Section Number | Title

32 00 00 EXTERIOR IMPROVEMENTS

*****EXTERIOR IMPROVEMENTS MUST ADHERE TO THE LANDSCAPE MASTER PLAN AS WELL AS THE DIVISION 32 TECHNICAL STANDARDS. THE LANDSCAPE MASTER PLAN CAN BE FOUND BY CLICKING ON THE LINK PROVIDED BELOW. SOME OVERLAP & DISCREPANCIES MAY OCCUR BETWEEN THE TWO DOCUMENTS AND NOT ALL EXISTING STANDARDS ARE INCLUDED IN THE MASTER PLAN. AS A RESULT, BOTH DOCUMENTS ARE TO BE UTILIZED HOWEVER WORK MUST CONFORM TO THE LANDSCAPE MASTER PLAN UNLESS WRITTEN EXCEPTION IS MADE BY OWNER. IT IS THE CONTRACTOR'S AND DESIGN PROFESSIONAL'S RESPONSIBILITY TO IDENTIFY IN WRITING TO OWNER ANY DISCREPANCIES IDENTIFIED BETWEEN THESE TWO DOCUMENTS THAT MAY ALTER A PROPOSAL OR BID.**

LANDSCAPE MASTER PLAN LINK
(https://in.nau.edu/wp-content/uploads/sites/139/2022/05/LMP-2022-Report_May.2022_pgs.pdf)

Part 1 – General

This section covers paving, site improvements and landscaping requirements for Owner.

Testing of materials will be by qualified materials testing laboratory hired by either the Contractor or the Owner.

Repaving and striping is required if staging or yard areas for construction are in an existing parking lot or an adjacent street. Any pavement damage or significant increased wear as a result of a construction project's laydown area(s) and/or site operations are the responsibility of the Contractor, and the Contractor shall restore the site back to its original condition. The Contractor may be required to repave the entire parking lot or roadway section. The Contractor may provide an alternate asphalt/concrete treatment to remediate the damaged condition back to a like new condition for review and approval. An alternate treatment would only be considered when recommended, designed, & stamped by a civil engineer registered in the state of Arizona. Any additional assessment, engineering, or other design and construction costs associated with these types of repairs are the responsibility of the Contractor and cannot be charged back to the project budget.

The most current version of the Flagstaff/Coconino County Pedestrian and Bicycle Design Guide (http://www.flagstaff.az.gov/index.aspx?NID=3181) shall be used for design and specification of paving and signage for bicycle routes and facilities.

Concrete surfaces shall be provided at motorcycle parking, ADA stalls, and in maintenance areas where oil or gas spillage could occur.

Access ramps shall be provided when the project is located at an intersection and at other intervals along a street if crosswalks are provided. Inclusion of these ramps must be evaluated by the DP with Owner's involvement for ADA Compliance.

Part 2 – Products

In addition to testing required by the latest revisions of Maricopa Association of Governments for Public Works Construction (MAG), aggregates must be subjected to five cycles of the sodium sulfate soundness test in accordance with the requirements of AASHTO T-104. The total loss shall not exceed ten percent by weight of the aggregate as a result of the test.

Paint for exterior items, such as handrails, bike racks, etc., shall be Modern Masters ME209 Pewter.

Part 3 – Execution

During construction projects that affect the parking areas on campus, the Contractor shall be responsible for providing barricades and appropriate signage for all parking lot entrances.

Signs shall read:
"Parking Lot Closed From _____ to _____. Use Lot # _____."

32 10 00 BASES, BALLASTS, AND PAVING
32 11 00 Base Courses

Part 1 – General

Base course materials and preparation shall be determined by a geotechnical engineer after an investigation of the proposed project area and the existing surface (may be pavement) and subgrade conditions present.

Complete base course design includes subgrade soil preparation information and compaction standards, base course composition, depth and compaction standards. Base course placement will comply with MAG Section 310.

Section Number | Title

Part 2 – Products

Base course materials shall be tested in accordance with MAG Section 701 and shall be consistent with Section 702.

Part 3 – Execution

The aggregate base course to be 6" minimum in depth, (more as defined on a project specific basis) 100% crushed rock conforming to MAG Specification 702, Type B, compacted per ASTM D1557-78;

32 12 00 Flexible Paving

Part 1 – General

Pavements are part of the site grading and storm drainage and will be designed in conformance with the storm water design guidelines. Use of permeable (also called porous or pervious) asphalt requires special permission by the Owner.

Asphalt and pervious or permeable pavements shall be designed by a geotechnical or civil engineer registered in the state of Arizona. A life cycle cost analysis (including proper maintenance procedures) shall be provided for the different types of proposed payment by the DP.

The Contractor shall furnish the Design Professional with a job-mix formula for the asphalt concrete not less than ten (10) days in advance of actual placement of the material. The job mix formula, upon approval of the DP, shall be used to establish the standards to which field test results will be compared, and to determine compliance of the materials furnished with all physical properties of the composite mix and its individual components as shown on the approved job-mix formula. The job-mix formula, with the allowable tolerances for a single test, shall be used for monitoring compliance with the specifications.

Part 2 – Products

Products will be consistent with Section 32 12 16 Asphalt Paving.

Part 3 – Execution

Execution of flexible pavements will be consistent with Section 32 12 16 Asphalt Paving or as specified in the plans and specifications by the DP.

Section Number | Title

32 12 16 | Asphalt Paving

Part 1 – General

This section is written as design guidance for any paving project and is intended to give sufficient detail to provide Design Professional the information required to prepare design development documents (60 %) for asphalt and Modified Asphaltic Concrete (MAC) paving projects throughout campus including roadways, parking lots, driveways, bike paths, pedestrian ways and sidewalks. This section also applies to patching and repairing of the above listed pavements. Further refinement should not be made without specific input from the Owner.

All new and replacement full pavement sections shall include subgrade, base course, asphalt, and chip seal. Patches shall match existing pavement sections.

Throughout the design process (CD 30%, 60%, 90%) formal written approvals are required.

The DP shall follow the recommendations of the geotechnical engineer with regard to pavement design, including but not limited to asphalt cement type, subgrade thickness, and pavement thickness. If a geotechnical engineer has not been retained for the work, then the minimum standards contained in this section shall be used.

Damage to existing utilities shall be repaired and returned to original or better condition by the Contractor.

Cold patching may be used only as a temporary measure. Permanent patches must be hot mix.

If asphalt patch is less than 25 sq. ft., hand method of placement and screening can be used. Materials must be hot mix.

If asphalt patch is greater than 25 sq. ft. or a critical area, use lay down machine.

When working at curbs, widen excavation, form and pour curb, cut straight asphalt edge, and patch.

All asphalt cuts shall be saw cut.

Manholes and valves shall be adjusted to grade after paving. Final adjustment shall be provided with concrete paving patch to roadway grade.

No asphaltic concrete curbing or driveway aprons are allowable.

All utility trench patching shall follow the same requirements as street and parking lot asphalt design, installation, and testing. Utilize "T-Top" trench repair from MAG 200-1.

Testing Requirements:
Contractor will secure an independent testing lab for quality control purposes. The Owner shall employ an independent testing lab for quality assurance. All testing shall be documented and reports shall be provided to the Owner on an ongoing basis as soon as the results are obtained. The schedule for testing and results will be developed between the Owner and the lab but shall not be longer than 2 days from when the tests results are obtained. Failing tests are to be reported immediately to the Contractor and the Owner. Retesting required due to test failures are to be paid for by the Contractor. Testing is to be scheduled along with the work, and delays caused by testing will not be subject to change orders for more time.

Asphalt paving shall be tested according to the MAG criteria for asphalt and any additional testing required to confirm consistency to the mix design.

Geotechnical testing shall be provided during paving operations.

In general, paving shall conform to MAG Sections 321- 336 and materials Sections 709 – 717.

