PSD TECHNICAL
SPECIFICATION

DIVISION 03
Concrete

Table of Contents

SECTION 03 05 00 – COMMON WORK RESULTS OF CONCRETE

Part 1: General

1.01 Summary
- A. Consider crushing and reusing hardened concrete as fill or as a base course for pavement or as aggregate in concrete mix.
- B. Source materials regionally where feasible.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required
- A. Provide appropriate documentation for recycled content materials and/or for the origin of regionally sourced materials.

1.05 Quality Assurance
- A. For mixes that include recycled content, comply with ASTM C 595 regarding mix design in lieu of Portland cement.
- B. For the use of fly ash in mixes, comply with ASTM C 618, Class N, F, C. Report chemical analysis of fly ash in accordance with ASTM C 311. Evaluate and classify fly ash in accordance with ASTM D 5759.
- C. For use of slag in mixes, comply with ASTM C 989.
- D. For use of silica fume in mixes, comply with ASTM C 1240.

1.06 Scheduling

1.07 Delivery, Storage, and Handling
- A. Contractor shall submit tickets for all concrete delivered to site.
  1. Quantity delivered.
  2. Actual quantity of each material in batch.
  3. Outdoor temperature in full sun and shade.
  4. Time at which cement was added.
  5. Time truck left plant, arrived on-site and finished pour.
  6. Numerical sequence of the delivery.
  7. Quantity of water that can be added in the field based on mix design and quantity of water actually added.
  8. Free moisture in fine and coarse aggregate on percent by weight.
  9. Temperature of batch.

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products
- A. COMPOUNDS, HARDENERS, AND SEALERS
  1. Curing and Compounds: ASTM C309 Type I Acrylic Base
     - i. Sonneborn “Kure-N-Seal W”,
     - ii. Dayton Superior “Day-Chem Cure and Seal (J-21)”, or
     - iii. Approved Equal.
  2. Products shall not interfere with bond of adhesive applied flooring.

Part 3: Execution

3.01 Preparation

3.02 Installation

A. INTERIOR SLABS ON GRADE
    1. Allow a minimum of 90 days between the placing of floor slab and installation of joint filler. Thoroughly clean joints of all dirt, laitance and foreign materials.
    2. Saw Cut Joints: Vacuum clean.
    3. Construction Joints: Re-cut to 2 inches deep. Vacuum clean.
    4. Completely fill joints with filler to bottom of saw cuts without use of backer rod. If crack below saw cut needs to be filled to prevent filler loss, close crack with silica sand. Install filler per manufacturer's printed instructions. Clean residue with manufacturer's solvent. Do not open to traffic until filler has cured per manufacturer's printed instructions.
    5. Vapor barrier goes on top of the gravel, directly beneath the concrete.

3.03 Cleaning and Protection

END OF SECTION 03 05 00

SECTION 03 45 00 – PRECAST ARCHITECTURAL CONCRETE

Part 1: General

1.01 Summary
- A. Wall Copings
- B. Supports, Anchors and Grouting
- C. Cleaning and Sealing Unit

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance
- A. Erection shall be done by qualified masons having experience in the successful installation of similar architectural precast work.
- B. Offset from true alignment between two connecting members: 1/4 inch maximum.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers
- A. Precasters:
    1. Continental Cast Stone Manufacturing, Inc.
    2. Fort Collins Precast, Inc.
    3. Approved Equal.
- B. Surface Sealer:
    1. Dayton Superior Weather Worker S-40, or approved equal.
    2. VOC compliant, 40 percent silane sealer; non-darkening; no surface film.
- C. Cleaner: ProSoCo Products, Inc., "Sure Clean" No.600, or approved equal.
- D. Surface Retarder: Burke "True Etch" form retarder and True Etch Release

2.02 Products
- A. JOINT SEALANTS: Polyurethane sealants with appropriate backer rods.

Part 3: Execution

3.01 Preparation

3.02 Installation

A. Apply 2 part masonry setting epoxy in drilled holes to receive dowels and anchor slots.
B. Set units on top of ice and waterguard membrane using shims to provide correct mortar joint height. Remove shims when epoxy is dry and before sealant application. Slush vertical joints full with mortar
C. Bed and head joints shall be 3/8 inch thick; maintain uniform joints. Set units in mortar raking joints back for sealant installation.
D. Tuck point Precast stone units with pointing mortar and tool joint concave to match adjacent brick masonry.

3.03 Cleaning and Protection

END OF SECTION 03 45 00

SECTION 03 60 00 – GROUT

Part 1: General

1.01 Summary

A. Under steel column bearing plates.
B. Under steel beam bearings.
C. Under precast concrete column covers.
D. At elevator sills.
E. Under site lighting standard base plates.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

A. Product Data
B. Samples

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products

A. NON-SHRINK GROUT OR DRYPACK:
    1. Acceptable Manufacturers and Products:
        i. Non-Metallic Grout: Meet performance requirements of ASTM C1107. Use one of the following:
            a. U.S. Grout Corporation "Five Star Grout".
            b. Master Builders "Master Flow 928".
            c. L&M Chemicals "Crystex".
            d. Euclid Chemical Company "HiFlow".
            e. Cormix Construction Chemical Co. "Supreme".

f. Or approved equal.

2. Provide minimum 28-day compressive strength of 6000 psi.

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

END OF SECTION 03 60 00

PSD TECHNICAL
SPECIFICATION

DIVISION 31
Earthwork

Table of Contents

SECTION 31 00 00 – EARTHWORK

Part 1: General

1.01 Summary
- A. Clearing, grubbing and site preparation
- B. Removal and disposal of debris
- C. Handling, storage, transportation, and disposal of excavated material
- D. Sheeting, shoring, bracing and protection work
- E. Pumping and dewatering as required or necessary
- F. Backfilling
- G. Pipe embedment
- H. Construction of fills and embankments
- I. Excavation for buildings & structures
- J. Trench stabilization
- K. Final grading
- L. Slope stabilization
- M. Erosion control
- N. Appurtenant work

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required
- A. Submit under provisions of Division 1 specifications.
- B. Product Data
- C. Test Reports

1.05 Quality Assurance
- A. All imported material to be free of hazardous and organic wastes, “clean” as defined by EPA, and approved for its intended use by the Owner or project geotechnical engineer.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements
- A. Burning will not be allowed on-site.
- B. ENVIRONMENTAL REQUIREMENTS
  1. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling
  2. Protect work from erosion or other similar types of damage until the project has been completed. Maintain and leave protection in place until permanent erosion control and soil stabilization is effective.
  3. Do not backfill or construct fills during freezing weather. Backfill or construct fills only when temperature is 35°F and rising.
  4. Do not use frozen materials, snow, or ice in any backfill or fill area.
  5. Do not backfill or construct fill on frozen surfaces.
  6. Protect excavated material from becoming frozen.
  7. Do not remove trees from outside excavation or fill areas unless authorized by the Owner; protect from permanent damage by construction activities
  8. Provide temporary bridges for roadways, walkways, driveways, etc. as construction conditions warrant.

Part 2: Products

2.01 Manufacturers

2.02 Products

A. General - Soil materials, whether from sources on or off the site must be approved by the soils engineer as suitable for intended use and specifically for required location or purpose.

B. Classification of Excavated Materials:
   1. Remove and handle all excavated materials regardless of its type, character, composition, condition, or depth.
   2. Transport and properly dispose of any rubble and waste materials found in excavation off the Owner's property.

C. Fills and Embankments
   1. To the max extent practical use excess earth from onsite excavation for fills and embankments.
   2. Obtain additional material from offsite as necessary. Imported fill material must be acceptable to the Owner and Engineer or Geotechnical Engineer.
   3. Material must be free from rocks or stones larger than 12 inch in greatest dimension and free from brush, stumps, logs, roots, debris, and organic and other deleterious materials.
   4. Fill and embankment material must be acceptable to Engineer.
   5. No rocks or stones larger than 6 inch in upper 18 inches of fill or embankment.
   6. Where allowed, distribute rocks and stones through the fill to not interfere with compaction.

D. Imported Structural Fill
   1. Limits extend a minimum of 2 feet beyond back of proposed pavement, slabs, curbs and walks.
   2. Imported structural fill, such as a minus ½-inch CDOT Class 7 Aggregate Road Base, conforming to the following:
      i. Gradation: 1" – 100% passing (percent finer by weight ASTM C136), No. 8 Sieve – 20-85% passing, and No. 200 Sieve – 20% (max).
      ii. Liquid Limit: 35 (max), Plasticity Index: 15 (max), R- Value: 50 (min).

E. Imported Fill
   1. Imported fill conforming to the following:
      i. Gradation (percent finer by weight ASTM C136): 3" – 100% passing, No. 4 Sieve – 50-100% passing, and No. 200 Sieve – 35% passing (max).
   2. Liquid Limit: 35 (max), Plasticity Index: 15 (max), Group Index: 10 (max).

F. Topsoil
   1. Topsoil is defined as friable (easily crumbled) clay loam surface soil, with high organic content, found in a depth of not less than 4" below existing grade. Excavate acceptable material further to provide all topsoil necessary for project needs
   2. Clean topsoil, free of plants and seed will be spread to 4" minimum depth for areas of the site.
   3. Dispose of grubbings, including any plant material and seeds, offsite.
   4. Stockpile of all remaining topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of rocks, stumps, stones larger than 2" in any dimension, and other extraneous or toxic matter harmful to plant growth for areas to be seeded or planted.

G. Pipe Embedment: Graded gravel
   1. Washed rock - 1½ inch minus

Sieve Size (Inch)	2	1½	1	¾	½	3/8
Percent Passing by Weight (%)	100	95-100	80-95	30-45	10-25	<1

2. Squeegee

Sieve Size (Inch)	3/8	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
Percent Passing by Weight (%)	100	85-100	30-70	5-40	0-15	0-10	0-5	<1

H. Compacted Trench Backfill
   1. Job excavated material finely divided, free of debris, organic material, and stones larger than 3 inch in greatest dimension without masses of moist, stiff clay, or topsoil.

I. Trench Cover
   1. Free of brush, debris and roots.
   2. May contain rubble and detritus from excavation, stones and boulders if well separated and arranged not to interfere with backfill settlement.
   3. In upper 18 inch no rock or rock excavated detritus, larger than 6" except with specific approval of Engineer.
   4. No stones larger than 6 inch in greatest dimension within 3 feet of top of pipe.

J. ACCESSORIES
   1. Silt Fence Fabric: woven polypropylene
      i. Mirafi 100X, "Envirofence"
      ii. Or accepted equal

Part 3: Execution

3.01 Preparation

A. EXAMINATION
   1. Field verify the location of all underground utilities, pipelines and structures prior to excavation.

B. PERFORMANCE—GENERAL
   1. Perform work in a safe and proper manner with appropriate precautions against hazard.
   2. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities.
   3. Contain all construction activity on the designated site and limits of work.
   4. Cost of restoration off site will be born by the Contractor.

C. PRESERVATION OF TREES
   1. Protect trees left standing from permanent damage by construction operation.

D. PREPARATION
   1. Clear all site areas to be occupied by permanent construction of grasses, roots, brush, and other objectionable material and debris.
   2. Clean and strip subgrade for fills and embankments of surface vegetation, sod, tree stumps and organic topsoil.
   3. Remove all waste materials from site and dispose.
   4. Remove debris, all trees, underbrush, stumps, roots and other combustible materials from site daily and dispose of off-site; on-site burning is not permitted.

3.02 Installation

A. TOPSOIL
   1. Strip on-site material meeting the topsoil definition to a minimum depth of 4 inches for all areas receiving grading.
   2. At the completion of work in each area, place and grade topsoil to maintain gradient is required. Roughen surface for erosion control.

B. DEWATERING

1. Provide and maintain adequate dewatering equipment (including power supply, if necessary) to remove and dispose of surface and groundwater entering excavations, trenches, and other parts of the work.
2. Keep each excavation dry during subgrade preparation and continually thereafter until the structure to be built or the pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
3. Dewater excavations which extend to or below groundwater by lowering and keeping the groundwater level beneath such excavation at least 12 inches below the bottom of the excavation.
4. Divert surface water or otherwise prevent it from entering excavated areas or trenches to the extent practical without damaging adjacent property.
5. Maintain all drainage pipes, keep clean and free of sediment during construction and final cleanup.
6. Dewatering to surface waterways requires Colorado Department of Public Health and Environment dewatering permit. Obtain dewatering permit and comply with discharge requirements therein, if necessary.

