Landscape Installation Standards and Guidelines

Introduction

Information within this **NLA** publication **'Landscape Installation Standards and Guidelines'** is intended to help/guide landscape contractors in preparing proper specifications for bidding purposes, guide them in the proper installation procedures and to help educate new professionals in the field of landscape construction. These guidelines were also intended to be used by property owners/developers as a guide/template and information source in the pre-construction bidding process, construction phase, and providing an 'apples to apples' bid process. These guidelines are mainly a guide and adherence to the letter of the specifications is largely dependent on site particulars and circumstances.

Standards within this publication are based on regional conditions common to northern Nevada including; water, climate, and soil characteristics. Because northern Nevada is a dry climate (7.5 inches per year) great care has been taken to assure water conservation techniques were integrated into all facets of these guidelines. It cannot be stressed strongly enough that water management is a main goal in the design and installation of an aesthetic and functional landscape. The benchmarks established shall also improve installation standards and professionalism within the landscape industry of northern Nevada.

Acknowledgments

This manual has come about through the efforts of many professionals and organizations throughout northern Nevada and the United States. Because of the rapid change in technology and influx of new talented individuals to northern Nevada there have been over twelve revisions to the original draft. Members of the Installation Standards Committee include: Brian S. Dean (chairman) and Tim Laskowksi. Other individuals who have contributed information and preliminary proofing of this publication include: Jason Perry, Bill Carlos, Steve Zuver, Tim Potter, and Joe Gilbert. Final review and critique of these completed standards where done by local experts such as Bill Carlos (UNR Cooperative Extension), Tim Potter (Environtech Landscaping) and Molly Sinnott (Sinnott Consulting). Diagrams and drawings were done by Brian S. Dean.

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Sample cover

Landscape Installation Standards

Date
Prepared for

Name of Residence

Address
Reno, Nevada

Written by:
Name of Designer
Company
Address
Phone number

General Conditions

Description

Landscape installation and design should use water saving techniques whenever possible. Installation shall include all labor, materials, and equipment to complete the scope of work as defined by these standards and guidelines. This shall include clean up and off site disposal of all debris generated by installation procedures.

Definitions

A. The word "**Owner**" used in these standards and contract documents shall be understood to mean name of resident or appointed representative. The words "**Landscape Designer**" used in these standards and contract documents shall be understood to mean original landscape architect/contractor or appointed representative who graphically plans or designs landscape.

B. The word "**Contractor**" used in these standards and contract documents shall be understood to mean individual, company, or group of individuals who carry out the actual work of installation or support in its construction.

C. The words "**shall**" or "**will**" used in these specifications means work is "to be as described". The words "**should**", "**preferred**" or "**desirable**" means the work is "preferred to be as described".

D. The term "**Scheduling of Installation"** means a starting of installation and approximate completion date shall be agreed upon by owner and contractor. This shall be given at time of bidding.

E. Site Conditions

1. Potential contractor shall personally visit site prior to bidding to become thoroughly familiar with the property, scope of work, irrigation system, drainage concerns and any unique site requirements.
2. Prior to commencement of work, the contractor shall document conditions on site which may affect the project for which the contractor may be held responsible.

Quality Assurance

A. Insurance

For commercial work contractor shall carry public and property damage liability insurance in the minimum amount of $1,000,000.00 and workman's compensation (SIIS) with owner named as "additionally insured" on both and shall furnish the owner with

certificates of coverage upon request. For residential work contractor shall carry public and property damage liability insurance in the minimum amount of $1,000,000.00 workman's compensation (SIIS) and security bond as required by the State of Nevada Contractors Board and shall furnish the owner with certificates of coverage upon request.

B. Warranty

1. Contractor shall have a qualified supervisor on site during all work operations to supervise work. The supervisor shall be able to communicate with the owner and laborers in English and the language of the landscape workers, both orally and in writing.
2. Labor is preferred to be an NLA and/or UNR Cooperative Extension Certified landscape technician or nursery worker.

C. Equipment shall be safe, properly suited for the task, and operated by qualified and trained personnel according to current ANSI (American National Standards Institute), the manufacturer's instructions, and current OSHA (Occupational Safety and Health Administration) published standards. Equipment shall be maintained in proper working condition, including properly sharpened cutting blades. Equipment must have all required safety devices in place and in operation as required by the manufacturer, OSHA, federal, state, and local regulations.

D. Safety

Contractor shall provide necessary precautions at all times for the protection of the public and employees as outlined by federal, state and local regulations. These include, but not limited to: OSHA, USDA (United States Department of Agriculture), EPA (Environmental Protection Agency), NDOT (Nevada Department of Transportation), and the State of Nevada Department of Business and Industry, Division of Agriculture and the ANSI.

E. Compliance

The contractor shall comply with all codes, rulings, reviews and requirements of all authorities having jurisdiction over work described in these specifications. This includes, but not limited to federal, state, county, city, governing boards and homeowner associations. Owner must provide homeowner association requirements to contractor prior to design and installation.

