, K 0.5% or above.
 - Bulk Density: 800 - 1,000 lbs/yd³
 - Moisture Content: 35% - 55%
- c. Certification of Compost Testing
 - The Contractor shall furnish to the City a signed statement certifying that the compost furnished is from the lot that has been tested.
- 3. Amended Topsoil (Seeding)
 - Offsite, mechanically combined product.
 - a. Amended Topsoil: Components of the amended topsoil product (compost and topsoil) shall meet all previously outlined criteria for the individual components.
- 4. Fertilizer
 - a. Before seeding or sodding, apply an inorganic mixture tilled thoroughly into the top six inches (6") of soil, unless otherwise stated.
 - 1 lb. of Nitrogen (N) per one thousand (1,000) square feet.
 - 2 lbs. Phosphorus (P205) per one-thousand (1,000) square feet.
 - 1 lb. Sulfur (SO₄-S) per one-thousand (1,000) square feet.
- 14.1.2.B SEED
 - 1. Grass Seed
 - Fresh, clean, dry, new-crop seed conforming to all State and Federal regulations and complying with the Association of Official Seed Analysts', "Rules for Testing Seeds" for purity and germination tolerances.
 - a. Seed Mixture
 - Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity, germination. All materials furnished shall be free of prohibited noxious weeds and meet State and City standards for restricted noxious weeds.
 - b. Proportions and Mixing
 - All seed shall be mixed by a wholesale seed supplier in the proportions necessary to obtain the application rate specified.
 - c. Labels
 - All seed and seed mixes shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the common, scientific and variety name(s) of the seed(s), the lot number, net weight, percent of weed seed content and the guaranteed percent of purity and germination.
 - d. Certification of Seed Testing
 - The Contractor shall furnish to the City a signed statement certifying that the seed furnished is from the lot that has been tested and comply with the Colorado Seed Law.
- 14.1.2.C SOD
 - 1. Sod Materials

- a. Sod shall be a true-to-name variety, blend or mixture as specified herein and be free of all noxious weeds. Sod shall have a moist, viable root system and of a density that it will not easily tear, break or crumble. Sod in rolls or pallets shall not be stored, after cutting from the sod farm, more than 48 hours and shall be protected from dehydration until installed.
- b. Provide strongly rooted sod, free of weeds and undesirable grasses, and machine cut to pad thickness of 0.75", excluding top growth and thatch. Provide only sod capable of vigorous growth and development when planted.
- c. Provide sod of uniform pad sizes with maximum 5% deviation in either length or width. Broken pads or pads with uneven ends will not be acceptable. Sod pads incapable of supporting their own weight when suspended vertically with a firm grasp on upper 10% of pad will be rejected.
- d. Cut sod using an approved method, in accordance with local governing American Sod Producers Association.

14.1.2.D HERBICIDES

- 1. Herbicide: EPA registered and approved, of type utilized by City of Greeley Parks Department.
- 2. Applicators must possess both a Colorado Department of Agriculture license and City of Greeley pesticide applicator's license.
- 3. The contractor making chemical applications must have a Qualified Supervisor on staff.

14.1.2.E EROSION CONTROL BLANKETS, MATS, FABRICS

Erosion control blankets, mats, of other commercial products for stabilizing disturbed areas may be required on certain projects. If so, the type, manufacturer, and installation method for these products will be approved by the City. (See Section 5 for more information.)

14.1.3 EXECUTION

14.1.3.A EXAMINATION

1. General

Verify that existing site conditions are as specified and indicated before beginning work under this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

All work is to be performed by personnel thoroughly familiar with proper and accepted methods for soil preparation, herbicide applications, fertilizing, seeding, mulching, etc. All work is to be performed under the direct supervision of the Contractor's superintendent, who shall be thoroughly familiar with the provisions of these specifications.

2. Damaged Earth

Inspect to verify that earth rendered unfit to receive planting due to concrete water, mortar, lime water or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the City. All access roadways or compacted soil shall be ripped to loosen.

3. Acceptance

Beginning installation indicates acceptance of existing conditions by Contractor.

14.1.3.B PREPARATION

1. Protection

- a. Locate structures, playground equipment, sewer, water, irrigation, gas, electric, phone, cable TV, other pipelines or conduits and equipment prior to commencing work.
- b. Be responsible for proper repair to landscape, utilities, walls, soft surface paths, pavements and other site improvements damaged by operations under this section.