Due to the variation in costs between conventional asphalts and polymer modified mixes, Owner may require that alternative mix designs be developed for paving including a low initial cost material and a higher initial cost/longer life material. Designers may use the FHWA spreadsheet Real Cost Life Cycle Cost Analysis for evaluating mix designs for life cycle cost. A link to this free software is: http://www.fhwa.dot.gov/infrastructure/asstmgmt/lccasoft.cfm

Part 2 – Products

At a minimum asphalt shall be in conformance with AASHTO Designation MP-1, Table I and shall be PG 58-26 for 19 mm asphaltic concrete and PG 58-22 for modified asphaltic concrete (MAG).

MAG Table 710-3 Marshall Mix Design Criteria will be used for both 19 mm (3/4 in) and MAC. The aggregates and mix to be incorporated into the work shall also meet the following additional requirements.

Test	Acceptable	Test Results
AC TYPE Test	19 mm	MAC
Absorbed Asphalt Range (ASTM 1559)	0 – 1%	0 – 1%
Combined Water Absorption (AASHTO T-84)	0 – 2.25%	0 – 2.25%
Marshall Stability (ASTM D1559)	1800 min	1,000 min
Flow (ASTM D1559) Units of .01 inches	8 to 18	15 min
Air Voids Content (mix)	3% to 5%	3% to 5%
Tensile Strength Ratio (TSR) (AASHTO T 283, with optional freeze cycle)	0.75 min	0.75 min
Sodium Sulfate Soundness (AASHTO T-104)	12 % max	12 % max
Percent Carbonates (Arizona test Method 238)	30 % max	30 % max
Binder Content	5.3% to 6.0%	8.0%to 9.0%

All asphaltic concrete and modified asphaltic concrete shall contain a minimum of 1% Portland cement or dry hydrated lime by weight of total aggregate added to the aggregate in a pug mill prior to addition of the binder. The moisture content of the aggregate immediately prior to the addition of the admixture shall be a minimum of 3.0 %.

See MAG for modified asphaltic concrete specifications.

<u>REQUIREMENTS FOR ANIONIC/CATIONIC EMULSIFIED ASPHALT</u>
(revise to include the following for CRS-2P)
CATIONIC RAPID-SETTING POLYMER-MODIFIED ASPHALTIC EMULSION, CRS-2P MATERIAL SPECIFICATIONS FOR CHIP SEAL COATING

Test Description	Test Method	Min	Max
TEST OF EMULSION			
Viscosity, SFS @ 122 F	D244	125	400
Settlement, 5 days, %	D244		5
Storage Stability 1 Day, %	A244		1
Class, Un-coated Par	A502	60	
Particle Charge Test	D244		+

Sieve Test, %	D244		0.30
Oil Distillate, % V of Emulsion	D244		3
Residue by Distillation, %	D244	66	
Tests on Residue by VACUUM RECOVERY A512			
Viscosity, ABS, Poise @ 140 F	D2171	1800	2800
Pen @ 77F, 100g/5 sec, Dmm	D5	40	90
Ductility, 77F, 5 cm/min, Cm	D113	40	
Solubility in TCE, %	D2042	97.5	
Toughness, inch-pounds	(1)	150	
Elastic Recovery by means of Ductilometer, %	T301	58	
Tenacity, inch-pounds	(1)	110	
Polymer Content (by wt. Of solids) %	CAL-401	2.5	
TEST ON RTFO RESIDUE			
Aging Ratio, ABS viscosities	D2171		2.5
POLYMER REQUIREMENTS			
Melt flow rate, dg/min 190 C	D1238		45

1) Benson method of toughness and tenacity: Scott tester, inch-pounds @ 77ºF, 20 inches per minute pull. Tension head 7/8" diameter.
2) Upon standing undisturbed for a period of 24 hours, the emulsion shall show no white milky film upon the surface.
3) The base asphalt shall be modified prior to emulsification.
4) The emulsion shall be pre-certified prior to use. A one-quart sample each of the base asphalt and polymer shall be supplied to the agency 10 days in advance to the project start.

Section Number Title

MODIFIED ASPHALTIC CONCRETE

Modified Asphalt Concrete (MAC) shall consist of a mixture of paving asphalt, modifiers and mineral aggregate which, with the addition of mineral filler and blending sand as may be required, shall be mixed at a central mixing plant in the proportions hereinafter specified to provide a homogeneous and workable mixture.

Modified Asphaltic Concrete (MAC) shall consist of furnishing asphaltic concrete with binder meeting the requirements of either:

Rubberized Asphaltic Concrete (RAC)
Polymer Modified Asphalt Concrete (PMA)
Polymer Modified Rubberized Asphalt Concrete – Dry Process (PMRAC)
SHRP graded PG64-28TR=(TR+)

At the locations shown on the plans in accordance with the following specifications. Within 10 calendar days of notice of award, the Contractor shall submit in letterform, the name of the supplier and a type of MAC to be supplied.

Contractor shall submit test results from an independent testing company 1 week prior to construction. Application and testing will be in accordance with MAG 321.

MATERIAL

BINDER
The asphalt rubber binder in the mix shall comply with MAG 717 and 335 except the rubber shall be type II and the minimum rubber content for Rubberized Asphaltic Concrete (RAC) shall be 17% as a percentage of total binder. Asphalt cement for all MAC shall meet the requirements of PG 58-22 as per AASHTO MP-1 Table I. Polymer shall be Type SBS and shall be 5.5% to 7% of the total binder for PMA. Twenty percent of the modifier for PMA shall be ground tire rubber. The PMA shall be such that the materials conform to the specification requirements. Ground rubber shall be Type II with the following gradation:

Gradation – Ground Rubber (Type II)

Sieve No.	% Passing
#10	100
#16	70-100
#30	25-60
#50	0-20

Section Number | Title

#200 0-5

Binder for Rubberized Asphaltic Concrete (RAC) shall conform to the following specifications:

Parameter	Requirement
Apparent viscosity, centipoise, 350ºF, Spindle 3, 20 RPM (ASTM D2196)	1500-6000 Centipoise
Penetration, 77ºF, dmm, 100g, 5 sec (ASTM D-5)	25 minimum 90 maximum
Penetration, 39.2ºF, dmm, 200 g, 60 sec (ASTM D-5)	15 minimum
Cone Penetration, 77ºF, dmm,150g, 5 sec (ASTM D-5)	25 minimum
Resilience, 77ºF, % (ASTM D-3407)	20 minimum
Softening Point, ºF (ASTM D-36)	135 minimum
TFOT Residue (ASTM D1754)	75 minimum
Penetration Retention, 39.2ºF, %"	

Haake type viscosity may be substituted for field control.

Binder for Polymer Modified Asphaltic Concrete shall conform to the following specifications:

Specification:	ASTM	SPEC. LIMITS	
ORIGINAL ASPHALT	**METHOD**	**MIN.**	**MAX.**
Penetration, 39.2 F (200g/60 sec), dmm	D5	25	
Penetration, 77 F (100g/5 sec), dmm	D5	40	90
Softening point, F	D36	180	
Flash point, F	D92	450	
Ductility, 39.2, F (5 cm/min), cm	D113	30	
Ductility, 77 F (5 cm/min), cm	D113	100	
Viscosity, 275 F, cst	D2170	1000	
Specification:	ASTM	SPEC. LIMITS	
Recovery, 39.2 F, %	D113 MOD	60	
Solubility in Trichlorethylene %	D2042	99	

AGED ASPHALT (RTFO)	METHOD	MIN.	MAX.
Retained Penetration, 77 F, %	D5	60	
Viscosity Ratio, 275 F, %	D2170		15
Softening Point, F	D36	175	
Ductility, 39.2 F (5 cm/min), cm	D113	20	

The asphalt binder modifier for the PMA shall contain a minimum of 20% recycled material.