F. Regulatory Requirements

Contractor shall have a current business license and current Nevada state contractors license for the jurisdiction where work is performed.

G. Guarantee *

The Contractor shall guarantee to repair or replace (including removal and installation costs), at no expense to the owner, any materials supplied by contractor including, but not limited to, hardscaping, irrigation, plant materials and/or workmanship that may develop

defects during a period of one (1) year after the work is accepted by the owner or landscape designer except in cases of owner neglect or acts of god. Contractor shall be liable to repair or replace with same or like materials or equal substitute (if same is unobtainable) any part of the site damaged by him/her during the repairing of any such defective apparatus, material or workmanship. The acceptance of these standards/contract documents shall be considered as a written guarantee of the Contractor to carry out this provision.
* Plant material guarantee may be negotiated with owner.

Part I TREE and SHRUB PLANTING

A. Provisions:

All of the provisions of the General Conditions and any applicable divisions elsewhere in this standards/contract document shall apply to this section.

B. Materials:

1. Plant Materials

a. Quality and size of plant materials shall conform to the landscape designer or owner specifications, and current ANSI code Z60.1 American Standard for Nursery Stock published by the American Association of Nurserymen. Plants shall be typical of their species or variety and shall have normal habits of growth. Plants shall be: sound, healthy, free of wounds, insect pests and diseases, vigorous, and well-branched (many lateral limbs) from the root flare to the tree top. Small roots (relative to container size) that have encircled the trunk shall be cut or pulled away to prevent girdling. Plants with large roots encircled or girdling the trunk should be rejected. Root balls shall be intact and unbroken.

b. Quantities necessary to complete the landscape designer's or owner's planned space requirements shall be furnished.

c. All plants shall conform to the minimum measurements specified by landscape designer or owner unless approved by landscape designer or owner.

d. Substitutions, additions or deletions of any plant material will not be permitted without the consent of the landscape designer or owner. Such substitutions, additions and deletions shall be accompanied by an equitable adjustment of the contract price when necessary. All plant material acquired through additions, deletions or substitutions shall be subject to all conditions and guaranteed as here-in specified.

e. **Landscape design plan and plant list** should incorporate water saving techniques and plants. Plans should be easily readable and include sufficient information to carry out the proper installation as intended by the designer. An irrigation design plan shall be submitted separately (see Part IV Irrigation). **Design plans** shall include the following information:

- North arrow or plan north arrow.
- Linear scale given in inches to feet in written form and may have a bar scale.
- Name, address and phone number of location where work is to be done.

- Name, address and phone number of owner.
- Name, address and phone number of landscape designer.
- Date when plans were drafted.
- Legend of plant material or lines and arrows pointing out plant locations.
- Outline and/or identity of existing structures, utilities, hardscapes, signage, light fixtures, plants that are to remain, and other necessary features to prevent conflict or blockage as plants mature.

Plant list should include the following information:

- Common and botanical name with variety.
- Size of plant should be given as one or a combination of the following: caliper, container size, balled and burlapped size, or height. All evergreen trees should include height.
- Quantity of each species.

C. Procedures:

1. Removal of existing plant material and soil; soil preparation; furnishing placement, and installation of plant material; hardscaping and irrigation; etc.
2. **Grubbing and Clearing**
   Existing plants (weeds, shrubs and trees) not on design, which occupy designed areas shall be removed by entire root system or grinding of stumps. If there is any doubt as to whether a plant will remain, contractor must ask the owner or landscape designer. If the plant to be removed is an herbaceous weed, an approved herbicide such as glyphosate (Roundup) may be applied as control. Such herbicide applications shall be made by a trained individual, State of Nevada Department of Agriculture certified applicator or company. Such individual shall follow label directions exactly.
3. **Protection of Existing and Planted Plants**
   All landscaped areas and plants that are to remain on site shall be protected to the most reasonable extent possible. Soil preparation (cultivation, rototilling, etc.) shall be restricted to soil not occupied by the roots of existing trees and shrubs. Precautions during construction should include limiting soil compaction, spilling of construction chemicals onto the soil, root damage, etc. Soil that is removed during construction should be saved and set aside for refilling after construction. Root zones around existing trees should be identified by a qualified and experienced arborist or qualified ISA (International Society of Aboriculture) certified arborist to rope off or set hay bales identifying these areas before and during construction. This limits construction equipment, soil disruption or spilled chemicals to only the construction area. The immediate area outside the roped or hay baled area should have organic mulch or material with absorbent and cushion characteristics such as wood chips placed at a depth of no less than 6 inches. This will reduce compaction and absorb any spilled chemicals that may occur. As trenches are dug, all medium to large roots (greater than 1 inch in diameter) torn by construction equipment shall be cut cleanly with pruning saws and/or loppers or hand pruners. This allows for proper compartmentalization (healing) which will reduce infection from soil borne diseases. Exposed roots should be covered immediately with wet burlap and maintained moist to reduce desiccation during