2. Existing Vegetation

- a. Contractor shall keep a log of all pesticide applications performed throughout the duration of the project, detailing applications. Notes shall be submitted to Owner at the completion of project.
- b. Herbicides shall be applied using well maintained spraying equipment by individuals working for the Contractor who are appropriately licensed by the State or Federal agency having jurisdiction over such applications. It shall be the responsibility of the Contractor to be knowledgeable of any and all current laws and regulations pertaining to pesticide applications, and to advise the City immediately if any requests for applications made by the City are inappropriate as they pertain to these laws and regulations.
- c. Herbicides and other chemicals shall not be applied during periods when wind or other physical conditions cause the herbicides to be transported off site, or a distance of more than five (5') feet from the immediate area where they are being applied. It shall be the responsibility of the Contractor to notify the City immediately if any weather or other physical conditions exist which would make application inappropriate.
- d. All herbicides and other chemicals shall be applied at rates as determined by the manufacturer's label.

d.1. Bluegrass areas

Existing vegetation, excluding trees and shrubs, in all areas designated to receive new bluegrass seed or sod, are to be sprayed with a contact non-selective post emergent herbicide (Roundup), a minimum of one (1) week and a maximum of (3) weeks prior to the ripping/tilling process.

d.2. Native areas

New seeding areas: Existing vegetation, excluding trees and shrubs, in all areas designated to receive new native seed mixes, shall be sprayed with a contact non-selective post emergent herbicide (Roundup), a minimum of one (1) week and a maximum of (3) weeks prior to the ripping/tilling process.

d.3. Over seeded areas

Spot treatment with selective post emergent herbicides may be required to eliminate undesirable vegetation in some areas. Coordinate herbicide application with the City a minimum of two (2) weeks prior to the seeding operation.

Reapply herbicide if necessary to insure complete kill of existing vegetation.

3. Surface Grade

Remove existing grass, weeds, debris and rocks larger than one and one half-inches (1½") in all areas designated to receive seed or sod. Verify that all rough grades have been established.

4. Erosion Control
(See Sections 12 and 13 for more information.)

14.1.3.C INSTALLATION

1. Soil / Seed or Soil / Turf Bed Preparation

a. General: All ripping and tilling operations shall be done in a direction which follows the natural contours of the land on slopes of 4:1 or flatter. Any irregularities in the ground surface resulting from soil preparation operations shall be corrected and sloped to drain as intended by the grading plans.

b. Ripping/Tilling

b.1. Soil shall be ripped or tilled to a minimum of eight inches (8"), with agricultural sub-soiler in all areas to receive seed or sod. This includes any areas compacted by construction traffic during the construction process, with four (4) passes in at least two (2) directions.

b.2. In areas where extremely stiff materials, or if debris is encountered during ripping, re-adjust equipment to avoid bringing up chunks of un-tillable material.

b.3. The soils shall be worked until it has become loose and friable and no clods greater than two inches (2") in diameter remain, unless directed otherwise by the City, prior to the addition of any soil amendments, seed, or mulch.

b.4. Remove stones larger than one and one-half inches (1½") in any dimension and sticks, roots, rubbish, and other extraneous matter.

b.5. Any required soil amendments (e.g. organic soil conditioners, fertilizer, etc.) shall be uniformly spread on the surface of soil which has been prepared as stated above and at the rates specified in sections 14.1.3.D, below.

2. Soil Amendments

a. Blue Grass Areas: Evenly distribute composted material in the bluegrass seed or sod areas at the following rates:

a.1. Apply the compost at four (4) cubic yards per one thousand (1,000) square feet.

a.2. Spreading the compost shall be accomplished with either a truck or trailer mounted spreader, capable of being adjusted to apply varying rates of material at a given speed.

b. Native Seed Areas: Evenly distribute composted material in the native seed areas at the following rates:

b.1. Apply the compost at two (2) cubic yards per one thousand (1,000) square feet.

b.2. Spreading the compost shall be accomplished with either a truck or trailer mounted spreader, capable of being adjusted to apply varying rates of material at a given speed.

b.3. In areas inaccessible with a truck or trailer mounted spreader, the compost can be delivered and spread with a tractor and/or by hand.

c. Over Seeding Native Seed into existing vegetation

c.1. No compost will be required in these areas.