C. SHEETING, SHORING AND BRACING
1. Provide proper and substantial sheeting, shoring, and bracing, in accordance with OSHA Standards as required, to prevent caving or sliding, to protect workmen and the Work, and to protect existing structures and facilities
2. Design and build sheeting, shoring, and bracing to withstand all loads that might be caused by earth movement or pressure, and to be rigid, maintaining shape and position under all circumstances.
3. Do not pull trench sheeting before backfilling unless pipe strength is sufficient, to carry trench loads based on trench width to the back of sheeting.
4. Do not brace sheeting left in place against the pipe, but support it in a manner that precludes concentrated loads or horizontal thrusts on pipe.
5. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment is completed.

D. TRENCH STABILIZATION
1. Thoroughly compact and consolidate subgrade for concrete structures, precast structures, and utility trench bottoms so they remain firm, dense and intact during required construction activities.
2. Remove all mud and muck during excavation.
3. Reinforce subgrade with crushed rock or gravel if they become mucky during construction activities.
4. Finished elevation of stabilized subgrade are to be at or below subgrade elevations.
5. Allow no more than ½ inch depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon

E. EXCAVATION FOR STRUCTURES
1. Excavate to elevations and dimensions within a tolerance of plus or minus 0.10 foot.
2. Soils shall be excavated to various depths below foundation elevation according to structural foundation plan.
    i. The subexcavation shall be configured at a minimum side slope inclination of 1(horizontal):1(vertical) from the toe of the subexcavation slope. The toe of the subexcavation slope shall be no closer than 5 feet outside the outermost edge of all concrete footings or building boundaries laterally, whichever is larger. Slope shall

continue to the proposed surface grades. Remove soft or otherwise unsuitable material, and replace with suitable material in excavation.

3. Provide dewatering and temporary drainage as required to keep excavations dry.

F. PAVEMENT OVEREXCAVATION AND SUBGRADE PREPARATION
   1. Excavate subgrade for drives and parking per the lines, grades, and dimensions within a tolerance of plus or minus 0.10 foot.
   2. Overexcavate and scarify existing soil as required under pavement areas, slabs, curbs and walks to meet the moisture and compaction specifications required.
   3. Place imported structural fill per plans and compaction specification herein. Extend a minimum of 2 foot beyond back of proposed pavement, slabs, curbs and walks.
   4. Reshape subgrade and wet as required

G. FILLS AND EMBANKMENTS
   1. Level and roll subgrade so surface materials will be compact and bond with the first layer of fill or embankment.
   2. Place in horizontal layers at maximum uncompacted depth per compaction specifications herein.
   3. Spread and level material deposited in piles and windrows before compacting.
   4. Thoroughly compact each layer by rolling or other means acceptable to Engineer to meet the moisture and compaction specifications herein.
   5. Alter compaction methods if material fails to meet specified density.
   6. Where a trench passes through a fill or embankment, place and compact fill or embankment to 12 inch above the top of the pipe before excavating the trench.
   7. Add water and harrow, disc, blade, or otherwise work each layer to obtain the uniform moisture content and adequate compaction.

H. COMPACTION
   1. Place backfill and fill materials in layers not more than 8 in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
   2. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure as described herein.
   3. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 698 as follows:
      i. For overexcavation areas under paving and structures, compact each layer of backfill or fill.
      ii. For fill under site features and concrete and asphalt pavements not within the public right-of-way, compact at 95 percent of maximum density within minus 2 to plus 2 percent of optimum moisture content. Compact in right-of-way to municipal standards and specifications.
      iii. At utility trench backfill, compact each layer of backfill at 95 percent maximum dry density to within minus 2 to plus 2 percent of optimum moisture content.
      iv. For fill under lawn or unpaved areas, scarify and compact the top 6 inches below subgrade and each layer of backfill or fill material to 90 percent maximum dry density to within minus 2 to plus 2 percent of optimum moisture content.
      v. Do not deposit or compact tamped or otherwise mechanically compacted backfill if frozen or if in water.
      vi. Take particular care to compact backfill which will be beneath slabs, pipes, drives, roads, parking areas, curb, gutters, or other surface construction.

I. BORROW OR SPOIL AREA

1. Obtain suitable material required to complete fill and embankments from approved offsite borrow area.
2. The location, size, shape, depth, drainage, and surfacing of borrow or spoil pits shall be acceptable to Owner of borrow area.
3. Make all areas regular in shape with graded and surfaced side and bottom slopes when completed.
4. Cut side slopes not steeper than 1:1 and uniform for the entire length of any 1 side
5. Final grade disturbed areas of borrow to uniform slope, 4:1 slope or flatter.
6. Use material free of debris and deleterious material.

J. BLASTING
1. Blasting or other use of explosives is not permitted.

K. TRENCH EXCAVATION
1. Establish alignment and grade or elevation from offset stakes.
2. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations.
3. Comply with pipe specification sections regarding vertical and horizontal alignment and max joint deflection.
4. Excavate trenches to provide a minimum depth of backfill cover over the top of pipe as follows. Coordinate depth of cover with utility owners. Increase depth as required by utility owner and at crossings.
    i. 1.5 feet for drainage piping
    ii. 2.5 feet for gas piping
    iii. 3.0 feet in paved or graded streets where surface grades are fixed
    iv. 5.0 feet for sanitary sewer and water piping
    v. 2.5 feet for electric conduit
    vi. Increase depth as required at vertical curves and for clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades.
5. Measure pipe cover depth vertically from top of pipe to finished ground or surface elevation.
6. Do not open more trench in advance of pipe laying than is necessary to expedite the work; not more than 200 feet.
7. REQUIRED~~,~~ Excavate trenches by open cut from the surface.
8. Limiting trench widths:
    i. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, embedment
    ii. If needed to reduce earth loads to prevent sliding, cut banks back on slopes which extend not lower than 1 foot above the top of the pipe
    iii. Stipulated minimum clearances are minimum clear distances, not minimum average distances
    iv. Max trench width from 6 inch above the top to trench bottom of the installed pipe: Pipe O.D. plus 24 inches
    v. Limiting trench widths and permissible clearances from 6 inches above top of pipe to trench bottom for installed pressure and non-pressure piping

Pipe Size (inch)	Minimum Trench Width	Maximum Trench Width
3	1’6”	2’6”
4	1’6”	2’6”
6	1’6”	2’6”

8	1’8”	2’8”
10	2’0”	3’0”
12	2’0”	3’0”
16	2’8”	3’8”
18	3’0”	4’0”
24	3’6”	4’6”
36	4’0”	5’0”

9. If the width of the lower portion of the trench exceeds the max permitted, provide pipe of adequate strength, special pipe embedment, or arch concrete encasement as required by loading conditions and as determined by Engineer.
10. Mechanical excavation
    i. Do not use where its operation would damage buildings, culverts, or other existing property, structures, or utilities above or below ground; hand excavate only in such areas.
    ii. Use mechanical equipment of a type, design, and construction and operated so that:
        a. Rough trench bottom elevation can be controlled.
        b. Uniform trench widths and vertical sidewalls are obtained from 1 foot above the top of the installed pipe to the bottom of the trench.
        c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls.
    iii. Do not undercut trench sidewalls.
    iv. Re-compact trench bottom disturbed by bucket teeth prior to placement of embedment material.
11. Except as otherwise required, excavate trenches below the underside of pipes for installation of granular embedment pipe foundation material.
12. Trench bottoms for 6 inches and smaller pipe may be excavated below pipe subgrade and granular embedment provided or the trench may be graded to provide uniform and continuous support (between bell holes or end joints) of the installed pipe.
13. Excavate to such depth below grade as Engineer directs and bring the trench bottom to grade with such material as Engineer may direct.
14. Provide concrete, or other foundations made necessary by unstable soil.
15. Excavate to provide adequate clearance for tools and methods of pipe installation.
16. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined.
17. Cuts in existing surface construction:
    i. No larger than necessary to provide adequate working space.
    ii. Cut a clean groove not less than 1½ inch deep along each side of trench or around perimeter of excavation area.
    iii. Remove pavement and base pavement to provide shoulder not less than 6 feet wide between cut edge and top edge of trench.
    iv. Do not undercut trenches, resulting in bottom trench width greater than top widths.
    v. Make pavement cuts to and between straight or accurately marked curved lines parallel to trench centerline or limits of excavation.
    vi. Remove pavement for connections to existing lines or structures only to the extent required for the installation, or as determined by Engineer.

vii. Where the trench crosses the drives, walks, curbs, or other surface construction, remove and replace the surface construction between saw cuts as specified for pavement.

L. PIPE EMBEDMENT

1. Embed pipes above and below the bottom of pipe.
2. Spread and surface grade granular embedment to provide continuous and uniform support beneath pipe at all points between pipe joints.
3. After grading, aligning, and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe and to hold the pipe in proper position and alignment during subsequent operations.
4. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent lateral displacement.
5. Granular embedment compact by slicing with shovel or vibrating
    i. 1. Maximum uncompacted thickness of layers: 6 inch
6. Compacted embedment: Place in horizontal layers at maximum uncompacted depth per compaction specifications herein. Thoroughly compact each layer to meet the moisture and compaction specifications herein.

M. TRENCH BACKFILL

1. Compacted backfill:
    i. For full depth of trench above embedment
    ii. Beneath pavements, surfacing, driveways, curbs, gutters, walks or other surface construction or structures
    iii. In street or highway shoulders
    iv. In established sodded areas
    v. Beneath fills and embankments
2. Where the trench for one pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench.
3. Place job excavated materials in 8 inch max uncompacted thickness, uniform layers
4. Increased layer thickness may be permitted for uncohesive if specified compacted density will be achieved.
5. Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe.
6. Thoroughly compact each layer to meet the moisture and compaction specifications herein.
7. Graded gravel:
    i. Deposit in uniform layers of 12 inch max uncompacted thickness.
    ii. Compact with suitable vibrating roller or platform vibrator to not less than 70 percent relative density per ASTM D4253/D4254.
8. Uncompacted backfill:
    i. Compaction of backfill above pipe embedment in locations other than those specified, is required only to prevent future settlement.
    ii. May be placed by any method acceptable to Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on, and will not result in displacement of installed pipe.
    iii. Do not drop compact masses of stiff clay or other consolidated material more than 5 feet into trench unless cushioned by 2 feet minimum of loose backfill above pipe embedment.

9. Finish the top portion of backfill with at least 4 inches of topsoil corresponding to, or better than, that underlying adjoining turf areas.

N. DRAINAGE MAINTENANCE
   1. Do not backfill trenches across roadways, drives, walks or other trafficways adjacent to drainage ditches or water courses prior to backfilling the trench on the upstream side of the trafficway to prevent impounding water after pipe is laid.
   2. Backfill so that water does not accumulate in unfilled or partially filled trenches.
   3. Remove materials deposited in roadway ditches or other water courses crossed by the trench line immediately after backfilling is completed and restore ditches and water courses to original section, grade, and contours.
   4. Do not obstruct surface drainage any longer than necessary.
   5. Provide and maintain temporary bridges and other structures across unfilled trenches as required to maintain traffic.

O. PROTECTION OF TRENCH BACKFILL
   1. Where trenches are constructed in ditches or other water courses, protect backfill from erosion.
   2. Install ditch checks where the ditch grade exceeds 1 percent.
      i. Minimum depth: 2 feet below the original ditch or water course bottom for the full bottom width
      ii. Minimum width: 18 inches into the side slopes
      iii. Minimum thickness: 12 inches

P. DISPOSAL OF EXCESS EXCAVATED MATERIALS
   1. Use excess excavated materials in fills and embankments.
   2. May dispose of up to 200 cubic yards of suitable excess excavated materials from onsite or offsite at locations on the site directed by Owner.
   3. Remove debris, junk, broken concrete, broken asphalt, rock, stones, stumps, logs, roots, and other unsuitable material from the site and dispose of it.
   4. Distribute excess earth from excavations located in unimproved property directly over the pipe trench and within the pipeline right-of-way to a max depth of 6 inch above the original ground surface elevation at and across the trench and sloping uniformly each way
      i. Carefully finish material thus wasted with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point.
      ii. Do not waste excess excavated material in the above manner where the trench lines crosses or is within a railroad, public road, or highway right-of-way.

Q. FINAL GRADING
   1. After completion of all other outside work and after backfilling is completed and settled, bring to grade at the elevations.
   2. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand work.
   3. Grade all surfaces for effective drainage, provide a 2 percent minimum slope except as otherwise required.
   4. Grade and surface to maintain gradient.

R. SLOPE AND CHANNEL STABILIZATION
   1. Cover channel banks, slopes or channel thalweg (water flow-line at deepest part of the channel) with erosion control fabric mat where grade is 3H to 1V or greater.
   2. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 6inch overlap minimum of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

3. Secure outside edges and overlaps at 48 inch intervals with 4-inch to 6-inch U-shaped type pins or wooden stakes depending on ground condition.
4. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
5. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.
6. Maintain integrity of erosion control fabric throughout installation.