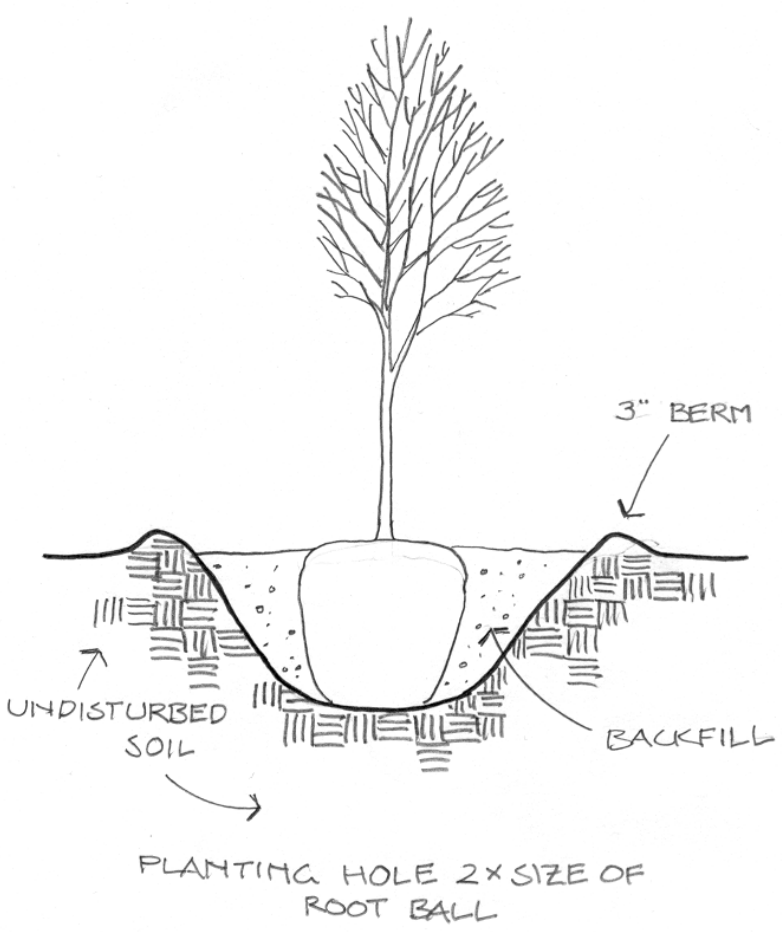
the entire duration of exposure to open air. Irrigate areas located close to the trunk to beyond the drip line to help supplement the lack of water absorbing roots that were cut or damaged. If any trunk damage occurs during construction a qualified arborist should be notified immediately to recommend curative or mitigating procedures.

4. Maintenance

- **a.** Maintenance shall begin immediately after each plant is planted and shall continue until completed work is accepted by landscape designer or owner or as agreed upon by owner and contractor.
- **b.** Maintenance shall consist of watering, keeping plants erect, maintaining of tree stakes, raising plant root balls which settle below grade, insect and disease control, and weed control.
- **c.** The contractor shall make request for final inspection by landscape designer or owner after planting is completed.

5. Planting Holes and Procedures

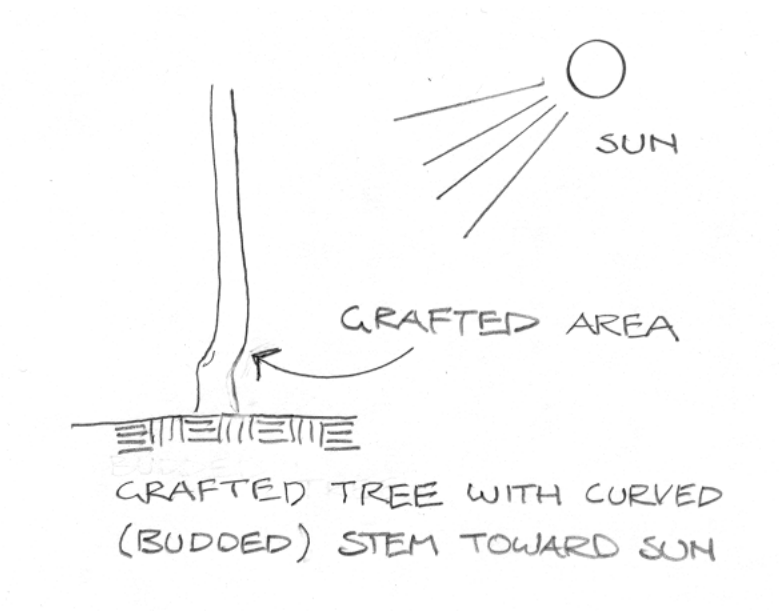
- **a.** Width of plant holes shall be excavated to a minimum of two times the diameter of the root ball where possible so as not to damage existing tree roots or as restricted by hardscaping (Carson City specifications dictate 3x; Sacramento specifications dictate 5x) and equal to the depth of the root ball. Sides of the hole shall slope upward to encourage root growth in the top 12" of soil. Sides of planting hole shall be scarified to promote root penetration into native undisturbed soil.