The Polymer Modified Rubberized Asphalt Concrete – Dry Process (PMRAC-DP) and SHRP graded PG64-28TR+ shall conform to requirements of Superpave Grade PG64-28 (AASHTO MP-1 and MAG Section 335) except as follows:

			PMRAC-DP
PG64-28TR+			
Test Properties	Test Method	Specification	Specification
Scrap whole tire rubber (Type II) content, %, Minimum		17.0	8.0
Trans-polyoctenamer rubber polymer (TOR), %, Based on the weight of the tire rubber		4.5	
SBS Polymer content %, Minimum			2.0
Original Testing			
COC Flash Point, °C, Minimum	ASTM D92	232	232
Softening Point, °C, Minimum	ASTM D36	50	50
Elastic Recovery, 10°C, 10cm, % recovery/1hr, Minimum	ASTM D6084	55	55
Solubility in Trichloroethylene, Minimum, %	ASTM D2042	97.5	97.5
Dynamic Shear, 64°C, 10 rad/sec, G∗/sin delta, kPa, Minimum	AASHTO TP5	1.00	1.00
G∗/sin delta, phase angle, degrees, Maximum		75	75
RTFO Residue Testing	AASHTO TP5		
Test Properties	Test Method	Specification	Specification
Dynamic Shear, 64°C, 10 rad/sec,			

Section Number | Title

G*/sin delta, kPa, Minimum		2.20	2.20
PAV Aging Residue Testing	AASHTO TP5		
Dynamic Shear, 25°C, 10 rad/sec, G*/sin delta, kPa, Maximum		5000	5000
Bending Beam Rheometer	AASHTO TP5		
Creep stiffness, -18°C, MPa/60 sec, Maximum		300	300
M-Value, -18°C, 60 sec, Minimum		0.300	0.300

Aggregate shall conform to Section 710.2.2.

The aggregate gradation will be as follows:

Sieve No.	Percent Passing
5/8	100
1/2	98 +/- 2
3/8	85 +/- 7
4	35 +/- 7
8	20 +/- 5
30	10 +/- 5
200	5 +/- 2

AGGREGATES CHARACTERISTICS

Combined aggregates shall conform to 710.2.2 except the minimum sand equivalent shall be 65 and at least 85% by weight of the aggregate retained on the #8 sieve shall consist of particles with at least one rough, angular surface produced by crushing.

MINERAL FILLER AND ANTI-STRIPPING AGENT

Mineral filler and anti-stripping agent shall be as per MAG Section 710.2.3.

MIX DESIGN REQUIREMENTS

The provisions of MAG Section 710.3 MIX DESIGN REQUIREMENTS shall apply to MAC except that:

References to asphalt, liquid asphalt, bituminous cement shall be changed to "binder conforming to 714.2.1."

For estimating purposes, the percentage of binder in the MAC shall be 8% for PMA and RAC. For estimating purposes, the percentage of binder in the MAC shall be 7% for TR+ and for PMRAC-DP. The exact amount of binder in the MAC shall be

subject to the Design Professional's approval after review of the Contractor's job mix formula and materials submittals. Marshal mix design criteria will be used for MAC.

PRODUCTION TOLERANCES

The provisions of MAG Section 710.4 PRODUCTION TOLERANCES shall apply to MAC except that:

References to asphalt, liquid asphalt, bituminous cement shall be changed to "binder conforming to 714.2.1."

PRODUCTION REQUIREMENTS

The provisions of MAG Section 710.5 shall apply for MAC except that:

References to asphalt, liquid asphalt, bituminous cement shall be changed to "binder conforming to 714.2.1."

Bituminous binder course shall 2" thick, conforming to MAG Specifications Section 710;

Bituminous surface course shall be 2" thick, conforming to MAG Specifications Section 710.

Sealer coat shall be applied after completion of laying of asphalt. DP to specify time frame and procedures. DP to include in asphalt section design.

32 12 19 Asphalt Paving Wearing Courses

Part 1 – General

All new asphaltic pavements shall include a wearing course.

Part 2 – Products

Quick setting and emulsified asphalt per MAG spec type CRS-2.
Aggregate gradation shall conform to MAG spec table 716-1 for moderate traffic areas and MAG spec Table 716-2 for high traffic areas. ADOT specification CM 11 will be considered as an alternate subject to availability of MAG specification material and credit price.

Submit chip sample for testing prior to application.

Section Number | Title

Part 3 – Execution

Loose chips shall be swept and removed within a 24-hour period and again at a later date if chips still remain.

Contractor is responsible for protection of all manholes and valve covers. All manholes and valve covers shall be marked with non-permanent orange paint and protected with cardboard (or equally effective material) prior to chip sealing.

32 12 36 Seal Coats

Part 1 – General

Bituminous surfacing shall be used only in exceptional cases. Chipseal is the preferred preservation method.

Part 2 – Products

N/A

Part 3 – Execution

N/A

32 12 73 Asphalt Paving Joint Sealants

Part 1 – General

Expansion joint filler material is used with asphalt pavements per MAG Sections 321-336.

Part 2 – Products

Joint materials shall be in conformance with MAG Section 729

Part 3 – Execution

N/A

Section Number | Title

32 13 00 Rigid Paving

This section includes concrete and pervious Portland cement based concrete pavements.

32 13 13 Concrete Paving
32 13 13.01 Concrete Paving –Vehicular Applications

Part 1 – General

Concrete ramps must meet the requirements outlined in the Design Guidelines.

Submittals
Shop Drawings: Submit sections and details where not fully dimensioned on the drawings.

Manufacturer's Data: Submit for all products.

Mix Design: Prior to pouring any concrete, submit concrete mixes for approval in accordance with Division 03. Separate mix designs shall be submitted for each type of concrete to be used in the project.

Record of Work: Provide record of time and date of placement, temperature, water additions to the mix, and weather conditions.

Quality Assurance
For placement restrictions see Division 03 Concrete.

All materials to conform to Division 03 Concrete

Prior to placement of concrete, independent testing lab must confirm subgrade compaction, Owner will confirm that the form placement conforms to the survey and is within the tolerances. Reinforcement shall be tied and supported in rebar chairs as approved by the DP. If welded wire mesh is used, support shall conform with plans and specs. Owner will confirm proper placement and spacing between the rebar or weld wire mesh and the forms.

Minimum Thicknesses:
1. Sidewalks not subject to Vehicle Traffic: 4".
2. Sidewalks and Drives subject to Vehicle Traffic: 6".
3. Structurally Supported Slabs (Such as Over Tunnels): As required to meet potential loading conditions.

4. Loading docks: 8”

Part 2 – Products

Reinforcement shall conformance with 03 21 00 Reinforcing Steel.

All loading docks shall be paved in concrete and reinforced per DP specifications.

Provide either welded wire fabric or fibrous reinforcement in concrete. One type is required for all on-grade slabs.

Curbs, gutter and cross pans finished with burlap drag or wood float. Do not plaster surfaces.

Immediately after float finishing sidewalks and ramps, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fine hair fiber-bristle broom except on inclined slab surfaces provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to the line of traffic.

Special Finishes: Do not use special finishes such as colored concrete, exposed aggregate, etc. unless specific approval from Owner is obtained. Evaluation will be made on a job-by-job basis. Do not use metal nosings on exterior concrete stairs.

Part 3 – Execution

Deposit concrete near final position on grade with minimum segregation and without damage of subgrade. Consolidate concrete so that concrete shall fill the forms and be free from rock pockets, bee holes, and honeycombing.

Finishing

Use equipment designed to spread, consolidate, screed and float freshly placed concrete in one pass, providing well consolidated, homogeneous mixture, requiring minimum of hand finishing to meet surface tolerances.

Finished surface tolerances:

Tested with 10' straight edge parallel to center line immediately following first floating of surface.

Advance straight edge 5'; space under straight edge shall not exceed 3/16".