S. SETTLEMENT
1. Warranty for settlement of all fills, embankments, and backfills is stipulated in the General Conditions from final completion of Contract under which Work is performed.
2. Repair or replace within 30 days after notice by Engineer or Owner.

T. FIELD QUALITY CONTROL
1. Provide under provisions of General Conditions and Division 1 Specifications.
2. Coordinate testing with Owner. Owner will provide all field testing to determine compliance of in-place and backfill materials and compaction in accordance with the specifications, and to verify design bearing capacities.
3. Fills and Embankment
    i. Two moisture-density relationship tests, ASTM D698, on each type of fill material
    ii. One in-place compaction test for each 5,000 square feet every 1.5 feet of vertical lift of material placed
    iii. Additional in-place compaction tests at the discretion of the Owner
4. Pipe Embedment and Backfill
    i. Two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate for each type of embedment on backfill material proposed, except granular embedment material.
    ii. One in-place compaction test every 200 lineal feet of trench in the compacted embedment zone and at every 1.5 feet of vertical lift of backfill materials, ASTM D2922/D3017.
    iii. One in-place compaction test near top of trench for trench depth of 2 feet or less, ASTM D2922/D3017.
    iv. Additional in-place compaction tests at the discretion of the Owner.
5. Pavement and Structural Subgrades
    i. At a minimum, two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate and adequate for each type backfill material proposed.
    ii. Perform tests for each footing, concrete site feature, and drainage structure subgrade. Perform tests at every 50 linear feet of subgrade of foundation walls, retaining walls, and curbing, pans, drainage features, walks, etc. (or portions thereof). Perform tests every 2,000 square feet required of building slab area, exterior slabs and pavement/flatwork areas (with no less that 3 tests). Test at subgrade and at every vertical lift of backfill materials placed.
    iii. Additional in-place compaction tests at the discretion of the Owner

U. BUILDING PAD RESHAPING
1. Building Pad Approval
    i. Overlot grading has taken place prior to the award of this Contract. Responsible for discing and reshaping the building pad area for those locations which have been damaged by freezing temperatures, frost, rain, accumulated water or construction activities.
    ii. Certify subgrade elevations and compaction for the building pad.

iii. If Architect/Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material.
iv. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

3.03 Cleaning and Protection

END OF SECTION 31 00 00

SECTION 31 10 00 – SITE CLEARING

Part 1: General

1.01 Summary
- A. Section Includes, but is not limited to:
  1. Removal of surface debris.
  2. Removal of paving and curbs.
  3. Removal of trees, shrubs, and other plant life.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance
- A. Coordinate clearing work with Utility Companies. Comply with their requirements.

1.06 Scheduling

1.07 Delivery, Storage, and Handling
- A. ENVIRONMENTAL REQUIREMENTS
  1. Observe environmental precautions based on conditions.
  2. Conform to applicable ordinances and codes for dust and erosion control, disposal of debris, use of herbicides, and other environmental requirements.

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products
- A. Herbicide:
  1. "Round Up" by Monsanto Agricultural Products

Part 3: Execution

3.01 Preparation
- A. Verify that existing plant life designated to remain is tagged or identified.

3.02 Installation

3.03 Cleaning and Protection
- A. PROTECTION
  1. Locate, identify, and protect from damage utilities that remain.
  2. Protect existing trees, plant growth, and features.
  3. Protect bench marks, and survey control joints from damage or displacement.
- B. CLEARING
  1. Clear areas required for access to site and execution of Work.

2. Clear undergrowth and deadwood, without disturbing subsoil.
3. Apply herbicide to remaining stumps and vegetation to inhibit growth.

C. REMOVAL
1. Remove trees and shrubs within marked areas. Remove stumps and root systems to depth of 3 feet.
2. Remove debris, rock, and extracted plant life from site.
3. Remove paving and curbs as required to connect to existing.
4. Remove debris from site clearing operations from the site.

END OF SECTION 31 10 00

SECTION 31 23 00 – EXCAVATION AND FILL

Part 1: General

1.01 Summary
A. This section covers excavation and trenching, including drainage, preparation of subgrades, pipe bedding, backfilling, compacting, and finish grading for underground pipelines and appurtenances.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance
A. "CDOT" refers to Colorado Department of Transportation designations in their "Standard Specifications for Road and Bridge Construction."
1. When CDOT is referenced herein.

1.06 Scheduling
A. Right-of-Way.
1. 1. In developed areas haul and stockpile excess material or erect suitable bulkheads to prevent deposition of excavated material where right-of-way or easements are not adequate to stockpile all excavated material without depositing it on private property.

B. Drainage and Groundwater.
1. Maintain excavations and trenches free from water during construction.
2. Remove water encountered in the trench to the extent necessary to provide a firm subgrade, to permit joints to be made in the dry, and to prevent the entrance of water into the pipeline.
3. Divert surface runoff and use sumps, gravel blankets, well points, drain lines or other means necessary to accomplish the above.
4. Maintain the excavation or trench free from water until the structure, or pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
5. Uncontaminated groundwater shall be prevented from entering into previously constructed pipe. Groundwater contaminated by sanitary waste shall be discharged into the sanitary sewer.
6. The pipe under construction shall not be used for dewatering.

C. Sequencing.
1. Perform pipeline installation within 50 linear feet of trench excavation.

2. Perform trench backfill within 50 linear feet of pipe installation.
3. Perform clean-up within 200 linear feet of trench excavation.
4. Where excavation is a hazard to automotive or pedestrian traffic, the amount of open trench and the time duration of that opening is to be minimized.
5. Maintain access to private residence and businesses.

D. Underground Obstructions.
1. Locate and verify all underground utilities and obstructions.
2. Maintain, protect and support by shoring, bracing or other means existing utilities, appurtenances and structures.
3. Take such protective measures as the utilities may direct where protection, alternations or moving of the utilities is required.

E. Weather.
1. Do not backfill or construct fills or embankments during freezing weather.
2. Do not place backfill, fill or embankment on frozen surfaces.
3. Do not place frozen materials, snow or ice in backfill, fill or embankments.
4. Do not deposit, tamp, roll or otherwise mechanically compact backfill in water.

1.07 Delivery, Storage, and Handling

A. Storage.
1. Provide adequate and orderly storage of excavated material adjacent to Work.
2. Pile suitable material for backfilling in an orderly manner a sufficient distance from banks or trench or excavation to avoid overloading and to prevent slides or cave-ins.
3. Do not stockpile excavated materials against existing structures, Work, or appurtenances.
4. Excess excavated material will not remain on job site for more than one (1) month.

1.08 Regulatory Requirements

A. MAINTENANCE AND CORRECTION
1. Scarify surface, reshape, and compact to required density completed or partially completed areas of work disturbed by subsequent construction operations or by adverse weather.
2. Maintain and correct backfill, fill and embankment settlement and make necessary repairs to pavement structures, seeding and sodding which may be damaged as a result of settlement for period of one (1) year after Substantial Completion and acceptance of the Work.

Part 2: Products

2.01 Manufacturers

2.02 Products

A. GENERAL
1. All material shall be free from frozen matter, stumps, roots, brush, other organic matter, cinders or other corrosive material, debris, broken asphalt and concrete, and any other material that is not suitable in the opinion of the Town.
2. If job excavated material is not sufficient or suitable, suitable material shall be imported. All imported material shall have a liquid limit not greater than 30 and a plasticity index not greater than 6.

B. STABILIZATION MATERIAL
1. Top 6 inches of pipe subgrade - If the existing soil in the trench bottom is judged to be unsuitable the top 6-inches of the pipe subgrade shall be removed and replaced with a stabilization material.
i. Stabilization material is crusher-run rock, conforming to ASTM D448, size #357.

Size	2 ½"	2"	1"	½"	#4
Percent Passing	100	95-100	35-70	10-30	0-5

2. Geotextile: CDOT, Section 712.08, Class A Table 712-2.
3. Subgrade below top 6 inches - Same as top 6 inches except that broken concrete and rock may be included in sizes permitting compaction without discernible voids.
    i. Alternative materials for stabilization of sub-grade will be considered for use as approved by the Town and Engineer.

C. BEDDING MATERIALS

1. Definition: Materials placed from the subgrade to an elevation 12 inches above the top of pipe.
2. Granular material.
    i. Angular crushed rock, conforming to CDOT #67.

Size	1"	3/4"	3/8"	#4	#8
Percent Passing	100	90-100	20-55	0-10	0-5

    ii. Or, well-graded angular crushed rock: 95% passing a one (1) inch sieve and not more than 5% passing a No. 4 sieve.
3. Concrete.
    i. Compressive strength: 4000 psi at 28 days minimum.
    ii. Class A concrete, reference Colorado Department of Transportation, Division of Highways, State of Colorado "Standard Specifications for Road and Bridge Construction".
4. Barrier material.
    i. Soil Classification.
        a. GC - clayey gravels, gravel-sand-clay mixtures.
        b. SC - clayey sands, sand-clay mixtures.
        c. CL - inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, clean clays.
        d. Material shall not be lumpy or hard but shall be finely divided, suitable, and free from stones.
5. Bedding material for service lines less than four (4) inches in diameter shall be sands or silts and clays meeting the Unified Soil Classification types ML or CL. Material shall not be lumpy or hard but shall be finely divided, suitable, and free from stones greater than ½ inch in its largest dimension.

D. TRENCH BACKFILL MATERIAL

1. Trench backfill material shall be placed from a point 12-inches above the pipe to 6-inches below the ground surface, to bottom of topsoil layer, or to the bottom of the pavement subgrade, whichever is applicable.
2. Trench backfill material shall be soil free from any rocks or stones which are larger than 6-inches, in any dimension.
    i. Rocks or stones which are larger than 3-inches, in any dimension, shall not be placed within one foot of pavement subgrade, or within one foot of the finished surface of unpaved areas.
    ii. Material shall not be lumpy or hard but shall be finely divided.

Part 3: Execution

3.01 Preparation

A. Topsoiling. Remove a minimum of 6 inches of topsoil and stockpile topsoil away from areas to be disturbed by construction. Keep topsoil segregated from non-organic excavation materials and debris.

3.02 Installation

A. TRENCHING

1. Avoid removal of obstructions.
2. Do not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, or other property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.
3. Use mechanical equipment so designed and operated that the rough trench excavation bottom elevation can be controlled with uniform trench widths and vertical sidewalls from an elevation one foot above the top of the installed pipe to the bottom of the trench, and trench alignment sufficiently accurate to permit pipe to be aligned properly between the pipe and sidewalls of the trench. Do not undercut the trench sidewall to obtain clearance.
4. Excavation in rock.
    i. Over excavate a minimum of six inches below the bottom of the pipe.
    ii. Backfill with Granular Material.
5. Preparation of Trench Bottom.
    i. Grade trench bottoms uniformly to provide clearance for each section of pipe.
    ii. Remove loose materials, water and foreign objects.
    iii. Provide firm subgrade suitable for application of bedding material.
    iv. Wherever unstable material is encountered in the bottom of the trench, over-excavate such material to a depth suitable for construction of a stable subgrade. Backfill overdepth with Stabilization Material and compact. A layer of geotextile fabric shall be placed between the stabilization material and the bedding material.
6. Stockpiling Excavated Materials.
    i. Pile suitable material for backfilling in an orderly manner a sufficient distance from banks of the trench to avoid overloading and to prevent slides or cave-ins.
    ii. Remove and dispose of excess excavated materials not suitable or not required for backfilling.
    iii. Do not stockpile excavated material against existing structures or appurtenances.
    iv. Excess excavated material will not remain on job site for more than one (1) month.
7. Limiting Trench Widths.
    i. Trenches shall be excavated to a width necessary to provide a 12-inch minimum working space between the pipe and the trench walls for proper pipe installation, joining, and bedding.
    ii. The maximum trench width at an elevation 12 inches above the top of the installed pipe, shall be 2 barrel diameters of the pipe or 32 inches whichever is greater.
        a. If the width of the trench, 12 inches above the top of the installed pipe, exceeds the maximum allowable trench width, a higher strength pipe or special pipe bedding shall be provided, as required by soil loading conditions and as determined by the Town.

B. PIPE BEDDING

1. A. Bedding classes: Provide higher class bedding where unexpected trench conditions are encountered.
2. B. Placement and Compaction.
    i. Distribute and grade bedding material to provide uniform and continuous support beneath the pipe at all points between bells and pipe joints.

ii. Deposit bedding material and compact uniformly and simultaneously on each side of the pipe to prevent lateral displacement.
iii. Compact granular bedding material by vibrating, slicing with a shovel, or bent tee-bar.

3. Ground Water Barriers.
   i. To impede passage of water through bedding material, construct a ground water barrier the full trench width, approximately 4 feet long, and from the bottom of all Granular Material to top of Granular Material.
   ii. Space:
      a. Approximately 10 feet downstream of each manhole for sanitary sewers and storm drains.
      b. Every 400 feet on water lines and force main.
      c. Place a ground water barrier 20 feet downstream of the edge of all drainage ways, streams and water courses.
4. Over Depth Excavation.
   i. Restore over excavated subgrades to proper elevation with Stabilization Material or Granular Material.