(Diagram A) Tree planting detail.

b. Root flare (base of trunk) on all trees and shrubs shall be identified prior to planting. More than often trees and shrubs have buried trunks or are too deep in their containers/wire cages prior to planting. It is important to check for root crown/root flare relative to container soil line and finish grade as this is a major cause of plant failure after installation. Excess soil shall be removed down to the large structural roots (while in the container or root ball). The plant shall be positioned with root flare even with or slightly above surrounding grade (depending on size and soil conditions) to allow for settling and to prevent crown and root rot. Simply stated – do not plant too deep.

c. Grafted trees should have the budded (grafted) portion of the tree oriented toward the afternoon sun to reduce sunburn in the crook just above the bud union.

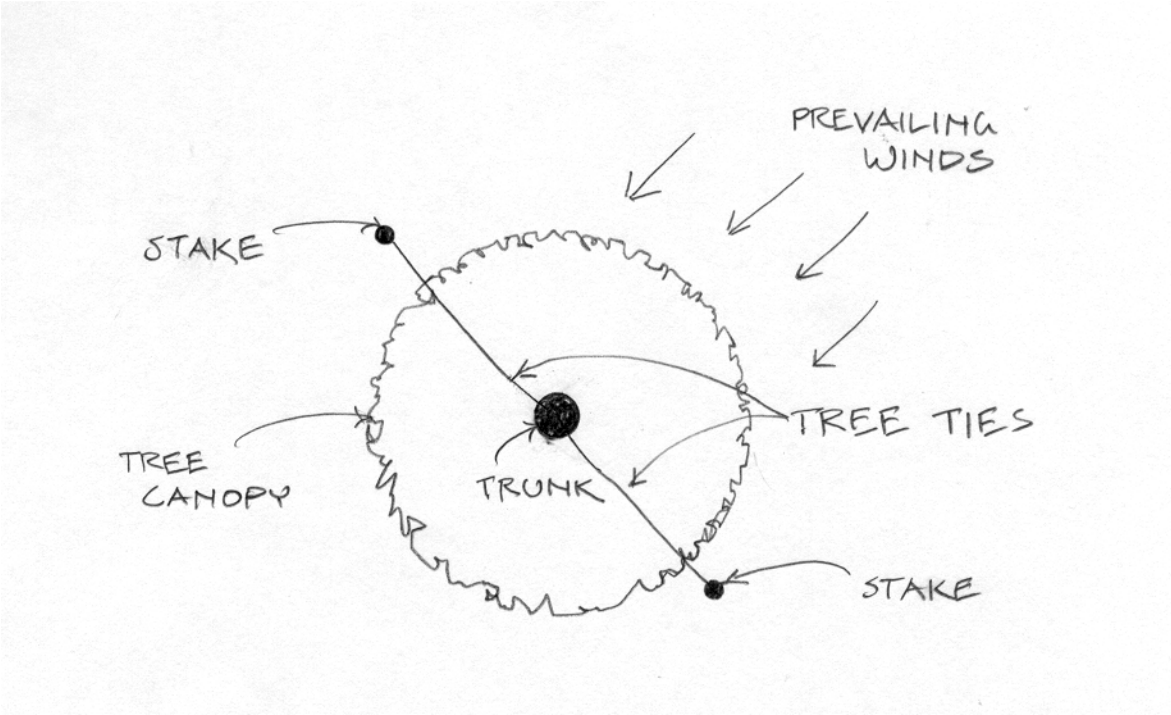


(Diagram B) Grafted tree detail showing budded stem oriented towards sun.

d. Three inch high basins or berms located outside planted root ball shall be constructed around trees and shrubs to allow retention of two inches minimum water depth over root ball.