3. Fertilizer

- a. For Sod and Seeded areas receiving organic soil amendments:
 - a.1. After applying soil amendments and fertilizer, thoroughly till area to a depth of six inches (6") minimum by roto-tilling, plowing, harrowing, or disking until soil is well pulverized.
 - b. Fill, compact and grade the site to within +/- 0.15' of grades indicated and specified.
- 4. Grading in all areas to receive seed or sod
 - a. For Seeding only: Do fine grading for areas prior to seeding. Perform as required to maintain positive drainage, prevent ponding and direct run-off into catch basins, drainage structures, etc. and as required to provide smooth well-contoured surface prior to proceeding.
 - b. For Sodding only: Do rough grading and eliminate low spots. Perform as required to maintain positive drainage, prevent ponding and direct run-off into catch basins, drainage structures, etc. and as required to provide smooth well-contoured surface prior to proceeding.
 - c. Prior to Acceptance of Grades: Hand-rake to a smooth even surface with a loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions. Remove debris, clods, rocks, vegetable matter, and any other objects that may interfere with planting or maintenance operations. Limit fine grading to areas that can be planted in the immediate future.
 - d. For Seeding: Establish finish grades to within +/- 0.15' of grades indicated.
For Sod: Grade areas along sidewalks and driveways approximately one and one half (1 1/2) inches below top of concrete.
 - e. Noxious weeds or parts thereof shall not be present in the surface grade prior to seeding or sodding.
 - f. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow the surface to dry before planting. Do not create muddy soil.
 - g. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Leave graded surface clean and free of trash and debris. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

14.1.3.D SEEDING

- 1. The Contractor shall notify the City prior to any seeding work.
- 2. All prepared areas, need to be firm, but not compacted, prior to seed application.
- 3. Bluegrass Areas
 - a. Sow Bluegrass mix at a rate of 5 lbs. per 1,000 sq. ft.
 - b. Sow turf grass seed using mechanical Type 3 drill, (Brillion) seeding machine for slopes 4:1 and flatter.
 - b.1. Distribute seed evenly over entire area by sowing equal quantities in two directions at right angles of each other.
 - b.2. For areas inaccessible to seeding machines use broadcast method. See 14.1.3.D below.

TABLE 14.1.3.D - BLUEGRASS SPECIES/VARIETY	
Use as specified per City approved drawings.	
SPECIES	POUNDS PER ACRE – PURE LIVE SEED
Kentucky Bluegrass, Moonlight	65.1
Kentucky Bluegrass, Northstar	65.1
Kentucky Bluegrass, Quantum Leap	65.1
Perennial Ryegrass	21.7

4. Native Areas

- a. Seed the listed varieties in the areas designated on the drawings.
- b. All seed is to be drilled 0.25 inch to 0.50 inch into the soil at the specified PLS/acre rate listed in the Seed Mix tables below, with a mechanical, power drawn drill seeder. Rows shall be spaced not more than eight inches (8") apart.
- c. The contractor shall drill equal quantities in two directions at right angles of each other.
- d. Seeding rates need to be increased 50% on slopes 6:1 or steeper.
- e. Seeding rates need to be increased 100% for areas that are seeded by hand broadcasting.
- f. Seeding native grasses into existing vegetation, or areas that have not been ripped and tilled to a minimum of 6 inches require the use of a seeder with:
 - f.1. Double Disc openers with depth bands.
 - f.2. Native Grass Seed Box with agitator and picker wheels.
 - f.3. Press wheels.
 - f.4. In hard ground areas, the City may require the use of a no-till Coulter unit.
- g. A cultipacker seeder (Brillion, Trillion type) is acceptable to use in well prepared (fine and firm) seed bed applications.
 - g.1. The seeder should be equipped with seed boxes to handle the type of seed being planted.
 - g.2. Native grass seed will need a seed box with an agitator and picker wheels.
 - g.3. Seeding rates would need to be increased 50% with a cultipacker seeder since it is a broadcasting application.

TABLE 14.1.3.D(1) - LOW GROW MIX	
Use a minimum 8' wide on sides of pathways. Use at property lines abutting residential properties. Used in open areas where short grasses are desired.	
SPECIES	POUNDS PER ACRE – PURE LIVE SEED
Buffalo grass	8.0
Blue gramma	6.5

TABLE 14.1.3.D(2) - SLOPE MIX Used on all slopes and berms.	
SPECIES	POUNDS PER ACRE – PURE LIVE SEED
Side oats gramma	4.0
Blue gramma	4.0
Little Bluestem	4.0
Sand dropseed	.12
Stream Bank Grass	8.0