C. BACKFILLING AND COMPACTION
1. Backfill trench promptly after completion of pipe bedding.
2. Deposit backfill material in uniform layers not exceeding eight inches in uncompacted thickness. Increased layer thickness may be acceptable provided it is demonstrated that the specified compacted density will be obtained.
3. Use methods and equipment appropriate for the backfill material. Do not use equipment or methods that will transmit damaging shocks to the pipe.
   i. Do not perform compaction by jetting or water settling.
4. Import material for trench backfill if compaction cannot be obtained with job excavated material, when specifically required by these Contract Documents, or required by jurisdictional authorities.
5. Rock and bedrock encountered in the excavation shall be separated from other excavated material and disposed of.
6. Topsoiling - Replace topsoil after construction and grading to the depth of stripping over all areas disturbed by construction operations and which will not receive other surface treatment.
7. Obtaining a site for disposal of excavated rock and bedrock material, excess excavated materials, and material not suitable for backfilling is necessary. If excavated materials are disposed on private property, written permission shall be obtained from the property owner and a copy given to Town.

D. FIELD QUALITY
1. Field Compaction Control.
   i. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with:
      a. ASTM D2922 (AASHTO T238) - Tests for Density of Soil and Soil - Aggregate In-Place by Nuclear Methods, or
      b. ASTM D1556 (AASHTO T191) - Tests for Density of Soil In-Place by the Sand Cone Method, or
      c. ASTM D2167 (AASHTO T205) - Tests for Density of Soil In-Place by Rubber-Balloon Method.
2. Compaction shall be to the following minimum densities.

i. Subgrade under footings or foundations: 100%
ii. Barrier material: 95%
iii. Pipe bedding.
    a. Compacted granular material: 80% (ASTM D4253, D4254)
    b. Barrier material: 95%
iv. Trench backfill.
    a. Within right of way and under areas of permanent surface improvements: 95%
    b. Under footings, foundations or structures: 95%.
    c. Seeded areas: 88%.
    d. All other locations: 95%.
    e. Do not compact topsoil.
v. Where granular materials are used in lieu of cohesive soils reduce the above percentages by 15% to arrive at the relative density and ASTM D4253 and D4254 shall apply.

3. Moisture Content.
    i. All compacted backfill shall be within 2% (+/-) of the optimum moisture content of the soil as determined by ASTM D698.
    ii. Water shall be added to the material, or the material shall be harrowed, disced, bladed, or otherwise worked to insure a uniform moisture content.

E. COMPACTION TEST FAILURE

1. Recompact the material to the required state of compaction. In cases where there is a failure to achieve the required state of compaction, the Town may require that the backfill be removed and recompacted or replaced.
2. A hydrostatic retest shall be required on water lines after recompaction if the hydrostatic testing had been performed prior to recompaction.
    i. Testing shall be performed between valves on both sides of area of recompaction.
3. C. A retest of wastewater lines shall be required after recompaction if the testing has been performed prior to recompaction.
    i. Testing shall be performed between manholes on both sides of area of recompaction.

3.03 Cleaning and Protection

END OF SECTION 31 23 00

PSD TECHNICAL
SPECIFICATION

DIVISION 32
Exterior Improvements

Table of Contents

SECTION 32 05 00 – COMMON WORK RESULTS OF EXTERIOR IMPROVEMENTS

Part 1: General

1.01 Summary
1.02 Related Sections
1.03 Definitions
1.04 Submittals Required
1.05 Quality Assurance
1.06 Scheduling
1.07 Delivery, Storage, and Handling
1.08 Regulatory Requirements
1.09 The following contractors are to be used for all new installation/plantings AND for any repairs.
   A. Bath Garden Center and Nursery
   B. Korby Landscape
   C. V&S Landscaping and Sprinkler Systems
   D. Waterwise Land and Waterscapes
1.10 Repairs to irrigation systems/landscaping are to be reviewed/approved and coordinated with PSD Outdoor Services even when using one of the approved contractors. Repairs may be needed due to:
   A. Trash receptacles, trailers, portable toilet placement
   B. Vehicle or pedestrian traffic during construction
   C. Other damages as documented by PSD

Part 2: Products

2.01 Manufacturers
2.02 Products
   A. Source materials and products regionally whenever possible. Submit documentation of manufacturing locations and origins of materials for products manufactured and/or sourced from within 500 miles of the building site.
   B. Use recycled and/or rapidly renewable materials whenever possible. Submit invoices and listings of recycled and/or rapidly renewable materials are used.
      1. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
      2. Select products with the highest recycled or rapidly renewable content that is readily available
   C. Use salvaged and recovered products where feasible. Submit documentation showing the origins of any salvaged products.

Part 3: Execution

3.01 Preparation
3.02 Installation

END OF SECTION 32 05 00

SECTION 32 10 00 – PAVING, SIDEWALKS, AND CURBING

Part 1: General

1.01 Summary

A. This section includes:
   1. Paving requirements
   2. Construction of curbs, curbs with gutters, cross-pan sections, and sidewalks.
   3. Pavement markings

B. **Refer to City of Fort Collins Streets Department specifications for paving.**

C. **Snowplow access required to all paved areas, including sidewalks.**

D. Curb Configuration: Vertical with full cut at drives and ramps. Invert curbs preferred. Roll curb on a case by case basis.

E. Drainage shall not cross major pedestrian paths.

F. Specify the least amount of asphaltic concrete paving as possible. Utilize light colored/high albedo materials with a high Solar Reflectance Index (SRI) instead of asphalt when feasible.

G. Where feasible, use rubberized asphalt. Preference shall be given to mixes using wet or dry crumb rubber materials. Crumb rubber shall be 100% post-consumer recycled tires.

H. Where feasible, incorporate crushed concrete or blast furnace slag complying with ASTM D692; recycled porcelain or other non-traditional aggregate material complying with ASTM D6155; or onsite demolition debris. Reduce use of Portland cement by using less cement or substituting a percentage of material with fly ash, slag cement or other recycled material. Provide appropriate documentation.

I. Consider porous pavement systems such as precast concrete pavers, monolithic concrete porous pavement, or recycled plastic pavers to reduce site impervious cover.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

A. Product Data

B. Samples

1.05 Quality Assurance

A. QUALIFICATIONS
   1. Installer (Pavement Marking) MUST BE regularly engaged in this type of work and with proper equipment for striping a project of this size.

B. STANDARDS (Pavement Marking)
   1. Comply with the Larimer County Urban Area Street Standards, latest edition.
   2. Comply with the Manual for Uniform Traffic Control Devices (MUTCD), latest edition.

C. WARRANTY
   1. Bituminous (Asphalt) Pavement: Two-year labor and material warranty covering creeping, shoring, cracking, settling, and ponding.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products

A. Concrete paving <u>required</u> at the following locations:
   1. Trash pick-up areas

2. Loading dock areas
3. Entrance walks

B. Concrete paving preferred at the following locations, where budget allows:
   1. Bus Traffic
   2. Parking areas
   3. Dumpster pads
   4. Service vehicle parking areas
   5. Play pads

C. Asphaltic pavement preferred elsewhere. Thickness to match use. Contact PSD Outdoor Services for detail.

D. Walks: walks that are driven on should be a minimum 6" deep and 8' wide where applicable.

E. Drain Pans: 4' drain pans are recommended. Concrete drain pans within asphalt pavement are preferred.

F. Wheelstops:
   1. May be used depending on location. **Check with PSD's Outdoor Services.**
   2. Permanent curbs preferred

G. Pavement Marking Materials:
   1. Paint markings shall not fade, crack, flake, or peel within the warranty period.
   2. Yellow color, or white markings/red curb for fire lanes, meeting requirements of Section 708.05, "Pavement Marking Paint" of the Standard Specifications for Road and Bridge Construction, 1986, Colorado Department of Highways.

Part 3: Execution

3.01 Preparation

3.02 Installation

A. EXECUTION
   1. Herbicide:
      i. In instances where base is replaced, herbicide is required
      ii. Check with PSD's Outdoor Services as to type of herbicide which may be used.
   2. Asphalt Reinforcing Mesh: 2" minimum overlay.
   3. Asphalt Edge Detail (Mandatory): Curb or 12"-wide reinforced concrete to depth of base course.
   4. Concrete Reinforcing: Maintain welded wire fabric between center and bottom 1/4 of slab. Fiber mesh may be used when called for.
   5. Concrete Finish: Medium broom texture perpendicular to main traffic flow.

B. FIELD QUALITY CONTROL
   1. Notify PSD Project Manager at least 24 hours in advance of the following:
      i. Start of excavation, backfilling and compacting operations.
      ii. Staking of grades/elevations.
      iii. Subgrade placement.
      iv. Base course placement.
      v. Prime coat.
      vi. Wearing surface placement.

C. SUBGRADE
   1. Scarify to a depth of 6 inches and compact.
   2. Do not work on subgrade while ground is frozen or muddy.

D. FORMING
   1. Forms shall be of full depth and shall be of such design as to permit secure fastening.

2. Face boards if used, shall be so constructed and shaped that their lower edge conforms to lines and radii of structures.
3. Use flexible or curved forms of proper radius for curves of 100 foot radius or less.

E. JOINTS
1. Traverse joints shall be located at intervals of 10 feet in curbs, gutters, and crosspans. For sidewalks tooled joints shall be at 5 feet. Joints shall be continuous through all three elements. Joints shall be a minimum of 1/4 thickness of the concrete. Set joints at right angles to face, top, and flow line.
2. Expansion joint material shall be installed between new structures and existing concrete, concrete pans, around fire hydrants, poles, inlets, other fixed objects, and between the ends of sidewalk slabs and curbs. Expansion joint material shall be vertical and with the top edge flush with the finished surface. The joint shall be edged with a suitable edging tool.
3. Sealing Joints:
    i. Apply cold poured silicone sealant in accordance with manufacturer's instructions. Backer rod is not required.

F. CONCRETE REPLACEMENT
1. Remove, dispose of and restore to original or better condition concrete drives, curbs, gutters, sidewalks, and similar structures that get damaged during construction.
    i. Remove concrete to neatly sawed edges or to existing smooth joint lines.
        a. Saw concrete to a minimum depth of 2 inches.
        b. If saw cut would fall within 3 feet of construction joint, cold joint, expansion joint, or edge, remove concrete to the joint.
    ii. Base course - construct in accordance with the Standard Specifications.
        a. Restore to same thickness as existing, but in no case less than 3 inches.
2. Restore to existing alignment, dimensions and grades, or new alignment, dimensions and grades.
3. Provide for a 30 diameter lap if existing concrete that is removed contains reinforcing steel. New steel shall be of same diameter and of equal or better quality.
4. Restore all surface improvements to the same thickness as existing, but in no case less than the following:
    i. Driveway - 6 inches.
    ii. Gutter - 6 inches measured at flowline.
    iii. Sidewalk – 5 inches.
    iv. Fire lane – 7” see sketch at end of section.
5. Tool outside edges of sections and joints with a 1/4 inch radius edging tool.

G. MANHOLE FRAMES AND VALVE BOXES
1. Prior to placing concrete adjust manhole frames and water valve boxes to final grade. Leave 1/4 inch below grade in areas of snowplowing.
2. Immediately remove foreign matter which is introduced into manholes, water valve boxes to provide free access to the facilities.
3. Valve boxes and manhole rings shall be straight and properly aligned.
    i. Valve boxes shall be inspected by placing a valve key on the operating nut to assure a proper alignment.

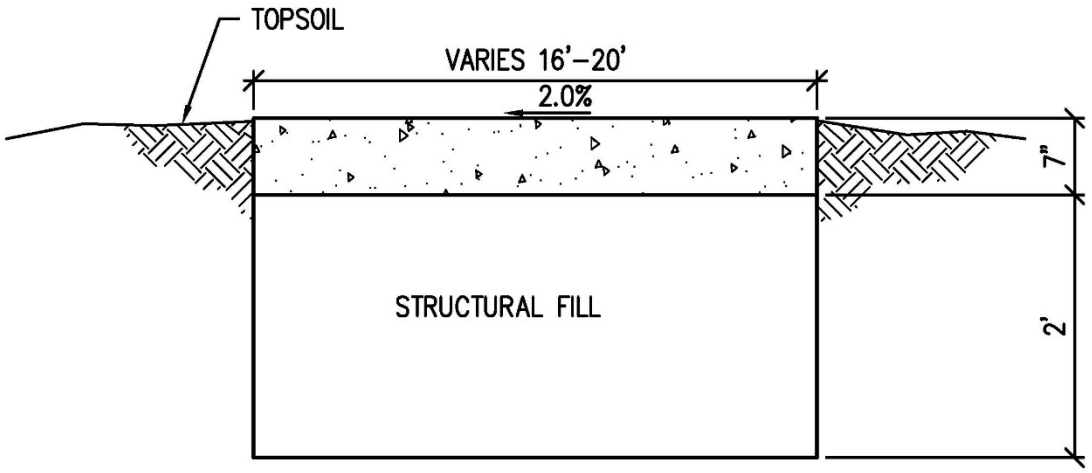
H. FINISHING
1. Trowel and brush face surface of curb and gutter.
2. Immediately after float finishing sidewalks and cross pans, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic flow.