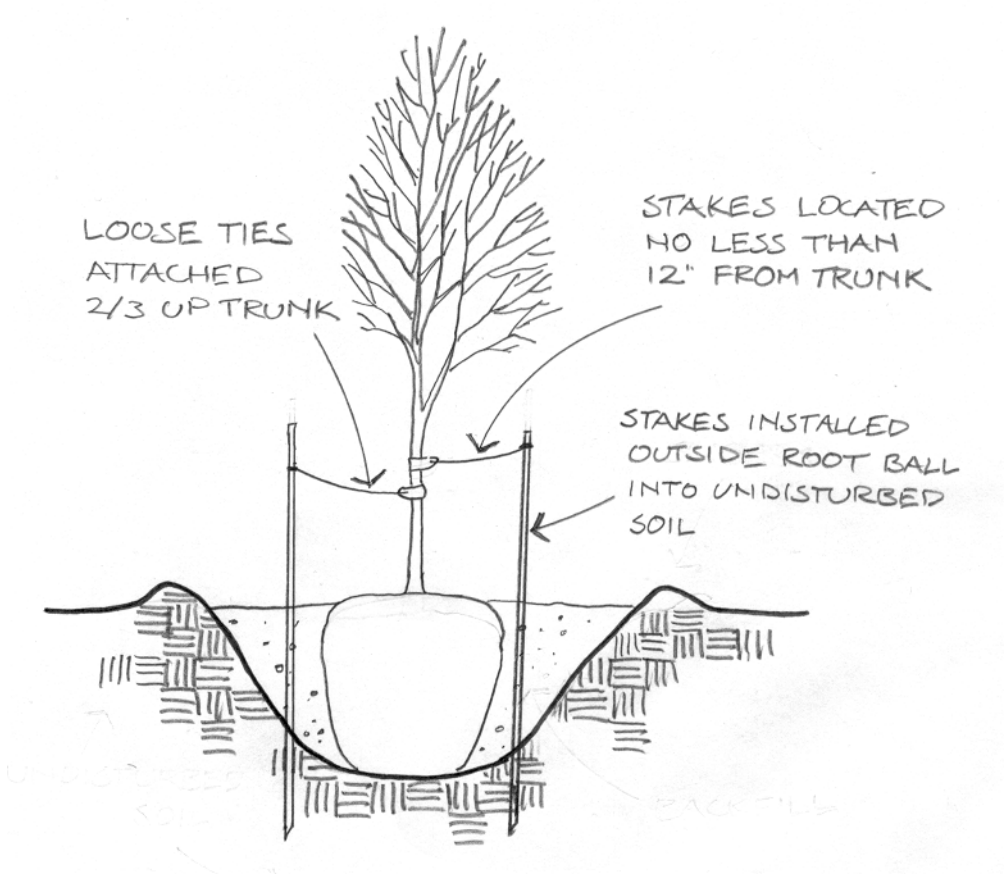
e. **Tree Staking and Ties**

Trees should be staked as necessary, to keep them in an upright position, but to allow the top and trunk to flex with the wind. Each tree supported shall have at least 2 stakes one on either side placed at a 90 degree or right angle to the wind (see diagram C).



(Diagram C) Stakes placed on opposite sides of trunk oriented at 90 degree angle to prevailing winds.

Short, stocky trees may require a minimum of support at the base. Stakes should be of treated wood or rot resistant material. Stakes shall be of sufficient size, height, and strength to support the tree in an upright position for at least one year to allow for proper trunk growth. Stakes shall be placed no closer than 12" to trunk and below any lateral branches so as not to rub and cause damage. Tree ties shall be loosely tied to the trunk but fixed tight to stake so as the tie does not slide down the stake. Ties should be loosely attached to the trunk so as not to pinch or girdle the tree cambium. Ties should be attached to the tree 2/3 the distance from the grade to the first lateral branch on well tapered trees. Trees without sufficient taper may require more than one tie per stake with the highest attachment located at the lowest lateral branch. Trees with very poor taper should be rejected prior to planting.



(Diagram D) Tree staking detail.

f. Immediately after planting operations are complete, all beds shall be watered and dressed off (raked and smoothly graded) so as to achieve a neat and presentable appearance.

g. Plants shall be pruned of dead limbs only at time of planting and according to the NLA maintenance standards to preserve the natural character or growth habit of the plant.

6. Mulch

If mulch is to be used where ground cover is not used it shall be no less than 3" deep with redwood, shredded bark, chips, organic matter, rock or like material as approved by landscape designer or owner. If a weed barrier is to be used it shall be a breathable/porous material to allow carbon dioxide and oxygen exchange with the soil, and water penetration/evaporation of the soil.

7. Placement

Trees and shrubs should be placed as indicated on the design or as directed by landscape designer, adjusting as necessary to allow for mature growth and not to crowd other plants, grow into overhead utilities or block signage, security lighting, and to allow visibility for vehicular traffic, and to prevent shallow/invasive roots from damaging hardscaping (sidewalks, foundations, decks, patio, etc.).

Part II TURF PLANTING

A. Provisions

All of the provisions of the General Conditions and any applicable divisions elsewhere in these standards/contract documents shall apply to this section.

B. Materials

1. Recommended species.

a. Kentucky bluegrass.

b. New generation and/or dwarf type fescues (fine fescues).

d. Perennial rye grass.

e. Other species may be suitable for specific applications but consideration should be given to climatic extremes and tolerances, dormancy period and maintenance.

2. Pre-plant fertilizer.

a. Use a slow release granular fertilizer on top of the soil or incorporated into the soil no more than ½ inch deep.

b. Fertilizer shall not contain any herbicides.

c. The ratio of N-P-K (nitrogen, phosphorus and potassium) should be based on the recommendations of a complete soil analysis or upon the recommendations of a professional horticulturist, UNR Cooperative Extension Service or other qualified individual with proven experience for this region. Two common pre-plant fertilizers used in this region are 16-16-16 and 16-20-0.