Joints

Control joints shall have a minimum depth of 1/4 of the thickness of the slab in the concrete or a minimum of ¾ inch.

Space at even intervals perpendicular to the path of travel.

The jointing pattern shall be equal to the width of the walk or drive to a maximum of 6 feet o.c. on any side or 10 feet for curb and gutter.

For small concrete replacements the jointing pattern shall match existing adjacent work.

Expansion joints with preformed joint filler in a vertical position, deviating not more than 1/4" from a straight line. Expansion joints shall be installed when abutting existing concrete or fixed structure. Expansion joint material shall be ½" thick and shall extend the full depth of contact surface and shall be at a maximum spacing of 60 foot o.c.

Saw Cutting and Patching

Joints shall be sawcut or added during placement with a jointing tool to eliminate random expansive cracking of slab surfaces. Sawcutting shall be performed within 24 hours of the slab

Curing

Required curing practices shall be specified by the Design Professional in the design documents. Contractor shall have curing equipment and accessories ready for use prior to placement of the concrete to ensure prompt curing once the exposed surfaces are finished.

Designers will provide for curing options for warm, dry and cold weather.

Concrete operations: Curing of the concrete should begin immediately upon finishing the surface. Finishing should not be completed until surface bleeding has stopped and the bleed water has dried immediately after finishing and water film has evaporated from surface. Do not use liquid membrane type on surfaces to receive mortar bed finishes.

Field Quality Control / Testing

General: All testing shall be performed by an approved testing laboratory. The following tests and procedures are subject to change during construction at the discretion of the Design Professional.

Control Tests: Control test of concrete work shall be made at such times and in such manner as recommended by the Design Professional, with Owner's approval, at the expense of the Owner. Each test shall consist of 3 standard 6" test cylinders cast and cured in accordance with ASTM C31 and C172. One cylinder shall be broken at the end of 7 days after placing, one cylinder shall be broken at the end of 28 days after placing. The remaining cylinder will be broken only when the previous test reports indicate unsatisfactory results. Tests shall be made at the time test cylinders are taken, and recorded on the reports to determine the slump, air content, unit weights, and temperature of the concrete. All tests shall be made in accordance with ASTM C39, C138, or C231.

Protection
Protect fresh uncured surfaces from rain.

Cold Weather: Maintain temperature of concrete above 50 degrees F. for minimum five days from placement.

No vehicle loads exceeding design loading. No equipment permitted on new pavement until design strength is attained.

Design Professional to specify cure of 3 to 7 days minimum unless special use / mix.

32 13 13.02 Concrete Paving – Pedestrian Applications

Part 1 – General

This section includes all general concrete paving for pedestrian travel ways or entry features, that do not have special prominence dictating special design finishes.

Part 2 – Products

N/A

Part 3 – Execution

Design Standard

A. 8' minimum design width at all sidewalks, including collector walks at residence hall buildings. Major pedestrian paths of travel ,or major/significant

building entries shall be of a width justified by traffic volume and aesthetic precedent. Standard gray, no color or pigment.

B. Sidewalks should have 6 inches of concrete over 4 inches of base course.
C. Magnesium floated, with a medium broom finish, perpendicular to the path of travel.

D. Expansion joints 20' maximum in a single run of paving.

E. Architectural scoring or joints to be at the same interval as the design width of the subject travel way. Designers option for widths greater than 8', or areas requiring special design consideration, maintaining patterns that are 3’x3’ minimum and 12’x12’ maximim, square or rectangular.

F. An additional 3' of width is required for walks that are adjacent to surface parking lots, where the edge facing parking is used as a wheel stop or overhang area.

G. Walk intersection corners shall be rounded and at all grade changes shall have appropriate curb cuts and transitions that allow full accessibility and safety.

H. A minimum 12' radius turn-around area is required for any dead-end walk.

32 13 16 Decorative Concrete Paving

Part 1 – General

Special paving methods outlined in this section to be used as an accent in special areas, such as building entries or the Pedway, or areas of significance on campus, such as plazas and gathering spaces. Decorative pavement shall be a simple, unifying element that creates pedestrian scale, and provides ease of maintenance and repair. Colored or stamped concrete is not permitted unless approved by Owner, in instances where flexibility in design elements may be appropriate when the landscape is to be reflective of the architectural design. Generally, the landscape, including pavement, is intended to knit buildings and character zones together.

Submittals and Mock-ups

Prior to installation of decorative pavement, Contractor to provide an 8’x8’ mock-up to ensure desired look is achieved and is in conformance with established campus standards. Approval by Owner (project manager and campus landscape

architect) is required. Mock-up shall stay in place throughout project duration as a standard for judging completed work. Do not move or destroy mock-up.

Part 2 – Products

Allowable Decorative Paving

Sand Finish Concrete Paving: to be used for the Pedway and special gathering areas such as plazas, courtyards, and building entries. Owner to provide Design Professional with standard design for Pedway at applicable projects. Concrete shall meet Owner standards and be 6" thick, fibermesh reinforced overlaying 4" of compacted aggregate base course. Concrete mix design must contain 60% fine aggregate and 40% large aggregate to achieve sand finish. Standard gray to be used, no color or pigment. Sand finish to be achieved using surface retarder as follows:

A. 'Top Cast' by Grace Construction Products or approved equal

B. Number code: grade 05

C. Etch/aggregate size to expose: light sandblast finish

D. Coverage: 250-350 square feet per gallon

E. Retardant removal per manufacturer's standards, typically within 6-24 hours after application. Timing of removal dependent upon temperature to create desired finish.

Integral Color Concrete Paving: for use at Pedway only, at bike lane. Specify 'graphite' pigment, Davis Colors (mix 2 lbs of 8084 per 1 cu. ft. of cement). Owner to provide Pedway design at applicable projects.

Sealer to be applied to decorative concrete paving after 14 day curing period unless otherwise directed by Owner. Owner has pre-approved the following product to be in compliance with these standards: MasterProtect H 400 Sealer (water-based 40% silane penetrating sealer).

Part 3 – Execution

Medium broom finish, perpendicular to path of travel.
Expansion joints 20' maximum in a single run of paving, except to be 37.5' at Pedway.

Section Number | Title

Architectural scoring or joints to be at the same interval as the design width of sidewalks. Design Professional's option for widths greater than 8', or areas requiring special design consideration, utilizing patterns that are 3'x3' minimum and 12'x12' maximum, square or rectangular.

At Pedway, use 2' long, ½" diameter rebar dowels at 2'-6" o.c. to tie pedestrian and bicycle lane sections together.

32 14 00 Unit Paving

32 14 13 Precast Concrete Unit Paving

Part 1 – General

Pavers should be a simple, unifying element to create a pedestrian scale and provide ease of maintenance and repair. Pavers can be used as an accent material in outdoor gathering spaces with no vehicular traffic. Use in vehicular areas shall be limited and as approved by Owner.

Submittals and Mock-ups

Prior to construction of the sample pavement, Contractor to submit one set of six units each for each type and color of paver required, showing full range of colors and textures. Pavers shall be consistent with the materials palette in the Landscape Master Plan and per Part 2 – Products, below.

Materials included in the palette are the only materials allowed for use at the exterior of all new buildings and renovations.

For all new and infill concrete unit pavers adjacent to existing pavement, a 36 square foot sample pavement (mock-up) shall be constructed on site near the proposed work area to evaluate the selected paver for matching. Contractor shall allow for sufficient time for the Owner and the DP to evaluate and approve the proposed pavement.

On new construction, a minimum 36 square foot sample pavement (mock up) shall be constructed to establish the standard of acceptance for all elements of the work, including but not limited to: curbing and expansion, bond pattern, tie-in with other materials and finishes, accessories, etc. The sample panel shall be approved by the Owner and the Design Professional prior to ordering materials and commencement of paver work.