3. Round back edge of curbs, lip of gutter adjacent to pavement, and edges adjacent to joints with edger of 1/4 in. radius.
4. Fill honeycombed back formed areas with mortar. Replace concrete sections when honeycomb is exposed to view.

I. FIELD QUALITY CONTROL

1. Compact to accepted densities submitted with the mix design. The following are minimum densities in accordance with ASTM D698:
    i. Subgrade: 95%
    ii. Base Course: 95%
2. The work shall be in accordance with the following tolerances:
    i. When checked with a ten foot (10') straightedge, grade shall not deviate by more than one-quarter inch (1/4") and alignment shall not vary by more than one-half inch (1/2"). Final elevation shall not depart from plan elevation by more than one-half inch (1/2").

3.03 Cleaning and Protection



- 10' joints
- dowel into existing concrete every 6'?
- if no rebar - fiber mesh as trucks will be driving on it?

NOTES:

1. 4,000 P.S.I. CONCRETE W/ FIBER MESH
2. CONTROL JOINTS: 10' C-C; EXPANSION JOINTS EVERY 100'
3. RECONDITION, LEVEL BASE UNDER WALK
4. BACKFILL SHALL ALLOW WATER TO DRAIN AWAY FROM WALK
5. SURFACE FINISH SHALL BE "ROUGH BROOM"

CONCRETE FIRELANE STRUCTURAL SIDEWALK DETAIL

2 / C3.0

NTS

END OF SECTION 32 10 00

SECTION 32 18 23.39 – SYNTHETIC RUNNING TRACK SURFACING

Part 1: General

1.01 Summary
- A. Surfacing of the running track.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products

A. Primers:
1. Polyurethane based primers specifically formulated to be compatible with the base and surfacing.

B. Black SBR Granules:
1. The rubber granules for the base mat shall be recycled SBR rubber, processed and chopped to 1 to 3mm size, containing less than 4% dust.

C. Polyurethane Binder:
1. Binder for the black rubber mat shall be an MDI based mono-component, polyurethane binding agent. The binding shall not have a free TDI monomer level above 0.2%, must be clear in color, not milky, and must be solvent free. The binding agent shall be specifically formulated for compatibility with SBR stranded or crumb rubber.

D. EPDM Granules:
1. The rubber granules for the structural spray wearing coats shall be EPDM peroxide cured, manmade rubber containing a minimum of 20% EPDM, with a gravity of 1.5+0.1, cryogenically processed and chopped to two different gradations, .05-1mm and 1-3mm. The EPDM rubber will be red.

E. Structural Spray Coating:
1. The spray coating will be Eurotan 1-C or approved equal, single component moisture cured, pigmented polyurethane, specifically formulated for compatibility with EPDM granules. The coating shall be the color red.

F. Line Marking Paint:
1. The line marking paint shall be polyurethane-based paint, specifically manufactured to be compatible with polyurethane synthetic track surfaces.

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

END OF SECTION 32 18 23.39

SECTION 32 18 23.53 – TENNIS COURT SURFACING

Part 1: General

1.01 Summary
1.02 Related Sections
1.03 Definitions
1.04 Submittals Required
   A. Acrylic color samples.
1.05 Quality Assurance
   A. The work shall be done in a thorough, workmanlike manner by member contractors of the United
   B. States Tennis Court and Track Builders Association, and shall conform to their standards for Tennis court construction. The contractor shall have a USTC & TBA Certified Tennis Court Builder on staff. Contractor references for five similar, successfully executed projects may be required.
   C. WARRANTY:
      1. The contractors shall guarantee their respective work against defective materials or faulty workmanship for a period of one (1) year and that the colored surface will not wear through for a period of two (2) years from the date of Substantial Completion.
      2. Slab to be post-tensioned concrete.
1.06 Scheduling
1.07 Delivery, Storage, and Handling
1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers
   A. Manufacturers
      1. Manufacturing of the emulsified asphalt and acrylic color shall conform to the TPS 5000 specification as distributed by TPS Coating, Inc. 720/963-1120 or approved equivalent.
      2. Acceptable Manufacturers and Systems include:
         i. TPS 5000,
         ii. Copeland Latexite,
         iii. Laykold 5000,
         iv. California Products Corporation Plexipave,
         v. or approved equal.
2.02 Products
   A. Crack Filler:
      1. Crack filling material shall be RhinoFill crack filler as manufactured by TPS Coatings, Inc., and distributed by E.J. Renner & Associates, (720)-963-1120, or approved equivalent.
   B. Prime Coat:
      1. Asphalt Courts: The prime coat material will consist of one (1) part SS-1H binder and two and one half (2.5) parts water.
      2. Post-Tensioned Concrete Courts: The prime coat material will consist of one (1) part TPS 5000 Primer and two and one-half parts water.
   C. Leveling Courses for Asphalt Court:
      1. The leveling course(s) for asphalt tennis courts shall consist of the following mixture:
         i. 10 gallons of SS-1H binder

ii. 10 gallons of emulsified asphalt surfacer
iii. 50 concrete sand (#4 minus)
iv. Sufficient water to make a workable mixture (fresh and potable)

D. Finishing Course(s):
1. The finishing courses will consist of two (2) applications of the following mixture:
i. 50 gallons of emulsified asphalt surfacer
ii. 400 lbs. of silica sand
iii. Sufficient water to make a workable mixture (fresh and potable)

E. Acrylic Color:
1. **Note: The following specified mixture provides for not less than 115 gallons of color concentrate per court. (This quantity is before water or any fillers are added.) This provision will be strictly enforced and monitored.**
2. For Slow Tennis Surface: The acrylic color applications shall consist of two (2) coats of the following mixture:
i. 50 gallons of undiluted TPS 5000 acrylic color (115 gallons per standard sized court)
ii. 20 gallons of water (fresh and potable)
iii. 400 lbs. Silica sand (30 mesh)

F. Color Selection:
1. Playing Area: Dark Green
2. Perimeter Area: Medium Green
3. Colors samples shall be approved by Owner's Representative prior to applying colors.

G. Playing Lines:
1. Playing lines shall be painted on using white, latex acrylic, line paint.

Part 3: Execution

3.01 Preparation

3.02 Installation

A. Asphalt Court Surface Preparation:
1. Prior to the surfacing applications, the surface shall be thoroughly cleaned (if needed) by the use of a power broom or power washer. Loose debris and flora shall be removed and cracks fill with the specified filler compound.
2. Subsequent to the cleaning of the court surface, a prime coat will be broom applied. Pools of the prime coat will be swept out to eliminate black fatty in spots.

B. Concrete Tennis Court Surface Preparation:
1. Prior to the surfacing applications, the surface shall be thoroughly cleaned (if needed) by the use of a power broom or power washer. Loose debris and flora shall be removed and cracks fill with the specified filler compound.
2. Contractor shall flood courts, mark and fill water-holding depressions with the leveling course mixture.
3. Remaining water-holding depressions greater than one-eighth inch (1/8" or cover a nickel) deep will be marked and filled with the leveling mix, again using a fourteen-foot (14') straight edge squeegee.
4. Water-holding areas will be determined by flooding the court with water and allowing it to drain for one hour on a 70 degree or warmer day. The court will be re-flooded and refilled as necessary to comply with these specifications.

C. Emulsion Lift for Concrete Court:
1. Contractor shall apply the one-inch (1") lift as follows:

i. The mixture will be agitated in a mixer capable of providing a consistent and homogeneous solution of the binder and aggregates.
ii. The mixture will be screeded over the entire surface using one-inch (1") rods; other methods of placing will not be allowed.
iii. After the lift has cured (approximately one (1) week), it will be compacted by a vibratory roller or with a static roller weighing three thousand pounds (3,000 lbs.).
iv. The resulting surface shall be free of depressions more than one-eighth inch (1/8") deep. Areas holding more water than one-eighth inch (1/8") in depth will be filled with the leveling course.

2. Leveling Course(s) for Asphalt Courts:
   i. Once the one-inch (1") lift has been rolled the contractor shall flood courts, mark, and fill all waterholding depressions with the leveling course mixture.
   ii. The mixture will be agitated in a one hundred (100) gallon paddled mortar mixer so as to provide a consistent and homogeneous solution. The mixture will be applied over the court area where needed using a fourteen foot (14') long rubber-tipped straight edge. After leveling course has cured, it will be compacted, once north-south then once east-west, with a minimum 3,000 lb. Static roller (a vibratory roller may be used). The court area will then be re-flooded and allowed to drain.
   iii. Remaining water-holding depressions greater than one-eight inch (1/8") (cover a nickel) deep will be marked and filled with the leveling mix, again using a fourteen-foot (14') straight edge squeegee.
   iv. Water holding areas will be determined by flooding the court with water and allowing it to drain for one hour on a 70-degree or warmer day. The court will be re-flooded and refilled as necessary.
3. Finishing Courses for Asphalt Courts:
   i. Contractor shall blend in water-holding patches and surface defects and provide for a wearing base with the finishing courses.
   ii. The mixture will be agitated in a one hundred (100) gallon paddled mortar mixer so as to provide a consistent and homogeneous solution. The mixture will be applied over the entire court area using a thirty inch (30") rubber-tipped squeegee. After each finishing application has been cured, any ridges will be removed with scrapers, and the application will be compacted with a minimum 3,000 lb. Static roller. One (1) finishing course will be applied and additional applications will be made as necessary to provide a uniform, ridge-free surface.
4. Acrylic Color:
   i. The mixture will be agitated in a one hundred (100) gallon paddled mortar mixer so as to provide a consistent and homogeneous solution. The mixture in two (2) applications will be applied over the entire court using a thirty-inch (30") rubber-tipped squeegee. The color is to be free of ridges and uniform. Refer to Part 2.04 for number of applications and court color selection.
5. Playing Lines:
   i. Playing lines two inches (2") wide will be accurately located and marked and masked by snapping a chalk line and placing one-inch (1") tape guide lines. Latex acrylic line paint will be brushed on to provide a uniform line. The lines shall have clear definition and ragged lines will not be accepted.

3.03 Cleaning and Protection

END OF SECTION 32 18 23.53

SECTION 32 31 00 – FENCES AND GATES

Part 1: General

1.01 Summary
- A. Installation of chain link fence, including concrete footings, hardware, and other related appurtenances.
- B. All fencing to have mow strip.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required
- A. Shop Drawings
- B. Product Data

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products
- A. Fence Fabric: Fabric shall be hot dipped galvanized (ASTM A392).
- B. Corner, Intermediate, and Terminal Posts: Corner, intermediate, and terminal posts shall be of sufficient length to allow for a depth of 3 feet below grade level minimum. Fabric shall be attached to the terminal posts by means of galvanized tension bars and held by galvanized tension bands. Corner posts shall be placed at every change in direction. Fences shall have top, center and bottom rail.
  1. Terminal, corner, and pull post shall be 2-7/8 inch O.D. galvanized pipe.
  2. Line Posts: 2-3/8 inch O.D. galvanized pipe.
  3. Top, Center and Bottom Rail: 1-5/8 inch O.D. galvanized pipe.
- C. Accessories and Hardware:
  1. Fittings: Fittings, caps, and other appurtenances shall be aluminum alloy galvanized pressed steel, malleable or cast steel as specified. Painted fittings are not acceptable.
  2. Connectors: The chain link fabric shall be securely fastened to terminal posts using 1/4" x 3/4" tension bars, with 14 gauge, 1-inch wide pressed steel bands spaced no more than 1 foot apart in the height of the fence. Such bands shall be equipped with 3/8-inch diameter carriage bolts and nuts. Bolt heads shall be on the field/court side of the fence. The fabric shall be fastened to line posts with 12 gauge steel ties spaced approximately 14 inches apart, and to the top rail with 12 gauge steel wire ties on approximately 24-inch centers
  3. Post Tops: Rounded/dome style, weather-tight closure; same material and diameter as post.
  4. Tension Wire: 9 gauge.
  5. Gate Frames: 1-1/2" nominal (1.9" o.d.).
  6. Hinges: Malleable iron; "Bulldog Hinges"; residential type for openings less than 4 feet.
  7. Latches: Integral padlock eye; operable from either side.
     i. Malleable fork type for single gate.
     ii. Fulcrum/Pioneer latches for double gates.
     iii. Add welded chain for locks