C. Procedures

1. Soil Analysis Most soils in this area are alkaline and of poor quality (lacking essential nutrients for proper growth and development), texture, and structure, ranging from coarse decomposed granite to hard packed clay (hard pan). A complete soil analysis will determine the condition, deficiencies and provide recommendations for amendments to the planting area with water conservation in mind. Such an analysis should give the following information.

- Soil pH
- Electrical Conductivity (EC)
- Sodium Absorption Ratio (SAR)
- Cation Exchange Capacity (CEC)
- Soil texture.
- Amount and types of salts.
- Available amount of macro and micro nutrients.
- Boron levels.

2. Soil Preparation of Turf Areas

Foreign matter such as building rubble, wire, cans, sticks, etc. and rocks greater than 1-1/2 inch diameter shall be removed from the top 4" of soil. No turf grass sod or seed shall be planted on soil which has been chemically treated until sufficient time has elapsed to permit dissipation and degradation of all toxic materials. Preparation of all turf areas shall have amendments or as

recommended by soil analysis. Quality topsoil or humus shall be relatively dry organic matter, shall not contain noxious vegetation, salts, pathogenic organisms, herbicides, or chemicals that could inhibit plant growth. Top soil mix shall be uniformly mixed and placed no less than 2" deep and incorporated to a depth of no less than 6" deep except in areas where tree or shrub roots are known to grow. An exception to the above soil preparation in planting areas may be permitted with owners consent or request. After tilling, rake to grade then roll with drum roller ½ full of water to firm the surface. Raking and rolling should be done in different directions until firm and smooth. Apply a starter fertilizer at a rate of ¾ to 1 pound of actual N (nitrogen) per 1,000 square feet and rake into soil no more than ½ inch; example a 16-20-0 fertilizer should be applied at 4.7 to 6.25 pounds per 1,000 square feet. Grade next to sidewalks, driveways etc. should be approximately 2 inches below the hard surface if sodded and even to hard surface if seeded. If needed, pH correction material shall be applied at a rate sufficient to correct the pH to a range of 6.5 to 7.2. Soluble salts shall not be higher than 500 parts per million.

3. Sod

a. Standards of Quality All shipments of turfgrass sod shall be accompanied by an invoice or sales slip indicating quality and whether the material is of a single variety, a blend or a mixture. Any sod in which one variety of any species makes up in excess of 90% of the turf shall be sold as that variety. Blends of species each being less than 90% shall be labeled as such and the species identified.

b. Quality Grades

1) Premium Grade turfgrass sod shall contain only the species and variety of turfgrass shown on the invoice and no weeds or foreign grasses.

4. Turf Installation

a. Seeding:

Spread the seed with a broadcast spreader following the below rates per 1,000 square feet making several passes in different directions.

Species of grass	**Pounds per 1,000 sq. ft**
Kentucky bluegrass	5
Creeping and chewing fescue	6
Tall fescue	8

Seed shall be raked in and covered lightly with ¼ - ½ inch organic matter. The top layer of soil must be kept constantly moist until grass is established and mowed for the first time. Watering should be done 3-8 times per day depending on weather conditions. Pooling and flooding shall be avoided to prevent drowning or washing away of the seed. First mowing shall be done when the grass has reached 3 inches tall and cut at 2 inches or higher. Continue mowing at this height until the grass has filled in. Seeding in spring and fall is preferred. Midsummer seeding and watering may predispose the seed to damping off disease.

- Blends of different species as listed below is suggested to reduce monoculture problems.

Rye Blue Grass Mix

%	Contents
55	perennial rye
25	creeping red (fine) fescue
20	Kentucky blue grass

Blue Grass Rye Mix

%	Contents
50	blue grass
50	rye grass

b. Sod:

Turfgrass sod shall be harvested, delivered and installed/transplanted within a period of 24 hours, unless suitable preservation methods have been implemented. Soil will be moist prior to installation and kept moist as sod is being laid. Rolls that are on the pallet should be kept moistened until laid. A square corner or straight border shall serve as the first row to start laying sod. Seam or join the pieces together so as not to leave gaps between rolls. Seams shall be staggered by starting every other row with a half roll. Fitting sod into odd shaped areas should be accomplished by cutting with a sod knife or serrated knife. As the sod is being laid it shall be immediately watered. After installation, the lawn shall be rolled with a roller containing ½ volume of water to remove uneven areas and to ensure good sod to soil contact. After installation the lawn area shall be irrigated thoroughly to a depth of 6" to 8" and watered at least 3 to 4 times a day. Over watering and pooling should be avoided. Watering times should be at 6 a.m., 9a.m., noon and 3 p.m. This irrigation schedule should continue until sod cannot be pulled up as the roots are established.

6. **Edging** shall be installed as needed on site where shrub beds border turf areas. Edging shall be composed of rust resistant metal, plastic, treated wood, concrete, brick or other approved material as agreed upon by owner or designer. Vertical edging should be set no less than 6" deep below grade for bluegrass turf areas and 4" deep for fescue and other clump grasses. Horizontal edging (usually concrete or brick) should be no less than 6" wide. Such procedures will prevent grass from encroaching into plant beds.