TABLE 14.1.3.D(3) - POND MIX Used in and around detention/retention ponds, and in areas that are designed to hold water, but are not necessarily wet the majority of the time.	
SPECIES	POUNDS PER ACRE – PURE LIVE SEED
Little Bluestem	2.0
Yellow Indian Grass	2.0
Switchgrass	1.0
Blue gramma	0.6
Side oats gramma	3.0
Prairie Sandreed	1.5
Western Wheatgrass	4.0
Stream Bank Grass	5.0

TABLE 14.1.3.D(4) - RIPARIAN MIX Used along irrigation ditches and in naturally wet areas.	
SPECIES	POUNDS PER ACRE – PURE LIVE SEED
Switchgrass	6.0
Reeds Canary grass	6.0
Stream Bank Grass	8.0

5. Companion Crops

Add the prescribed companion crop with the native seed mixes to be planted at the rate listed.

TABLE 14.1.3.D(5) - COMPANION CROP or COVER CROP Add the appropriate companion crop or cover crop to the native seed mixes to be planted.	
SPECIES	POUNDS PER ACRE – PURE LIVE SEED
Spring Planting: Triticale	15.0
Fall Planting: Triticale	15.0

6. Broadcast Seeding

Some areas may be inaccessible to a drill. In these mutually agreeable areas, seed shall be uniformly broadcast at 2 times the specified rate. Seed is to be evenly distributed and sown in equal quantities, in two directions at right angles to each other. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Hand broadcasted

seeded areas need to be raked in to provide a minimum of ¼" cover and a maximum of ½" cover.

7. Watering Newly Seeded Areas

- a. Bluegrass areas: Coordinate with City the irrigation controller settings to provide adequate moisture for seed germination, and to avoid erosion.
- b. Native areas
 - b.1. Some native areas may have irrigation available, in which case, follow the guidelines for Bluegrass areas above.
 - b.2. Native areas without irrigation
 - o Spring Planting: Plan the planting operation to start as soon as the soil can be worked and prior to the spring rainy season.
 - o Fall Planting: Place seed prior to the first hard frost in the fall, but after dormancy begins for the varieties being planted.

8. Erosion Protection

- a. Slopes of 6:1 or flatter require no erosion protection.
- b. Protect seeded slopes steeper than 6:1 against erosion with jute or coir-fiber erosion-control mesh installed and stapled according to manufacturer's recommendations.

14.1.3.E SODDING

- 1. The Contractor shall notify the City prior to any sod work.
- 2. The City will be on site during sod operations.
- 3. Sodded areas shall be smooth and firm before lying. Sod shall be laid by staggering the joints. On slopes, sod shall run parallel to a 90 degree angle to the slope.
- 4. When in position, sod shall be watered and lightly rolled to ensure contact with the soil surface.
- 5. Lay sod within 48 hours from time of stripping. Do not plant if ground is frozen.
- 6. Lay sod parallel to contours to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to sub grade or sod. Water and tamp or roll lightly to ensure contact with sub grade. Work sifted soil into minor cracks between pieces of sod. Remove excess soil.
- 7. Water sod thoroughly with a fine spray immediately after planting or after completion of every 500 sq. ft.

14.1.3.F MAINTENANCE OF SOD

1. General

- a. Begin maintenance of lawns immediately after each area is planted and continue for a period of not less than 30 days for sodded areas and until satisfactory growth is achieved.
- b. Maintain lawns by watering, fertilizing, weeding, mowing and trimming and other operations such as replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas up to and until final acceptance has been issued from the City, in writing.
- c. Resod bare areas using same materials specified for lawns.

2. Watering

- a. Water new lawn area sufficiently to thoroughly moisten soil and in such a manner as to avoid erosion. Commence watering on the day of installation and continue as needed.
 - b. A new sod watering permit will be required.
 - c. Provide and maintain temporary piping, hoses and lawn watering equipment to convey water from sources and to keep lawn areas uniformly moist as required for proper growth up to and until final acceptance has been issued from the City, in writing.
3. Mowing: Mowing during maintenance period is the responsibility of the Contractor. Do not begin mowing until the sod has had at least 7 consecutive days from installation to root into the soil. Mowing height shall be no less than 2". Mow newly seeded areas when 75% of grass reaches 3" height.

14.1.3.G CLEANING

Remove and haul from the site all excess materials and debris generated during the construction process. Perform daily cleaning during installation of the work, and upon completion of the work. Clean paved and finished surfaces soiled as a result of work under this section. Clean out drainage inlet structures as required. Repair any and all damage.