D. Connections: Center rails, bottom rails and top rail terminal connections shall be welded to posts. Welds are not required on top rails at line posts. Welds shall be brushed clean and painted with a rust inhibitor. Paint color to match the galvanized finish on the post and rails.
E. Footings: Minimum depth of footings shall be 3 feet for fence posts. Line, corner, and intermediate posts shall be set in cylindrical concrete foundations. Hole shall be excavated for the full depth of post and footing; not less than 10 inches in diameter for all line posts; 12 inches in diameter for corner, intermediate, and terminal posts

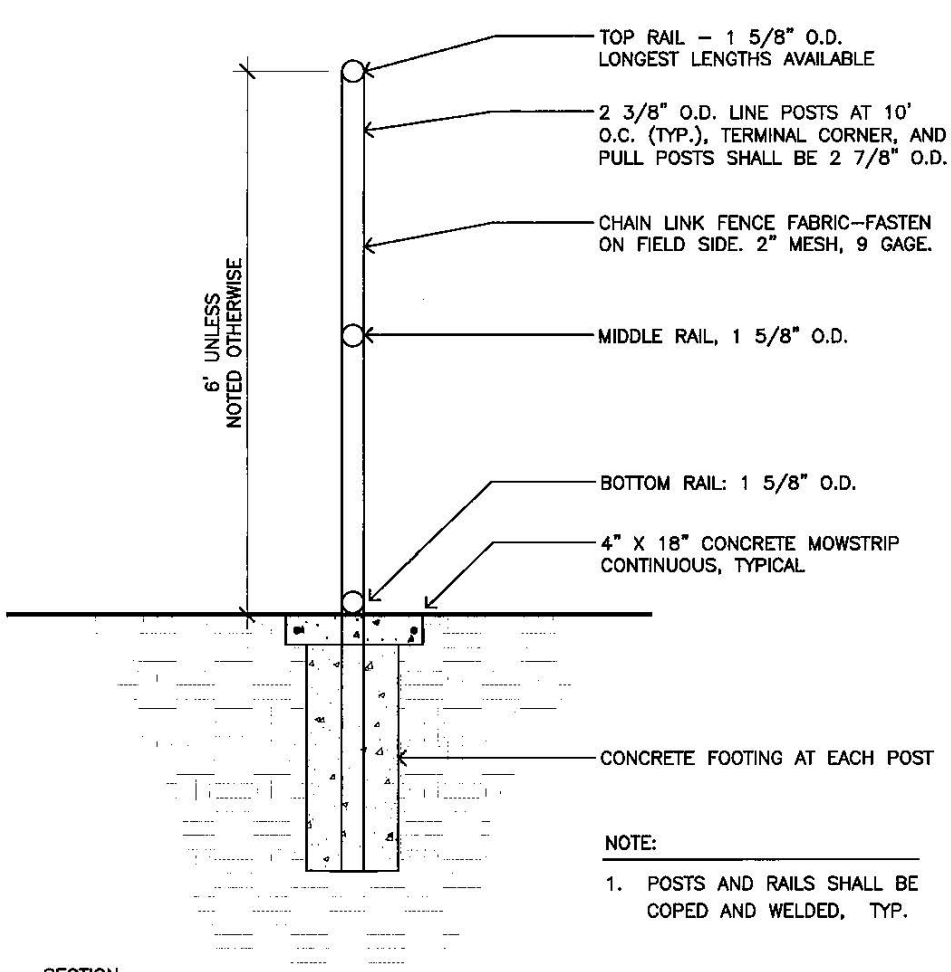
Part 3: Execution

3.01 Preparation

3.02 Installation

A. Fence mow strips required as directed by PSD. See sketches at end of section.

3.03 Cleaning and Protection



NOTE:

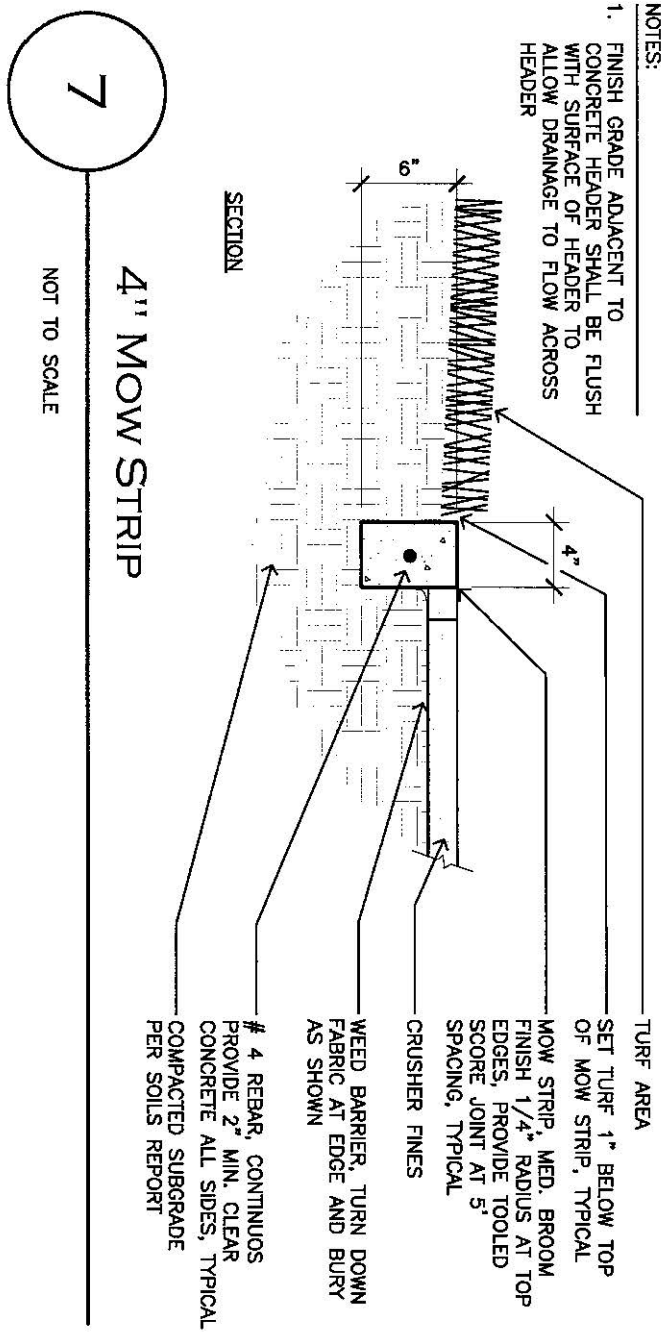
1. POSTS AND RAILS SHALL BE COPED AND WELDED, TYP.

SECTION

11

6' Chain Link Fence With Concrete Mow Strip

NOT TO SCALE



END OF SECTION 32 31 00

SECTION 32 80 00 – IRRIGATION

Part 1: General

1.01 Summary

A. Section Includes:
   1. Landscape irrigation systems.
   2. Irrigation controllers and accessories.

B. Automatic pond aeration systems may be required and will be considered on a site by site basis.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance

A. Owner inspections to be scheduled by contractor- required for approval/acceptance of system.

B. Guarantee, Warranty and Replacement.
   1. For a period of one year from commencement of the formal maintenance period, guarantee/warranty irrigation materials, equipment, and workmanship against defects. 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.
   2. Contract documents govern replacements identically as with new work. Make replacements at no additional cost to the contract price.
   3. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

C. Water flow and consumption rates: Provide irrigation system in accordance with approved water budget for landscape.

D. Installer Qualifications: Engage an experienced Installer with minimum 3 years experience with work similar in material, design, and extent to that indicated for this Project and certified as a Certified Irrigation Contractor (CIC) through a WaterSense labeled program.

E. Post-Installation Audit: Conduct an audit of the irrigation system [immediately after installation] [after one year of operation] [and three years thereafter] by a WaterSense Irrigation Partner.

1.06 Scheduling

A. TESTING:
   1. Pipelines jointed with rubber gaskets or threaded connections may be subjected to a pressure test at any time after partial completion of backfill. Pipelines jointed with solvent-welded PVC joints shall be allowed to cure at least 24 hours before testing.
   2. Subsections of mainline pipe may be tested independently, subject to the review of the Owner's Representative.
   3. All costs, including travel expenses for site visits by the Engineer, for any reinspection that may be required due to non-compliance with the Construction Documents shall be the sole responsibility of the Contractor.
   4. Hydrostatic Pressure Test (Solvent Weld Mainline Pipe):
      i. Subject mainline pipe to a hydrostatic pressure equal to 140 PSI for two hours. Test with mainline components installed.
      ii. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
      iii. Expose all remote control valves their riser pipe and service tee fittings.

iv. Leakage will be detected by visual inspection. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat the test until the pipe passes test.
v. Cement or caulking to seal leaks is prohibited.

5. Volumetric Leakage Test (Gasketed Mainline Pipe):
   i. Backfill to prevent pipe from moving under pressure. Expose couplings and fitting.
   ii. Expose all remote control valves their riser pipe and service tee fittings.
   iii. Purge all air from the pipeline before test.
   iv. Subject mainline pipe to 140 PSI for two hours. Maintain constant pressure. The amount of additional water pumped in during the test shall not exceed 0.96 gallons per 100 joints of 3-inch diameter pipe and 1.28 gallons per 100 joints of 4-inch diameter pipe. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat the test until the pipe passes test.
   v. Cement or caulking to seal leaks is prohibited.
6. Operational Test:
   i. Activate each remote control valve in sequence from controller. The Owner's Representative will visually observe operation, water application patterns, and leakage.
   ii. Repeat test(s) until each lateral passes all tests. Repeat tests, replace components, and correct deficiencies at no additional cost to the Owner.
7. Central Control System Acceptance Test:
   i. Upon completion of construction, a System Acceptance Test must be passed.
   ii. Following construction completion and a Review by the Engineer, an evaluation period will begin. After 30 days of continuous service without major system problems, the system will be accepted and the guarantee/warranty period will begin. If at any time during the 30-day evaluation period, a major system problem occurs, the source of the problem will be determined and corrected and the 30-day evaluation period will start again. Equipment will not be accepted until such time as the System Acceptance Test is passed.
   iii. If successful completion of the System Acceptance Test is not attained within 90 days following commencement of the evaluation period, the Owner's Representative has the option to request replacement of equipment, terminate the order, or portions thereof, or continue with the System Acceptance Test. These options will remain in effect until such time as a successful completion of the System Acceptance Test.
8. Control System Grounding:
   i. Test for proper grounding of control system per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
   ii. Replace defective wire, grounding rod, or appurtenances. Repeat the test until the manufacturer's guidelines are met.

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

A. Work and materials shall be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code as published by the Western Plumbing Officials Association, and applicable laws and regulations of the governing authorities.

Part 2: Products

2.01 Manufacturers

2.02 Products

A. SLEEVING:

1. Install separate sleeve beneath paved areas to route each run of irrigation pipe or wiring bundle.
2. Sleeving material shall be PVC Class 200 pipe with solvent welded joints.
3. Sleeving diameter: equal to twice that of the pipe or wiring bundle.

B. PIPE AND FITTINGS:
1. Mainline Pipe and Fittings:
    i. Use rigid, unplasticized polyvinyl chloride (PVC)
    ii. Use Class 200, SDR-21, rated at 200 PSI
    iii. Use rubber-gasketed pipe equipped with factory installed reinforced gaskets for mainline pipe with a nominal diameter greater than or equal to 3-inches.
    iv. Use ductile iron fittings on gasketed pipe with a nominal diameter greater than or equal to 3-inches.
    v. Use solvent weld pipe for mainline pipe with a nominal diameter less than 3-inches or where a pipe connection occurs in a sleeve.
2. Lateral Pipe and Fittings:
    i. Use rigid, unplasticized polyvinyl chloride (PVC)
    ii. Use Class 160, SDR-26, rated at 160 PSI.
3. Specialized Pipe and Fittings:
    i. Copper pipe: Use Type "K" rigid pipe conforming to ASTM Standard B88. Use Type “M” soft tubing conforming to ASTM Standard B88. Use wrought copper or cast bronze fittings, soldered, flared mechanical, or threaded joint per installation details or local code. Use a 95-percent tin and 5-percent antimony solder.
    ii. Low Density Polyethylene Hose:
        a. 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.
        b. Use spiral barb fittings supplied by the same manufacturer as the hose.
    iii. Use dielectric union wherever copper-based metal (copper, brass, bronze) is joined to iron-based metal (iron, galvanized steel, stainless steel).
    iv. Assemblies calling for flanged connections shall utilize stainless steel studs and nuts and rubber gaskets.
    v. Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 nipples and PVC Schedule 40 threaded fittings.
    vi. Joint sealant: Use nonhardening, nontoxic pipe thread sealant formulated for use on threaded connections and approved by the pipe fitting and valve manufacturers. Where directed by valve manufacturers, use thread tape for threaded connections at valves instead of thread paste.
4. Thrust Blocks:
    i. Use thrust blocks for fittings on pipe greater than or equal to 3-inch diameter or any diameter rubber gasketed pipe.
    ii. Use 2-mil plastic.
    iii. Use No. 4 Rebar.
5. Joint Restraint Harness:
    i. Use a joint restraint harness wherever joints are not positively restrained by flanged fittings, threaded fittings, and/or thrust blocks.
    ii. 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.

iii. Use bolts, nuts, retaining clamps, all-thread, or other joint restraint harness materials that are stainless steel.