PART III LAND FILL, GRADING AND DRAINAGE

A. Provisions:

All of the provisions of the General Conditions and any applicable divisions elsewhere in these standards/document shall apply to this section.

B. Materials:

Fill material shall be of known origin; free of noxious weeds, contaminates such as soil active herbicides, pathogenic organisms or other chemicals that can inhibit plant growth.

C. Procedures

1. Drains and drainage piping shall conform to current standards as defined by state and local building standards.
2. Berms shall be no more than a 1 to 3 ratio of rise to run.
3. French drains shall be constructed with 3" minimum semipermeable or perforated PVC or ADS pipe installed subsurface. Pipe shall have drainage holes facing downward and centered in the drainage ditch. Drainage ditch shall be no less than 8"-12" deep with pea gravel or ¾" minus washed river rock or fractured rock.
4. Turf grade shall be no less than 2%-3% slope.
5. Grade shall slope away from building and towards the street at a minimum of ½" per foot. High point of grade at foundation shall be 6" minimum below finish floor grade unless foundation serves as a retaining wall to soil grade.

PART IV IRRIGATION

A. Provisions:
All of the provisions of the General Conditions and any applicable divisions elsewhere in these standards/document shall apply to this section.

B. Scope:
Contractor is responsible for irrigation installation, retrofitting and adjustments to accommodate water requirements of specified plant material. This includes, but is not limited to: the supply, material quality and installation of pipe and fittings, backflow prevention devices, valves and valve boxes, controllers and control circuits, sprinkler heads and risers, auto-drain valves, and drip irrigation. Installation and materials shall emphasize water conservation.

C. Design Plans: (graphic presentation) shall include clear and specific drawings on reproducible sheets with all components symboled and keyed. Plans shall display points of reference (buildings, existing trees, hardscaping, etc.). Additional information shall include:

- North arrow or plan north arrow.
- Linear scale given in inches to feet in written form and may have a bar scale.
- Name, address and phone number of location where work is to be done.
- Name, address and phone number of owner.
- Name, address and phone number of landscape designer.
- Date when plans were drafted.
- Outline and/or identity of existing structures, utilities, hardscapes, signage, light fixtures, plants that are to remain, and other necessary features

Location of the following shall also be included in the plans:

- Points of connection (POC) including exact location of POC together with tie-in fittings, where known. Type, size and length of meter service piping.
- Routing of main and lateral lines.
- Gate and specialty valves.
- Backflow prevention devise (BPD).

- Sprinkler control valves (remote control valves).
- Quick coupling valves.
- Sprinkler head location (pop-up sprays, rotary/impact heads).
- Controller location.
- Lateral drip tubing.
- Other related equipment as needed.

1. **Pressure**
   - Systems shall be designed to the lowest static or dynamic pressure available in any twelve month period.
   - Pressure regulation valves shall be required when the available static pressure exceeds the design pressure by more than 25 psi.
   - Pressure within a zone shall not exceed the intended sprinkler head design pressure by more than 20% without the use of pressure compensating device.
2. **Zoning** Separate zones (areas controlled by a single valve) shall be provided for turf, shrubs, ground covers and trees, raised planters or pots, and whenever possible northeast and southwest sun exposures and areas of total shade and south slopes exposed to sun to maximize water usage and reduce waste. No single zone shall be designed with sprinkler heads of differing precipitation rates or pressure requirements (e.g. bubbler heads, spray heads, rotor heads or drip heads shall not be mixed in the same zone or valve).
3. **As-Built Plans** shall be furnished upon completion of installation to the owner showing all changes made to the original plans to simplify troubleshooting in the future. Such plans shall be diagrammatic and approximate to reflect changes and adjustments as necessary from original plans to meet conditions in obtaining complete water coverage.

D. Materials:

1. Main line pipes shall be PVC schedule 40 pipe. Size shall be dependent on GPM (gallons per minute) flow, static pressure and distance from POC (point of connection) to last zone.

2. Lateral line pipes shall be PVC schedule 40 or class 200 sized per zone.

3. Wires shall be 12, 14, or 18 gauge. 12 and 14 gauge shall be single strand and 18 gauge shall be multiple strand. All wires should be UL underground approved (UL direct burial plastic coated wire).

4. Irrigation heads

- **Spray heads** shall be used in lawn areas where spacing of 15' or less is desired.
- **Rotary/impact heads** shall be used in lawn areas where spacing greater than 15' is desired.

5. Controller/timers shall be capable of watering a minimum of three cycles per day with multiple programs.

6. Lateral drip tube shall be polyethylene or flexible pvc. ½" diameter up to 200 feet from valve and ¾" diameter for runs greater than 200 feet.

7. Drip distribution tube (often called spaghetti) shall be 7/32" or ¼" tube that is run from ½" or greater drip tube to immediate plant vicinity with emitter controlling distribution volume.