14.1.3.H PROTECTION

Provide and install barriers as required and as directed by the City to protect the seeded and sodded areas against damage from pedestrian and vehicular traffic until well established and accepted by the City. Provide any additional erosion control measures which are necessary for the successful establishment of grass areas.

14.2 **IRRIGATION**

(Note: **14.2.1** and **14.2.2** regarding Sprinkler Systems are **guidelines only**.)

14.2.1 MATERIALS

1. Sleeving
 - a. Install a separate sleeve beneath paved areas to route each run of irrigation pipe or wiring bundle.
 - b. Sleeving material beneath pedestrian pavements shall be PVC Class 200 pipe with solvent welded joints.
 - c. Sleeving beneath drives and streets shall be PVC Class 200 pipe with solvent welded joints.
 - d. Sleeving diameter: equal to twice that of the pipe or wiring bundle.

2. Pipe and Fittings

a. Mainline Pipe and Fittings

Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end suitable for solvent welding.

Use Class 200, SDR-21, rated at 200 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241. Use PVC pipe rated at higher pressures than Class 200 in the case of small nominal diameters that are not manufactured in Class 200.

Use solvent weld pipe for mainline pipe with a nominal diameter less than 3-inches or where a pipe connection occurs in a sleeve. Use Schedule 40, Type 1, PVC sol-

vent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.

b. Lateral Pipe and Fittings

Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end suitable for solvent welding.

Use Class 160, SDR-26, rated at 160 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241.

Use solvent weld pipe for lateral pipe. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, of a type approved by the pipe manufacturer.

c. Specialized Pipe and Fittings

c.1. Low Density Polyethylene Hose

- Use pipe specifically intended for use as a flexible swing joint.
- Inside diameter: 0.490 +/- 0.010 inch.
- Wall thickness: 0.100 + 0.010 inch.
- Color: Black.
- Use spiral barbed fittings supplied by the same manufacturer as the hose.

c.2. Assemblies calling for flanged connections shall utilize stainless steel studs and nuts and rubber gaskets.

c.3. Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 nipples and PVC Schedule 40 threaded fittings.

d. Joint sealant: Use non-hardening, nontoxic pipe thread sealant formulated for use on threaded connections and approved by the pipefitting and valve manufacturers.

Where directed by valve manufacturers, use thread tape for threaded connections at valves instead of thread paste.

e. Joint Restraint Harness

Use a joint restraint harness wherever joints are not positively restrained by flanged fittings, threaded fittings, and/or thrust blocks.

Use a joint restraint harness with transition fittings between metal and PVC pipe, where weak trench banks do not allow the use of thrust blocks, or where extra support is required to retain a fitting or joint.

Use bolts, nuts, retaining clamps, all-thread, or other joint restraint harness materials that are zinc plated or galvanized.

Use on pipe greater than or equal to 3-inch diameter or any diameter rubber gasketed pipe.

3. Mainline Components

a. Master Valve Assembly: As presented in the installation details.

b. Flow Sensor Assembly: As presented in the installation details.

c. Isolation Gate Valve Assembly: As presented in the Manufacturer's instructions. Acceptable manufacturer's are American AVK, Clow, Kennedy, Mueller, Matco, Nibco, or Waterous.

- d. Quick Coupling Valve Assembly: As presented in the installation details.
4. Sprinkler Irrigation Components
- a. Remote Control Valve (RCV) Assembly for Sprinkler Laterals: as presented in the installation details. (Contact the Parks Department for details.) Use wire connectors and waterproofing sealant to join control wires to solenoid valves. Use standard Christy I.D. tags with hot-stamped black letters on a yellow background. Install a separate valve box over a 3-inch depth of ¾-inch gravel for each assembly. Provide PRS-Dial pressure regulators at all spray and rotor sprinkler remote control valves.
 - b. Sprinkler Assembly: As presented in the drawings and installation details.
 - c. Sprinkler Pressure Test Kit: Provide Rain Bird PHG assembly, and Rain Bird Pitot Tube (part no. 41017), for use in pressure adjustment for spray and rotors sprinklers.
 - d. Component connection, hook-up of electrical, sprinkler heads, and testing shall be per manufacturer's recommendations.
5. Control System Components
- a. Irrigation Controller Unit: As presented in the installation details.
 - b. Lightning protection: Provide one 12" x 36" x 0.0625" ground plate, one 5/8"x10 foot copper clad UL listed grounding rod, 30 feet of #6 AWG bare copper grounding wire, and one CADWELD connector, and two 6-inch round valve boxes at each irrigation controller.
 - c. Wire markers: Prenumbered or labeled with indelible nonfading ink, made of permanent, nonfading material.
 - d. Power Wire
Electric wire from the power source to satellite control unit shall be solid or stranded copper, Type UF single conductor cable or multi-conductor with ground cable, UL approved for direct underground burial. Power wires shall be black, white, and green in color. The Contractor is responsible for verifying that the power wire sizes are compatible and adequate for the control system being used.
Splices: Use 3M 82-A series connectors.
Conduit: PVC Schedule 40.
Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored yellow, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW?"
 - e. Control Wire
Use American Wire Gauge (AWG) No. 14 solid copper, Type UF or PE cable, UL approved for direct underground burial from the controller unit to each remote control valve.
Common Wire: Use American Wire Gauge (AWG) No. 12 solid copper, Type UF or PE cable, UL approved for direct underground burial from the controller unit to each remote control valve.
Color: Wire color shall be continuous over its entire length.
Control wire: Red.
Common wire: White.
Spare control wire: Any color except Red or White.
Spare common wire: Any color except those above.
Splices: Use 3M DBY-6 or 3M DBR-6.

Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored yellow, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

14.2.2 SPRINKLER SYSTEM INSPECTIONS

Verify construction site conditions and note irregularities affecting work of this section. Report irregularities to the City prior to beginning work.

Irrigation System Layout Review: Irrigation system layout review will occur after the staking has been completed. Notify the City one week in advance of review. Modifications will be identified by the City at this review.

14.2.3 EXCAVATION, TRENCHING, AND BACKFILLING

1. Excavate to permit the pipes to be laid at the intended elevations and to permit work-space for installing connections and fittings.
2. Minimum cover (distance from top of pipe or control wire to finish grade):
 - a. 24-inches over mainline pipe and over electrical conduit.
 - b. 28-inches over control wire.
 - c. 18-inches over lateral pipe to sprinklers.
3. PVC lateral pipes may be pulled into the soil utilizing a vibratory plow device specifically manufactured for pipe pulling. Minimum burial depths equal minimum cover listed above.
4. Backfill only after lines have been reviewed and tested.
5. Excavated material is generally satisfactory for backfill. Backfill shall be free from rubbish, vegetable matter, and stones larger than 2-inches in maximum dimension. Remove material not suitable for backfill. Backfill placed next to pipe shall be free of sharp objects that may damage the pipe.
6. Backfill unsleeved pipe in either of the following manners:
 - a. Backfill and puddle the lower half of the trench. Allow to dry 24 hours. Backfill the remainder of the trench in 6-inch lifts. Compact to 85% Standard Proctor Density at optimum moisture.
 - b. Backfill the trench by depositing the backfill material equally on both sides of the pipe in 6-inch lifts and compacting to 85% Standard Proctor density at optimum moisture.
 - c. Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves. Minimum compaction of backfill for sleeves shall be 95% Standard Proctor Density, ASTM D698. Use of water for compaction around sleeves, "puddling", will not be permitted.
7. Dress backfilled areas to original grade. Incorporate excess backfill into existing site grades.
8. Trenches may be curved to change direction or avoid obstructions within the limits of the curvature of the pipe. Minimum radius of curvature and offset per 20-foot length of pipe-by-pipe size are shown in the following table. All curvature results from the bending of the pipe lengths. No deflection will be allowed at a pipe joint.

SIZE	RADIUS	OFFSET PER 20' LENGTH
1½"	25'	7'-8"
2"	25'	7'-8"
2 ½"	100'	1'-11"
3"	100'	1'-11"
4"	100'	1'-11"

14.2.4 GUARANTEE / WARRANTY AND REPLACEMENT

The purpose of this guarantee/warranty is to insure that the City receives irrigation materials of prime quality, installed and maintained in a thorough and careful manner. Guarantee/warranty irrigation materials, equipment, and workmanship against defects for a period of **two years** from commencement of the formal maintenance period. Fill and repair depressions. Restore landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repair damage to the premises caused by a defective item. Make repairs within seven days of notification from the Owner's Representative. Make replacements at no additional cost to the City. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

14.2.5 MAINTENANCE ACCESS

To assure that the detention facility performs as designed, maintenance access shall be provided, and shown on the Final Plat. Regional detention ponds are usually dedicated to the City for operation and maintenance. For privately maintained facilities such as commercial or industrial sites, an easement shall be granted to the City to allow access and to assure that the facility continues to function as intended. The City has standard easement agreement forms for this purpose.