Retain sample pavement (mock-up) during construction as a standard for judging completed unit paver work. Do not move or destroy mock-up until work is completed.

For roadway applications, pavement section should include a concrete subbase for pavers. Consult with geotechnical engineer if the area will have vehicular traffic.

Part 2 – Products

Paver units shall be whole and undamaged prior to installation. Units that are chipped, cracked, broken or stained are not allowed

Provide materials obtained from only one source for each type and color of pavers.

Bedding and joint sand shall be clean, non-plastic, and free from deleterious or foreign matter. The sand shall be natural or manufactured from crushed rock. The sands shall be as hard as practically available.

Sound durable particles free from organics, clays, deleterious and foreign matter. Use an aggregate base course material per MAG Section 702.

Bed Sand shall conform to ASTM C33 and joint sand shall conform to ASTM C144 not more than 1% passing No. 200 sieve.

Pavers must be 4” x 8” x 3 1/8” (80 mm) or 4” x 18” x 3 1/8” (80 mm).

Paver Materials

Owner has pre-approved the following manufacturers to be in compliance with these standards:

- Belgard Holland Pavers, 4” x 8” x 3 1/8” (80 mm), ‘Sedona Blend,’ or approved equal. Sand-set, concrete subbase required.
- Belgard Plankstone, 4” x 18” x 3 1/8” (80 mm), ‘Rio’ (blend of charcoal and gray), or approved equal. Sand-set, concrete sub-base required.

ACCESSORIES

Upon recommendation by the geotechnical engineer, a geotextile fabric may be specified for paver installation. Use of fabric is reserved for areas with clay soil or damp conditions.

Section Number | Title

Part 3 – Execution

Contact Blue Stake before conducting any excavations. See procedures in Division 1.

Excavate the pavement area to allow for the pavers and the bedding sand layer.

Prepare subgrade soil per the recommendations of the soils report. In all cases, this will include even grading of the area and compaction. The subgrade shall be free from water, clay and rocks. If recommended, provide a geotextile fabric.

Verify location, type, installation and elevations of edge restraints around the perimeter area to be paved.

Place an approximately 1-1 ¼ inch deep sand bed. Use polymeric sand in joints where sand washing out of joints will be an issue.

Lay out work in pattern provided in the plans and specs to minimize cutting. Cut pavers as necessary to fit within the edge restraints.

Lay the pavers with consistent spacing for joints and provide an even flat surface with no elevation deviation between pavers of greater than 1/16" will be unacceptable. Pavement tolerance of 3/16" is allowed over a distance of ten feet.

Install per MAG detail 225 with modifications per manufacturer's recommendation.

32 14 30 Concrete Stepping-stone Pavers

Generally, for limited use along seat walls as a skateboard deterrent. This design requires high level of maintenance and should be limited to special design areas.

Preferred size: 2' square. Standard gray concrete (no color or imprint). Must be surrounded by bluegrass turf or low ground cover. Surrounding with unplanted mulch or gravel is not acceptable.

32 14 45 Grass Pavers

To be used where contiguous lawn areas are desired to provide subgrade support for pedestrian or vehicular fire truck traffic. Install per manufacturer's specifications. Owner has pre-approved the following manufacturers to be in compliance with these standards: Grasspave.

Section Number | Title

32 15 00 Aggregate Surfacing

32 15 13 Cinder Surfacing

32 15 40 Crushed Stone Surfacing

Part 1 – General

Gravel roads shall be constructed with the proper cross section to allow for drainage and maintenance. Use the Coconino county lot split standard for sloping of roadway bed and shoulders for emergency and maintenance access driveways.

Part 2 – Products

If no geotechnical recommendations are available surfacing and subgrade for gravel roadways, use the recommended gradation from the EPA gravel roadway guidelines: http://www.epa.gov/nps/gravelroads/.

Requirement	Aggregate Base Course	Gravel Surfacing
Sieve	Percent Passing	Percent Passing
1"	100	
3/4	80-100	100
1/2"	68-91	
No. 4	46-70	50-78
No. 8	34-54	37-67
No. 40	13-35	13-35
No. 200	3-12	4-15
Plasticity Index	0-6	4-12

Part 3 – Execution

Contractor to call Blue Stake before grading the roadway area.

Excavate within the area to allow for driveway material, shoulders, and drainage areas.

Scarify and compact the subgrade per MAG Section 301

Install the subgrade ABC per MAG Section 310.

Section Number | Title

Install the crushed stone (gravel surfacing) wearing course per MAG Section 310.

32 15 40.01 Crusher Fines Surfacing

Part 1 – General

May be used at seating areas or as secondary, informal path in forested area or through lawn or native grass areas. Use concrete border at paths. Not to be used at building entries, areas with high velocity stormwater runoff, areas that require snow plowing, or primary circulation routes.

Part 2 – Products

¼" minus 'Madison Gold' decomposed granite with fines.

Use CE-Structural Soil or approved equal as subbase material where new trees are planted in crusher fines. Planting pit to be 10' diameter minimum.

Tackifier tube used when trees (new and existing) are not planted in crusher fines area.

Part 3 – Execution

Install 4" thick without weed fabric. Proper subgrade preparation, an underdrain system, or a minimum slope should be utilized to assist drainage.

32 16 00 Curbs and Gutters

Curbs are used to define the roadway areas and for drainage control.

Part 1 – General

For concrete curbs see Division 03 Concrete.

Part 2 – Products
N/A

Part 3 – Execution

Refer to division 33 for utility marker requirements in curblines .

Section Number | Title

32 17 00 Paving Specialties

32 17 13 Parking Bumpers

Parking bumpers shall only be specified for pavement installations within 2’ of existing structures or fences.

32 17 23 Pavement Markings

All roadway pavement markings other than lane striping are to be thermoplastic . They may not be painted.

Painted traffic markings to be 4" wide and contain glass beads.

All bike lane assemblies, turn arrows, stop bars, crosswalks, or similar roadway pavement markings are to be thermoplastic.

Typical right angle parking stalls are to be installed at a minimum stall size of 9’x18’ and are to be striped on-center of these dimensions. Refer to the Design Guidelines for additional detail on ADA parking stalls.

Parking lot striping color schemes:
White – Used for vehicle stall lines & motorcycle parking hatched areas
Yellow – Hatches used for no parking of any type. Stenciled inside “no parking”.
Blue – Hatched Accessible aisles, ADA Stall Lines & Accessible Icons. Stenciled “no parking” inside of hatched areas.
Red – Curbs, Fire Lanes, & Hatched Areas anywhere we do not want there to be parking. Typically associated with fire truck access areas. Stenciled “no parking” inside of hatched areas.

32 17 23.33 Plastic Pavement Markings

Preformed Thermoplastic Pavement Markings

1. **USE:** A durable, high skid resistant, retroreflective pavement marking material suitable for use as interstate shields, route shields, bike path, roadway, intersection, airport, commercial or private pavement delineation and markings.

    1.1. The markings must be a resilient white, yellow or other color thermoplastic product, the surface of which must contain glass beads and abrasives in an alternating pattern. The markings must be resistant to the detrimental effects of motor fuels, lubricants, hydraulic fluids etc. Lines, legends and symbols are capable of being

affixed to bituminous and/or Portland cement concrete pavements by the use of the normal heat of a propane torch.

1.2. The markings must be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastic when heated with the torch.

1.3. The markings shall not have minimum ambient and road temperature requirements for application, storage, or handling.

2. **MANUFACTURING CONTROL AND ISO CERTIFICATION:** The manufacturer must be ISO 9001:2008 certified and provide proof of current certification. The scope of the certification shall include manufacture of reflective highway markings.

3. **MATERIAL:** Must be composed of an ester modified rosin resistant to degradation by motor fuels, lubricants etc. in conjunction with aggregates, pigments, binders, abrasives, and glass beads which have been factory produced as a finished product, and meets the requirements of the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways. The thermoplastic material conforms to AASHTO designation M249-79 (98), with the exception of the relevant differences due to the material being supplied in a preformed state.