C. SPRINKLER IRRIGATION COMPONENTS:
   1. As presented in the installation details.

D. CONTROL SYSTEM COMPONENTS:
   1. Irrigation Controller Unit – MOTOROLA ACE:
      i. Communication: Internet protocol compatible. Provide all necessary communication interfaces and peripheral devices and wiring.
      ii. Provide Hoffman enclosure rated for outdoor installation, lockable, with back panel, two louvers, and two filters.
      iii. Minimum accessories include:
         a. Radio communication between IRRINET and SCORPIOS M units.
         b. 3 stage 24VAC field surge protection with on/auto/off switching
         c. Ethernet communication between central and ACE/ M unit masters
         d. Weather stations
      iv. Wire markers: Prenumbered or labeled with indelible nonfading ink, made of permanent, nonfading material.
   2. Irrigation Controller Unit – MOTOROLA IRRINET units:
      i. Provide configuration with integrated surge protection.
      ii. Communication: Provide all necessary communication interfaces and peripheral devices and wiring.
      iii. Provide Hoffman enclosure rated for outdoor installation, lockable, with back panel, two louvers, and two filters.
      iv. Wire markers: Prenumbered or labeled with indelible nonfading ink, made of permanent, nonfading material.
   3. Control Wire:
      i. 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.
      ii. Color: Wire color shall be continuous over its entire length. Use red for control wire, white for common wire, and blue for spare wires.
      iii. Splices: Use 3M DBY-6 or 3M-DBR-6. King splice-size dependant on wire # and size.
      iv. 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 red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."
   4. Sensor Cable:
      i. Use wire designed for direct burial, as recommended by central control system manufacturer.
      ii. Splices: Use approved connectors as recommended by central control system manufacturer.

E. OTHER COMPONENTS:
   1. Tools and Spare Parts: Provide operating keys, servicing tools, and spare parts.

Part 3: Execution

3.01 Preparation

3.02 Installation

A. INSPECTIONS AND REVIEWS:
   1. Site Inspections

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

B. LAYOUT OF WORK:
   1. Stake out the irrigation system. Items staked include: sprinklers, pipe, control valves, controller, and isolation valves.
   2. Install all mainline pipe and mainline components inside of project property lines.

C. 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):
      i. 24-inches over mainline pipe and over electrical conduit.
      ii. 26-inches over control wire.
      iii. 12-inches over lateral pipe to sprinklers.
   3. Maintain at least 15-feet clearance from the centerline of any tree.
   4. PVC lateral pipes must be installed in open trench. Minimum burial depths equal minimum cover listed above.
   5. Backfill only after lines have been reviewed and tested.
   6. Excavated material is generally satisfactory for backfill. Backfill must 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.
   7. Backfill unsleeved pipe in the following manner:
      i. Backfill and puddle the lower half of the trench. Allow to dry 24 hours. Backfill the remainder of the trench in 6-inch layers. Compact to density of surrounding soil.
   8. Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves. Minimum compaction of backfill for sleeves shall be 95% Standard Proctor Density, ASTM D698-78. Use of water for compaction around sleeves, "puddling", will not be permitted.
   9. Dress backfilled areas to original grade. Incorporate excess backfill into existing site grades.
   10. Where utilities conflict with irrigation trenching and pipe work, contact the Owner's Representative for trench depth adjustments.

D. SLEEVING AND BORING:
   1. Install sleeving at a depth that permits the encased pipe or wiring to remain at the specified burial depth.
   2. Extend sleeve ends six inches beyond the edge of the paved surface. Cover pipe ends and mark with stakes.
   3. Bore for sleeves under obstructions that cannot be removed. Employ equipment and methods designed for horizontal boring.

E. ASSEMBLING PIPE AND FITTINGS:
   1. General:
      i. Keep pipe free from dirt and pipe scale. Cut pipe ends square and debur. Clean pipe ends.
      ii. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.
      iii. 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.

2. Mainline Pipe and Fittings:
    i. Use only strap-type friction wrenches for threaded plastic pipe.
    ii. PVC Rubber-Gasketed Pipe:
        a. Use pipe lubricant. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
        b. Ductile iron fittings shall not be struck with a metallic tool. Cushion blows with a wood block or similar shock absorber.
    iii. PVC Solvent Weld Pipe:
        a. Use primer and solvent cement. Join pipe in a manner recommended by the manufacturer and in accordance with accepted industry practices.
        b. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.
        c. Snake pipe from side to side within the trench.
    iv. Fittings: The use of cross type fittings is not permitted.
3. Lateral Pipe and Fittings:
    i. Use only strap-type friction wrenches for threaded plastic pipe.
    ii. PVC Solvent Weld Pipe:
        a. Use primer and solvent cement. Join pipe in the manner recommended by the manufacturer and in accordance with accepted industry practices.
        b. Cure for 30 minutes before handling and 24 hours before allowing water in the pipe.
        c. Snake pipe from side to side within the trench.
    iii. Fittings: The use of cross type fittings is not permitted.
4. Specialized Pipe and Fittings:
    i. Copper Pipe:
        a. Use flux and solder. Join pipe in manner recommended by manufacturer and in accordance with local codes and accepted industry practices.
        b. Solder so that continuous bead shows around the joint circumference.
    ii. Insert dielectric union or flange wherever copper-based metal (copper, brass, bronze) and iron-based metal (iron, galvanized steel, stainless steel) are joined.
    iii. Low Density Polyethylene Hose: Install per manufacturer's recommendations.
    iv. Flanged connections: Install stainless steel studs and nuts and rubber gaskets per manufacturer’s recommendations.
    v. PVC Threaded Connections:
        a. Use only factory-formed threads. Field-cut threads are not permitted.
        b. Use only nonhardening, nontoxic thread sealant.
        c. When connection is plastic-to-metal, the plastic component shall have male threads and the metal component shall have female threads.
    vi. Make metal-to-metal, threaded connections with nonhardening, nontoxic pipe sealant applied to the male threads only.
5. Thrust Blocks:
    i. Use cast-in-place concrete bearing against undisturbed soil.
    ii. Size, orientation and placement shall be as shown on the installation details.
    iii. Wrap fitting with plastic to protect bolts, joint, and fitting from concrete.
    iv. Install rebar with mastic coating as shown on the installation details.
6. Joint Restraint Harness:
    i. Install harness in the manner recommended by the manufacturer and in accordance with accepted industry practices.

F. INSTALLATION OF MAINLINE COMPONENTS:

1. Master Valve/Flow Sensor Assembly:
    i. Brand valve box lid with MV. Branding device must create letters a minimum of 2-inches in height and 0.2-inches deep in lid.
2. Isolation Gate Valve Assembly:
    i. Locate at least 12-inches from and align with adjacent walls or edges of paved areas.
    ii. Brand valve box lid with IGV for each isolation gate valve. Branding device must create letters a minimum of 2-inches in height and 0.2-inches deep in lid.
3. Quick Coupling Valve Assembly:
    i. Brand valve box lid with QCV for each quick coupling valve. Branding device must create letters a minimum of 2-inches in height and 0.2-inches deep in lid.
4. Air-Vacuum Relief Valve Assembly: Brand “AV” on valve box lid in 2-inch high letters.

G. INSTALLATION OF SPRINKLER IRRIGATION COMPONENTS:

1. Remote Control Valve (RCV) Assembly for Sprinkler Laterals:
    i. Flush mainline before installation of RCV assembly.
    ii. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve wires. Install connectors and sealant per the manufacturer's recommendations.
    iii. Install only one RCV to a valve box. Locate valve box at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical. Arrange grouped valve boxes in rectangular patterns. Allow at least 12-inches between valve boxes.
    iv. Attach ID tag with controller station number to control wiring.
    v. Brand valve box lid with appropriate controller number and station number for each remote control valve, for example 4-12. Branding device must create letters a minimum of 2-inches in height and 0.2-inches deep in lid.
    vi. All fittings (T and elbows) shall NOT be located inside the valve box. Fittings shall be outside of the box with piping run under the box. No part of the box shall come in contact with pipe or fittings.
    vii. Valve box shall be supported in the corners of the box with bricks to help with settling of the box.
2. Sprinkler Assembly:
    i. Flush lateral pipe before installing sprinkler assembly.
    ii. Locate rotary sprinklers 3-inches from adjacent walls, fences, or edges of paved areas.
    iii. Locate spray sprinklers 3-inches from adjacent walls, fences, or edges of paved areas.
    iv. Install sprinklers perpendicular to the finish grade.
    v. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.
    vi. Adjust the radius of throw of each sprinkler for best performance.
3. Sprinkler Analyzer Kit:
    i. Use a pitot tube pressure gauge at the furthest rotor sprinkler assembly from the respective remote control valve. Adjust pressure at each rotor remote control valve to provide an operating pressure of 60 PSI at the worst-case rotor sprinkler head. Typically the worst-case sprinkler is the sprinkler furthest from the remote control valve. Complete pressure adjustment for every rotor remote control valve.
    ii. Turn over pitot tube pressure gauge and kit to the District at completion of construction.

H. INSTALLATION OF CONTROL SYSTEM COMPONENTS:

1. Irrigation Controller Unit:
    i. Lightning protection: Drive grounding rod into soil its full length. Space rod and grounding plate 20 feet apart in a straight line away from satellite controller. Connect #6 AWG copper grounding wire to rod from plate using CADWELD connection. Install 6inch round valve box over grounding rod connection and over grounding plate. Connection of grounding wire to between satellites in groups must be per satellite controller manufacturer or distributor's recommendations.
    ii. Attach wire markers to the ends of control wires inside the controller unit housing. Label wires with the identification number of the remote control valve to which the control wire is connected.
    iii. Connect control wires to the corresponding controller terminal.
2. Control Wire:
    i. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape spaced at 10-foot intervals.
    ii. Provide a 24-inch excess length of wire in an 8-inch diameter loop at each 90-degree change of direction, at both ends of sleeves, and at 100-foot intervals along continuous runs of wiring. Do not tie wiring loop. Coil 24-inch length of wire within each remote control valve box.
    iii. Install common ground wire and one control wire for each remote control valve. Multiple valves on a single control wire are not permitted, unless two wire specific.
    iv. If a control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per the manufacturer's instructions. Locate splice in a valve box that contains an irrigation valve assembly, or in a separate 10-inch standard round box.
    v. Unless noted on plans, install wire parallel with and below PVC mainline pipe.
    vi. Protect wire not installed with PVC mainline pipe with a continuous run of warning tape placed in the backfill six inches above the wiring.
3. Sensor Cable:
    i. Route cable as directed on plans. Install with minimum number of field splices.
    ii. Install cable using open trenches. Use of vibratory plow is not permitted.
    iii. Carefully backfill around cable to avoid damage to wire insulation or wire connectors.
    iv. If cable must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate splices in housing afforded by other control system components or separate 12-inch standard valve box. Coil 3-feet of cable in valve box.
    v. Install cable parallel with and below mainline pipe.
    vi. Provide continuous run of warning tape above cable. Install warning tape six inches above cable. Encase cable within electrical conduit where not installed in common trench with PVC mainline pipe.

I. INSTALLATION OF OTHER COMPONENTS:
1. Tools and Spare Parts: Prior to the Review at completion of construction, supply to the Owner operating keys, servicing tools, and spare parts.

J. WINTERIZATION AND SPRING START-UP:
1. Winterize the irrigation system in the first fall after final acceptance and start-up the irrigation system in the first spring after final acceptance. Repair any damage caused in improper winterization at no additional cost to the Owner. Coordinate the winterization and start-up with the landscape maintenance personnel.

3.03 Cleaning and Protection

A. MAINTENANCE:

1. Upon completion of construction and Review by the Owner's Representative, maintain irrigation system for duration of warranty period.
    i. Monitor system periodically to assess effectiveness. Verify water consumption is consistent with water budget. Verify components are adjusted and functioning properly. Verify that irrigation system pressure is within manufacturer specifications.
    ii. Document all irrigation water use.
    iii. Make and document minor adjustments, if any, as necessary.
2. Following completion of the Contractor's maintenance period, the Owner will be responsible for maintaining the system in working order during the remainder of the guarantee/warranty period, for performing necessary minor maintenance, for trimming around sprinklers, for protecting against vandalism, and for preventing damage after the landscape maintenance operation.