8. Laser tubing is typically used in densely planted flower and groundcover plant beds and can be used around trees to distribute low volumes of water over a greater surface area to minimize evaporation.
9. Micro sprays are above ground fan like sprayers typically used in densely planted flower and groundcover plant beds. Especially useful with plants requiring high humidity. Spacing is dependent on density of plantings.
10. Main supply or ball valves shall be brass construction, non-rising stem, mainline size.
11. Valve boxes shall provide 6" minimum clearance on all sides to allow for operation and service.
12. Electric Remote Control Valves. A remote controlled solenoid operates valve which is activated by the controller/timer which can be plastic or brass. When used for drip irrigation, a pressure regulator and wye strainer should be installed.
13. Backflow Prevention Devices (BPD) shall be installed as required by local authorities, and details set forth by Truckee Meadows Water Authority & Washoe County Health Department or local governing body. Options include:

a. Reduced Pressure (RPA) and Double Check (DC) backflow preventers shall be installed with a minimum clearance of 12" between the bottom of the valve and finished grade. RP devices should be installed so as access for maintenance is easy. Installation shall be located close to drainage so water discharge is disposed of quickly.

b. Pressure Vacuum Breaker (PVB) assemblies shall be installed no less than 12" above highest water outlet eg. head, emitter, valves, etc..

c. There shall be one Atmospheric Vacuum Breaker (AVB) down stream of each remote control valve and 12" above highest water outlet.

14. Emitters shall typically emit ½, 1, and 2 gallons per hour. The use of pressure compensating emitters is recommended to adjust for changes in elevation, or long runs etc. that may cause pressure fluctuation.

E. Procedures

1. Locating Underground Services must be done 2 working days prior to digging by calling U.S.A. North 1-800-642-2444 or 1-800-227-2600. These include natural gas lines, telephone cables, electrical cables, etc.
2. Remote Control Irrigation Valves shall be installed in planter beds whenever possible. Valve box shall be large enough to allow for ease of access and/or necessary repairs. Install valve manifold with unions or manifold tees of some type. Extra wire shall be coiled in valve box to accommodate servicing. Valves should be installed with water proof connectors (eg. King connectors, 3M – DBY, or Spears DS-300 or newer products as they become available) to prevent electrical shorts and damage to valves or controllers. A minimum 3" depth of drain rock shall be installed in the bottom of the valve box to allow for adequate drainage, and a 4" stand pipe and cap shall be installed for manual drains and gate valves.
3. Pipe and Control Wires shall be installed and snaked in common trenches whenever possible.

4. **Main lines** shall be no less than 18" below grade and **lateral lines** shall be no less than 12" below grade. Backfill for trenches shall be free of rocks, debris, and should be compacted so that settlement and concaving of trenches does not occur.
5. **Manual Drains or Auto Drains** shall be installed on mainline at lowest point to allow for drainage. A brass gate valve or compression style globe valve with a cross handle top should be installed if manual drains are selected. One half cubic foot of drain rock shall be installed below manual drains to allow for drainage. A breathable filter fabric around the rock should be used to separate the rock from the soil to prevent contamination.
6. **Automatic Drains** should be installed on all low points of lateral lines. One half cubic foot of drain rock shall be installed below auto drains to allow for drainage. A breathable filter fabric around the rock should be used to separate the rock from the soil to prevent contamination.
7. **Flush Piping System** to free system of all debris before installing all irrigation heads, drip emitters, and bubblers. This shall be done at the nearest head to the valves.
8. **Turf Irrigation Heads** shall be installed so maximum water efficiency can be achieved. Heads shall be installed so that the top is flush with finished grade allowing room for sod when necessary. Heads should be installed with a swing joint or swing pipe assembly to allow for horizontal and vertical movement or adjustments. Pop up heads should rise no less than 3" above grade during operation to allow for clearance over grass blades. Head should be set within one-half inch of level with the compacted and settled finish grade. Spacing shall be head to head or less for proper coverage. In areas of high wind head to head spacing should be reduced. Heads shall be closer at top of slopes and further apart at slope base – never exceed head to head spacing.
9. **Drip Irrigation Remote Control Valves** shall have a filter and pressure reducer to insure adequate filtration and prevent fittings and emitters from blowing off tubing. Tubing shall be installed under mulch and staked down to keep stable. Drip irrigation should typically have two emitters per shrub, three emitters per tree (dependent on plant size at planting and each plant's particular water needs) spaced at the perimeter of the root ball/container or edge of planting area. If plants are on a slope, emitters shall be located on uphill side of root ball
10. **Bubblers** shall be used to water shrubs and trees only.
11. **Pipe Connecting Compounds and Gluing**
    a. **PVC Threaded Connections** shall use 3 to 5 wraps of teflon tape.
    b. **Metal Connections** shall use teflon based pipe compound.
    c. Never use pipe dope on automatic control valves per manufacturers recommendations. Follow manufacturers recommendations for gluing based on pipe and fitting sizes, types, temperature, moisture, etc.