3.1. Graded Glass Beads:

3.1.1. The material must contain a minimum of thirty percent (30%) intermixed graded glass beads by weight.
The intermixed beads shall be clear and transparent. Not more than twenty percent (20%) consists of irregular fused spheroids, or silica. The index of refraction shall not be less than 1.50.

3.1.2. The material must have factory applied coated surface beads and abrasives in addition to the intermixed beads at a rate of 1/2 lb. (± 20%) per 11 sq. ft. The surface beads and abrasives must be applied in an alternating arrangement across the surface of the material so that the surface is covered in what is best described as a “checkerboard” pattern of glass beads and abrasive materials. The abrasive material must have a minimum hardness of 8 (Mohs scale). These factory-applied coated surface beads shall have the following specifications:

1) Minimum 80% rounds
2) Minimum SiO_2 content of 70%;
3) Minimum refractive index of 1.5
4) Maximum iron content of 0.1%

Size Gradation		Retained, %	Passing, %
US Mesh	Um		
12	1700	0 - 2%	98 - 100%
14	1400	0 - 6%	94 - 100%
16	1180	1 - 21%	79 – 99%
18	1000	28 - 62%	38 - 72%
20	850	62 - 71%	29 – 38%
30	600	67 - 77%	23 - 33%
50	300	86 - 95%	5 – 14%
80	200	97-100%	0 - 3%

3.2. Pigments:

3.2.1. White: The material shall be manufactured with sufficient titanium dioxide pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected.

3.2.2. Red, Blue, and Yellow: The material shall be manufactured with sufficient pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected. The yellow pigments must be organic and must be heavy-metal free.

3.2.3. Other Colors: The pigments must be heavy-metal free.

3.3. Heating indicators: The top surface of the material (same side as the factory applied surface beads) shall have regularly spaced indents. These indents shall act as a visual cue during application that the material has reached a molten state so satisfactory adhesion and proper bead embedment has been achieved and a post-application visual cue that the installation procedures have been followed.

3.4. Skid Resistance: The surface of the preformed retroreflective marking materials, wherein every other shaped portion contains glass beads, or abrasives with a minimum hardness of 8 (Mohs scale), shall upon application provide a minimum skid resistance value of 60 BPN when tested according to ASTM: E 303.

3.5. Thickness: The material must be supplied at a minimum thickness of 90 mils (2.29 mm) or 125 mils (3.15 mm).

3.6. Retroreflectivity: The preformed retroreflective marking materials upon application shall exhibit adequate and uniform nighttime retroreflectivity. The marking materials shall have the following retroreflectivity as measured using a Delta LTL 2000 or LTL-X Retroreflectometer:

White preformed reflective marking materials–minimum of 275 $mcd \cdot m^{-2} \cdot lx^{-1}$

Note: Initial retroreflection and skid resistance are affected by the amount of heat applied during installation. When ambient temperatures are such that greater amounts of heat are required for proper installation, initial retroreflection and skid resistance levels may be affected.

3.7. Environmental Resistance: The material must be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to oil and gasoline.

3.8. Abrasives: The abrasives and surface beads must be applied in an alternating arrangement across the surface of the material so that the surface is covered in what is best described as a "checkerboard" pattern of glass beads and abrasive materials. The abrasive material must have a minimum hardness of 8 (Mohs scale).

4. **APPLICATION:**

4.1. Asphalt: The materials shall be applied using the propane torch method recommended by the manufacturer. The material must be able to be applied without minimum requirements for ambient and road temperatures and without any preheating of the pavement to a specific temperature. The material must be able to be applied without the use of a thermometer. The pavement shall be clean, dry and free of debris. Supplier must enclose application instructions with each box/package.

4.2. Portland Concrete: The same application procedure shall be used as described under Section 4.1. However, a compatible primer sealer may be applied before application to assure proper adhesion.

5. **PACKAGING:** The preformed thermoplastic markings shall be placed in protective plastic film with cardboard stiffeners where necessary to

prevent damage in transit. Linear material must be cut to a maximum of 3' long pieces. Legends and symbols must also be supplied in flat pieces. The cartons in which packed shall be non-returnable and shall not exceed 40" in length and 25" in width, and be labeled for ease of identification. The weight of the individual carton must not exceed seventy (70) pounds. A protective film around the box must be applied in order to protect the material from rain or premature aging.

6. **TECHNICAL SERVICES:** The Contractor shall provide technical services as required.

32 17 26 Tactile Warning Surfacing

Wherever curb ramps are installed they shall comply with the Design Guidelines for universal accessibility. These ramps shall also include a tactile warning area paved using detectable warning/cast iron truncated domes in an area determined by the ADA Design guideline requirements. Use Neenah Foundry cast iron truncated dome, or approved equal.

****END OF SECTION****

Section Number | Title

32 30 00 SITE IMPROVEMENTS

Part 1 – General

All site improvements shall be designed with sustainability in mind and shall conform to the Design Guidelines for Sustainability. Consider Low Impact Development (LID) stormwater management, snow plowing and storage, maximum accessibility, and other innovative practices for design of site improvements.

NAU's Landscape Master Plan, Principles, Standards and Concept Designs section to be referenced for supplemental information. Site improvements shall conform to the Landscape Master Plan. Proposed design and construction drawings to be reviewed by Owner's campus landscape architect for approval. Requirements set forth in the Technical Standards, Landscape Master Plan and Owner's campus landscape architect's review shall be incorporated into the construction documents prepared by the DP. Where discrepancies exist, Owner (campus landscape architect) shall be consulted and Owner shall have ultimate authority on final decisions.

Part 2 – Products

Products used for site improvements are covered in Sections 31 00 00 and 32 00 00.

Part 3 – Execution

If no direction is given in the plans and specs follow manufacturer's recommendations or MAG applicable sections.

32 31 00 Fences and Gates

Part 1 – General

Refer to NAU Landscape Master Plan, Principles and Design Standards, Railing section, for specific information regarding allowable locations on campus, including appropriate character zone (Historic North, Central Innovation, or Mountain South) and site placement. Also refer to concept plans in Landscape Master Plan for guidance regarding preferred type and placement.

Generally, fencing, railing and handrails to be treated as a unifying campus element with consistent use of specified materials while allowing some variability in design.

Part 2 – Products

Allowable materials and locations as per below. Variations to be approved by Owner.

Paint used on fences, handrails, and gates shall be Modern Masters ME209 Pewter unless otherwise specified by Owner.

Temporary, non-structural barrier: may be used to discourage pedestrian access or to protect newly installed landscaping during establishment period. Standard is plastic black post and chain.

Ornamental black iron fencing design with brick masonry pillars: May be used at north and central campus to define campus edges. Replicate existing style, including cap, brick, and metal detailing. Not for use at interior campus areas.

Rustic steel: Can be used at south campus when separation rail is needed for pedestrian safety. Use Corten or weathering steel, pre-treated to induce rusting and then sealed to reduce staining. Use concrete cap and stone base/pillars (natural sandstone or limestone), sealed.

Stainless steel or steel handrail/fall protection railing painted color as noted in Part 2-Products of this section: To be used throughout campus in all character zones, at stairs or ramps, or areas requiring fall protection. Specify stainless steel or steel painted with new NAU standard silver color paint as approved by Owner, or galvanized aluminum (unpainted), with rounded top rail with round or square vertical supports welded to top rail. With Owner approval, black, brown or green painted railing may be specified at certain locations where existing context dictates. Fall protection railing to have 4” maximum vertical or horizontal spacing.