END OF SECTION 32 80 00

SECTION 32 82 00 – IRRIGATION PUMPS

Part 1: General

1.01 Summary
1.02 Related Sections
1.03 Definitions
1.04 Submittals Required
1.05 Quality Assurance
- A. GUARANTEE/WARRANTY AND REPLACEMENT:
  1. The manufacturer shall warrant the pumping system to be free of defects and product malfunctions for a period of two years from date of start up or thirty months after shipment, whichever occurs first.
  2. The programmable controller shall be unconditionally warranted for 5 years from the date of shipment. The pumping system manufacturer shall be responsible for all warranties, pass through warranties are not acceptable.

1.06 Scheduling
1.07 Delivery, Storage, and Handling
1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers
- A. Acceptable Manufacturers:
  1. FLOWTRONEX PSI Ltd., 10717 Harry Lines Blvd., Dallas, Texas 75220, 214.357.1320. Local Representative: Joe Sciole, 4618 Twin Peaks, Loveland, CO 80538. (970) 461-8882
  2. SYNCHROFLO, 6700 Best Friend Rd., Norcross, Georgia, 30071, 770.447.4443. Local Representative: John MacIntyre, Munro Supply, 1271 Elmwood Court, Colorado 80020, 303.439-2600.
  3. WATERTRONICS, 525 Industrial Drive, Hartland, Wisconsin 53029, 800.356.6686, 414.367.5000, F: 414.367.5551. Local Representative Torian Roesch (303) 807-9386.
  4. Or approved equal

2.02 Products
- A. GENERAL REQUIREMENTS:
  1. All design or construction documents must be reviewed by PSD.

Part 3: Execution

3.01 Preparation
3.02 Installation
- A. INSPECTIONS AND REVIEWS:
  1. Site Inspections:
     i. Beginning work of this section implies acceptance of existing conditions.
- B. PUMPS AND MOTORS:
  1. Shipping, off-loading and the technical start up shall be furnished by the pump station manufacturer. The pump station manufacturer shall furnish location and mounting details to Owner's Representative.
  2. Anchor pump system to concrete mounting pad and complete all piping connections prior to startup and operation of the pump system.
  3. Electrical connection shall consist of a single conduit from 3 phase 460 volt 200 ampere disconnect to the pump station main disconnect.

4. Technical start up procedures by the pump station manufacturer shall include the following:
5. Station start up and pressurization
6. Pressure, flow, and programming adjustments
7. Monitoring of irrigation cycle when possible. Technician will instruct operations personnel as to the operation, adjustment and maintenance of the pump station.

3.03 Cleaning and Protection

END OF SECTION 32 82 00

SECTION 32 90 00 – PLANTING

Part 1: General

1.01 Summary

A. This section includes:
1. Soil preparation and soil amendments
2. Finish grading Fertilizer
3. Wood Mulch
4. Weed Barrier
5. Steel Headers
6. Tree Stakes and Tree Wrap
7. Plant Materials
8. Seeding and Sodding

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance

A. Contractor shall have at least five years experience in commercial landscape and irrigation maintenance and shall have prior experience in at least two other projects of similar size and scope.

B. INSPECTIONS:
1. Site Inspection:
i. Contractor will inspect existing site conditions and note irregularities affecting the work of this section.
ii. Verify that grading operations have been satisfactorily completed and that topsoil of adequate quantity and quality has been placed in areas as specified. Verify that the areas to be revegetated are protected from concentrated runoff and sediment from adjacent areas. Note previous treatments to the areas such as temporary seeding or mulching and discuss with the Owner's Representative how these treatments will affect permanent revegetation.
2. Pre-Planting Inspection:
i. Plant material shall be inspected by Owner's Representative before planting. Plants for inspection must be in a single location preferably on the project site. Rejected materials must be removed from the site, replaced and reinspected before planting. If the supplier is a local nursery, tagged plants may be inspected at the nursery.

Photographs of the plant materials to be obtained from non-local sources may be submitted to the Owner's Representative for preliminary inspection. This preliminary inspection is subject to final approval of plants at the job site. **The Owner reserves the right to reject plant material at any stage of construction or guarantee period**.

ii. Soil amendments, backfill mixes and mulches will be inspected at the site by the Owner's Representative before they are used in planting operations.

iii. Owner's Representatives will inspect staked locations of trees before digging for those plants occurs. Owner's Representatives will inspect the location of shrubs in their containers at the proposed locations before digging commences. Contact Owner's Representative at least two days in advance.

3. Substantial Completion Inspection:
   i. As soon as all planting is completed, a review and preliminary inspection to determine the condition of the vegetation will be held by the Owner's Representatives upon request by the Contractor. If a second substantial completion review is required due to incomplete work, the contractor is responsible for the additional costs incurred by their consultants.
   ii. The inspection will occur only after the following conditions have been met: Planting is completed; Sod is installed; Seeding is complete; Irrigation system shall be fully operational with heads properly adjusted; Landscape areas will be free of weeds and neatly cultivated; Plant basins shall be in good repair; Trees are staked or guyed; Debris and litter shall be cleaned up and walkways and curbs shall be cleaned of soil and debris left from planting operations.
   iii. If, after the inspection, the Owner's Representative is of the opinion that the work has been performed as per the Contract, and that the vegetation is in satisfactory growing condition, he will give the Contractor **Written Notice of Acceptance** and the **Guarantee Period** shall begin.
   iv. Work requiring corrective action in the judgment of the Owner's Representative shall be performed within the first ten (10) days of the guarantee period. Any work not performed within this time will necessitate an equivalent extension of the guarantee period. Corrective work and materials replacement shall be in accordance with the Contract, and shall be made by the Contractor at no cost to the Owner.
   v. Final approval and Substantial Completion notice will be given when all deficiencies are corrected.
4. End of Guarantee Period Inspection:
   i. At the end of the first and second full growing season the Owner's Representatives will inspect trees for satisfactory condition. The inspection shall take place in September and the Owner's Representative shall contact the Contractor concerning replacements. Replacements may take place the following spring if deemed proper or necessary.

C. PLANT MATERIAL GUARANTEE/WARRANTY PERIOD:
1. Provide a two-year warranty from the date of Substantial Completion. Substantial Completion is hereby defined as the point at which the Landscape Contractor is 100% complete with installation and is ready for a Substantial Completion Review. The Owner's representative will have sole authority to grant Substantial Completion. The minimum two-year warranty includes all aspects of this section including installation, and materials.

2. Guarantee plant material used in this section against defects due to any cause for a period of **two full growing seasons** from the date of acceptance of all work. This **guarantee includes insect infestation or infection by disease organisms**.
3. Replace woody vegetation when it is no longer in a satisfactory condition as determined by the Owner's Representative for the duration of the Warranty Period. Make replacements within fourteen days of notification from the Owner's Representative. Replacement planting for trees shall be done in the spring planting season, except as approved otherwise. If a tree is in marginal condition at the end of the guarantee period it may be agreeable to both parties to wait until the end of the growing season before deciding whether to replace that tree. Plant materials that are replaced during the warranty period shall be replaced one time at the Contractor's expense. Cost of subsequent replacements, if required, shall be negotiated with the Owner's Representative. Warranty replacement plant materials planted within 6 months after Substantial completion shall have the same end of warranty as the original installation. Plants replaced within 6 months of the end of the warranty shall be warranted an additional 6 months after the date of completion of the initial warranty period.
4. It is the responsibility of the Landscape Contractor to monitor ongoing maintenance of the project during the warranty period. If the Landscape Contractor finds fault with ongoing maintenance activities of the Maintenance Contractor, they shall be immediately brought to the attention of the Owner's Representative. The warranty will in no way be invalidated because of activities of the Maintenance Contractor unless approved by the Owner's Representative.
5. Replacements shall be of the same kind and size as originally specified. Repairs and replacements shall be made at no expense to the Owner.

D. SEED AND SOD GUARANTEE/WARRANTEE PERIOD:
1. Guarantee seed and sod against defects for a period of two growing seasons from the date of final acceptance.
2. Replace turf when it is no longer in a satisfactory condition as determined by the Owner's Representative for the duration of the warrantee period.
3. Areas seeded in the spring shall be inspected for required coverage the following fall no later than October. Areas seeded in the fall will be inspected October of the following year.

1.06 Scheduling
1.07 Delivery, Storage, and Handling
1.08 Regulatory Requirements

Part 2: Products
2.01 Manufacturers
2.02 Products

A. <u>Landscape Products:</u>
1. The landscape products include: steel edging, tree stakes, soil amendments, fertilizer, wood mulch, weed barrier fabric, tree wrap, plant materials, seed and sod
2. Utilize locally sourced materials where feasible.
3. Utilize recycled content material for weed barrier fabric, tree wrap, steel edging and tree stakes where feasible.
4. Use recycled content mulch where applicable
5. Consider using 100 percent recycled cellulose in spray applied mulch.

B. <u>Amendment:</u>

1. Submit a minimum of 2 samples of soil to the Colorado State University Soil Testing laboratory for analysis and fertilizer recommendations. Samples shall be taken from widely varying sections of the site.
2. Organic material amendments required.

C. Fertilizer:
1. Fertilizer for seed and sod shall be commercial type, of uniform composition, free flowing, and conforming to applicable state and federal laws. Fertilizer shall be formulated to meet the suggestions of the CSU soil laboratory for turf fertilization.
2. Fertilizer for trees, shrubs, and perennials: no special requirements, evaluated on case by case basis.
3. Microbial treatment should be considered on a case by case basis

D. Sodding:
1. Sod shall be Colorado grown. Use “big roll” where possible.

E. Plants:
1. Reference City of Fort Collins Forestry Plant List.
2. Preference given to native, water conserving species. Non-native species must be noninvasive.
3. Minimum tree sizes.
   i. Deciduous trees 2” caliper minimum
   ii. Evergreen trees 6’ height minimum Execution

Part 3: Execution

3.01 Preparation

3.02 Installation

A. SOIL PREPARATION AND FINISH GRADING:
1. Do not plant until finish grade has been reviewed by the Owner's Representative. This review does not reduce Contractor's responsibility to provide a finished product that drains.

B. TREE AND SHRUB PLANTING:
1. Tree Staking: Prior to planting, stake all proposed tree locations for review by the Owner's Representative**.** Any plant material installed prior to this review is subject to removal or relocation at the expense of the Contractor.
2. Planting Pits:
   i. Dig planting pits twice the diameter of the rootball for container and balled and burlapped stock. Establish bottom of the planting pit so that the top of rootballs will be slightly higher than surrounding grade in order to allow for settlement. Roughen edges of planting pits to provide a rough surface on edges. Retain excavated material next to planting pit for mixing organic amendment and fertilizers.
   ii. For planting trees amend excavated planting pit soil with organic amendment.
3. Shrub Planting:
   i. Remove stock from containers including shrubs in peat pots. Do not break the rootballs.
   ii. Apply Osmocote fertilizer at the base of the plant after backfilling. Apply at manufacturer's recommended rate. Water lightly to activate fertilizer.
4. Tree Planting:
   i. Establish planting pit as specified above.
   ii. If trees are containerized, remove trees from containers. If trees are balled and burlapped, leave burlap firmly secured until after planting.

iii. Handle trees carefully during planting. Avoid excessive shaking and rapid movements. Protect tree trunks with a soft cloth or rubberized material when handling by the trunk.
iv. Roughen the sides of planting pits.
v. Gently lower tree into planting pit and set plumb. Establish bottom of pit so that top of tree rootball is approximately 2 inches above surrounding grade. Protect trunk and tree branches while placing tree. Untie and remove burlap from the top 1/3 of the rootball. Remove wire basket from rootball. Backfill tree planting pit using the mixture described in section above. Backfill one-half of pit with backfill mixture and water in thoroughly before placing any more backfill.
vi. Backfill the rest of the planting pit with backfill mixture and water in thoroughly. Lightly compact backfill. Do not vigorously compact. Apply slow release Osmocote fertilizer around the rootball diameter of the tree. Apply at manufacturer's recommended rate. Stake evergreen and deciduous trees. Trees should be plumb. Install 2 stakes per. Wrap deciduous trees with specified tree wrap. Wrap from bottom of trunk to the first major lateral branch. Secure with jute or other biodegradable material. Install after November 15 and no later than December 15. Remove wrap approximately March 15 and no later than April 15. If there are spade dug and planted trees they shall be deep watered with a watering needle angling from the inside of the ball out toward the perimeter.

3.03 Cleaning and Protection

END OF SECTION 32 90 00