Weathering steel handrail/fall protection railing or fencing: May be used with Owner approval at south campus at stairs or ramps, or areas requiring fall protection or fencing. At pedestrian gathering areas, treat with muriatic acid and peroxide to induce rusting, followed by sealant to prevent staining of concrete/rubbing off of rust. If unsealed, offset from concrete to prevent staining. When used as handrail/fall protection railing, specify rounded top rail with round or square vertical supports welded to top rail. Fall protection railing to have 4” maximum vertical or horizontal spacing. Existing railing in good condition may be

painted to match weathering steel. When used as fencing, match FUTS (Flagstaff Urban Trail System) design.

Part 3 – Execution

No unique requirements. Install per manufacturers' requirements.

32 32 00 Site Walls

Mock-up shall be constructed by Contractor to establish the standard of acceptance for all elements of the work. The sample wall shall be approved by the Owner and the Design Professional prior to installation. Retain mock-up during construction as a standard for judging completed. Do not move or destroy mock-up until work is completed.

Refer to NAU Landscape Master Plan, Principles and Design Standards, Walls section, for specific information regarding allowable locations on campus, including appropriate character zone (Historic North, Central Innovation, or Mountain South) and site placement. Also refer to concept plans in Landscape Master Plan for guidance regarding preferred wall type and placement.

Stucco, CMU and basalt stone not to be used for site walls. Pre-cast block to be only as specified in Section 32 32 23.

Construction and plans for all site walls shall be approved by Owner to ensure appropriateness of materials, design, and placement.

Skateboard deterrent: Exterior planters, seat walls, and retaining walls shall be designed to deter skateboard use. Metal skatestops are discouraged. Acceptable methods to be used:

Breaks or interruptions every three feet minimum along top of wall/at wall cap, using 1" deep x 2" wide sawcuts. Cuts shall be designed to be integral to site element.

Chamfered or rough edges which are less likely to be ground down.

Strategic placement adjacent to or within landscape beds or lawn/native grass areas.

Section Number	Title

32 32 13 Cast-in-Place Concrete Retaining Walls

Part 1 – General

Concrete work to conform to Technical Standards Division 3: Concrete.

Part 2 – Products

Exposed surfaces of cast-in-place concrete low-height (approximately three feet) freestanding and retaining walls to be sand finish, in North zone along North-South Pedway only, and throughout central and south campus. Sand finish must match Owner's established standard for appearance and quality, to be standard gray, without color or pigment, beveled/chamfered edge preferred. Board form texture, without color or pigment, beveled/chamfered edge, may also be used at south campus zone. Appearance and quality to match Owner's standard.

Wall cap options as follows:
North zone (along Pedway only) and Central zone: no cap, to provide clean lines and modern detailing, or utilize sand finish concrete cap (standard gray) for more classic appearance.

South zone: sand finish concrete cap (natural gray) for classic appearance, or manufactured concrete pre-cast product cap, to mimic look of natural limestone. Product to be approved by Owner. No cap at board form texture concrete walls

Part 3 – Execution

Contractor to construct wall mock-up for Owner approval by Campus Landscape Architect; mock-up is to remain throughout project duration.

32 32 23 Segmental Retaining Walls

Part 1 – General

Contractor to submit product sample to Owner and DP prior to purchase.

Part 2 – Products

Owner has pre-approved the following products to be in compliance with these standards:

- Low height freestanding or retaining walls up to 30" high, gravity walls up to 36" high: product to be as approved by Owner. , Appropriate application as a seat, edge or planter wall, with strategic location required to deter skateboarding

- Mass segmental retaining walls to be used where higher retaining walls are required. Product to be Belgard 'Mega-Tandem Wall,' 'Danville Beige' with 'Mega-Tandem' cap. Can be used for free-standing seat walls up to 36" high, gravity retaining walls up to 10' high without surcharge, and reinforced walls up to 15' high. Wall terracing is preferred, with plantings, to soften visual impact. To be used in North and South character zones, or Central zone with campus landscape architect approval only.

Part 3 – Execution

Install per manufacturer's direction.

32 32 53 Stone Retaining Walls

Part 1 – General

In Central campus, clean lines and modern detailing shall be used. Sandstone and limestone in natural form to have tight coursing with long rectangular blocks and smooth face. In North campus, pitched, chiseled faces are desired to mimic the stonework at the campus historic buildings. In South campus, drystack limestone is preferred. Use of natural stone may be able to be coordinated with Owner (Landscaping & Outdoor Services) in some instances, using Owner's stockpiles.

Stone sample(s) to ensure desired visual appearance, including coloration and facing, along with testing data, to be submitted to Owner for approval. Required testing for sandstone, to be performed by a registered geologist, is ASTM C-170 Standard Test Method for Compressive Strength of Dimension Stone, including parallel and perpendicular loads. Provide test results to Owner for review and approval prior to selection of stone source. Limestone shall be hard enough to avoid cracking and fracturing. Testing for limestone to be at Owner's request.

Anti-graffiti product to be applied following completion of stonework. Apply silane/siloxane sealer before application of anti-graffiti product to provide protection against water absorption and penetration, prolonging life of the stone. A silane/siloxane sealer is preferred above a sealer containing only one of these ingredients. Owner has pre-approved the following product to be in compliance with these standards: Vandlguard.

Part 2 – Products

Limestone Walls

Classic Limestone Wall

A. Character zone: North
B. Placement: high visibility accent areas and seat walls.
C. Wall cap: natural limestone.
D. Rectangular blocks 6”-12” high and 12”-18” long with pitched, chiseled face.
E. Rock and mortar color to match existing campus limestone.
F. Source to be within 500 miles of campus

Modern Limestone Wall

A. Character zone: Central
B. Placement: high visibility accent areas and seat walls.
C. Wall cap: none
D. Drystack large cut blocks, 2’-3’ in length and 12”-18” high maximum.
E. Rock color to match existing campus limestone
F. Source to be within 500 miles of campus

Drystack Limestone Wall

A. Character zone: South
B. Placement: seat walls, edge wall, and retaining walls under 3 feet high.
C. Wall cap: none
D. Drystack large blocks in natural form, 2’-3’ in length and 12”-18” high maximum.
E. Rock color to match existing campus limestone
F. Source to be within 500 miles of campus

Sandstone Walls

Classic Sandstone Wall

A. Character zone: North
B. Placement: high visibility accent areas and seat/edge walls.
C. Wall cap: natural limestone or sandstone, manufactured concrete cap as approved by Owner , or sand finish concrete cap
D. CMU with sandstone veneer
E. Rectangular blocks 6”-12” high and 12”-18” long with pitched, chiseled face
F. Raked mortar joints with color pigment to match natural stone
G. Source within 500 miles of project location
H. Minimum 4” thick veneer with rock bedding planes parallel to ground to discourage spalling.

Section Number | Title

Modern Sandstone Wall

A. Character zone: Central
B. Placement: high visibility accent areas and seat/edge walls.
C. Wall cap: none, sand finish concrete cap, or natural sandstone
D. CMU with sandstone veneer in ashlar pattern
E. Rock color should match existing red sandstone on campus
F. Raked mortar joints with color pigment to match natural stone.
G. Source within 500 miles of campus
H. Recommended veneer to be 4" thick with rock bedding planes parallel to ground to discourage spalling.

Part 3 – Execution

Contractor to construct wall mock-up for Owner approval, and mock-up shall remain throughout project duration.

Cast-in-place retaining walls with a stone veneer shall be sealed on the side which contacts soil to prevent efflorescence from appearing on the outside of the wall.

All stone veneer walls shall not have stonework extend below grade or surface of adjacent pavements and walks. At least two inches of the foundation shall be exposed above adjacent grade level.

32 33 00 Site Furnishings

Refer to NAU Landscape Master Plan, Principles and Design Standards, Furnishings section, for specific information regarding allowable locations on campus, including character zone (Historic North, Central Innovation, or Mountain South) and site placement. Also refer to concept plans in Landscape Master Plan for guidance regarding preferred furnishing type and placement.

Furnishings appropriate for each site/building shall be included in the project. Furnishings should be durable, either placed or designed to deter skateboarding, and composed of sustainable materials. Central campus furnishings, at certain areas, are encouraged to be expressive in design.

32 33 13 Bicycle Racks and Skateboard Racks

Part 1 – General

Existing bike racks of the same model may be re-used on projects with the Owner's (Project Manager and campus landscape Architect) approval. Existing bike racks

that are re-used shall all match in color and finish within the same location. Per Owner direction, existing bike racks to be painted in Modern Masters ME209 Pewter.

Part 2 – Products

Bike Rack

A. Character zone: campus-wide
B. Placement: near building entrances, between buildings, or at social gathering spaces.

Owner has pre-approved the following manufacturer to be in compliance with these standards: Madrix Model UT160, unpainted or powdercoat finish 'Storm Metallic' as approved by Owner.

Skateboard Rack

A. Character zone: campus-wide
B. Placement: near building entrances, between buildings or at social spaces.
C. Owner has pre-approved the following products to be in compliance with these standards: Board Loch brand products 'Genesis 7,' 'Spartan 7,' or 'Spartan 14,' Zinc plated finish.

Part 3 – Execution

Install per manufacturer's direction, on a separate concrete pad from the sidewalk/path of travel.

32 33 23 Site Trash and Litter Receptacles

Part 1 – General

As approved by Owner (Campus Landscape Architect and Project Manager): Big Belly trash/recycling receptacle, Landscape Forms 'POE' waste and recycling receptacles, Anova 'Exposition' double receptacle/recycler.

Part 2 – Products

Owner has pre-approved the following manufacturers to be in compliance with these standards:

1. Big Belly solar-powered trash and recycling stations
   A. Character zone: campus-wide
   B. Placement: areas requiring receptacles, including near building entries, social spaces, and along pedestrian circulation routes.

C. BB5 HUB (Big Belly 5) compactor with SB5 (Smart Belly 5) companion recycler (COMPANION RECYCLER-L; left side companion, never right side), Big Belly hopper to be standard black, Smart Belly faceplate, icon in blue (never 'flap') faceplate. Visual Order Tools (VOTs) to be sent to Owner for sign-off/approval; without the foot-controlled opener, as it will assuredly become stuck/damaged in snow clearing efforts

2. Landscape Forms 'POE'
   A. Character zone: campus-wide
   B. Placement: areas requiring receptacles as an alternate to Big Belly.
   C. Powder-coated metal, color: 'Titanium,' side opening without lock to permit access in winter conditions.
   D. Waste receptacle: 'Landfill' label sign, clear vinyl, white text. Titanium color.
   E. Recycling receptacle: 'Recyclable Material Only' label sign, clear vinyl, white text. Lid and body color: Titanium. Diverter/shield/door top plate color: Ocean. 5" dia. Holes.

3. Anova 'Exposition' double receptacle/recycler with side doors
   A. Character zone: campus-wide
   B. Placement: areas requiring receptacles, as an alternate to Big Belly.
   C. White decal labels with no background color: "Mixed Recycling" and "Landfill."
   D. SLEX70, low-profile fusion advantage finish 'Textured Charcoal'

Part 3 – Execution

Place on a concrete pad or other paved surface.

32 33 33 Site Manufactured Planters

Part 1 – General

Planters below are pre-approved Alternate planters may be considered on a case-by-case basis if approved by Owner.

Part 2 – Products

Quick Crete Products Corp. precast concrete 'Cascade Round' series planter
A. Character zone: campus-wide
B. Placement: Pedestrian gathering areas, building entries

Section Number | Title

C. Color: 'Latte', texture: 'Craftsman's Etch,' standard gloss sealer, drain hole, interior water sealant
D. 36" outside diameter x 18" height (or other size variation as approved)
E. Watering saucer preferred to limit staining of concrete from soil organics

Quick Crete Products Corp. precast concrete 'California' series rectangular planter
A. Character zone: central
B. Placement: Pedestrian gathering areas, building entries
C. Color: 'Latte', texture: 'Craftsman's Etch,' standard sealer, drain hole, interior water sealant
D. 24" wide x 96" length x 24" height (or other size variation as approved)

Landscape Forms Kornegay 'Quartz' series planter
A. Character zone: central
B. Placement: Pedestrian gathering areas, building entries
C. Color: 'Natural Gray' or 'Terra Cotta', drain hole, Alga-chem and Bituminous sealant
D. 45" or 27" height (or other size variation as approved)

Part 3 – Execution

No unique requirements

32 33 43 Site Seating and Tables

Part 1 – General

Some existing benches may be replaced with tables and chairs to deter skateboarding and increase social activity. Benches should be placed to capitalize on mountain views and in more intimate quiet spaces.

Alternative furnishings may be included with approval from Owner. In Central Campus Character zone, expressive furnishings design may be encouraged significant campus gathering areas.

Part 2 – Products

Benches:
Owner has pre-approved the following manufacturers to be in compliance with these standards:

Metal Bench

A. Character zone: campus-wide
B. Placement: Gathering areas with crusher fines or pavement
C. Landscape Forms 'Parc Vue,' powder-coated metal, color: "Titanium,' backed bench with arms
D. Custom skateboard deterrent required (provided by manufacturer)

Thermory (heat modified ash) Bench

A. Character zone: campus-wide
B. Placement: intimate seating areas
C. Anova 'Allure' Thermory 6' Contour Bench without armrests: Owner approved alternative material. Recycled plastic not preferred. Tropical hardwood not permitted
D. Custom skateboard deterrent desired (provided by manufacturer) unless strategically located
E. Concrete pad or footings required for supports

Resysta Bench

A. Character zone: campus-wide
B. Placement: intimate seating areas and social spaces
C. mmcite 'Intervera' bench with backrest and armrest, 6' long, Resysta boards with CO2 lacquer finish, RAL 9007 powdercoated steel supports.
D. Custom skateboard deterrent required (provided by manufacturer) unless strategically located.
E. Concrete footings required for support.

Tables and Chairs:

Attached

A. Character zone: campus-wide
B. Placement: Pedestrian gathering areas
C. Landscape Forms 'Carousel,' powder-coated metal color: 'Titanium,' chairs with or without backs, perforated seats and table
D. Anova 'Beacon Hill,' Thermory Owner approved alternative material, fusion advantage finish color: 'pewter,' flat or contour seats. Recycled Plastic not preferred. Tropical hardwood not permitted.

Moveable

A. Character zone: campus-wide
B. Placement: Pedestrian gathering areas with increased security, so that furniture cannot be removed, i.e. fenced area

C. Landscape Forms ‘Catena’ tabletop steelhead perforated without umbrella hole, ‘Parc Vue’ 24” single backed bench seat, powder-coated metal color ‘titanium’

Umbrellas

A. Character zone: campus-wide
B. Placement: optional with Landscape Forms tables and chairs
C. Landscape Forms ‘Solstice Cygnus,’ powder-coated metal custom colors: NAU blue or gold
D. Canvas umbrellas not allowed

Chairs

A. Character zone: central and south campus
B. Placement: Pedestrian gathering areas
C. Adirondack chairs: Loll Designs Adirondack Collection 4 slat, flat, (standard or rocking), colors: charcoal, evergreen, leaf, custom NAU blue
D. Chaise Lounge: Maglin MCL720 Series-M, powder-coated steel, south campus colors: ‘Bronze 14’ or ‘Silver 14,’ central campus colors: ‘Graphite,’ ‘Silver 14,’ or custom NAU blue

Other/Custom Furnishings:

Picnic Table

A. Character zone: campus-wide
B. Placement: Pedestrian gathering areas with crusher fines or concrete pad (not in grass). Strategic placement required to deter skateboarding.
C. 6’ or 12’ length, supports to be smooth standard gray concrete, weathering steel or Corten, seats and table top to be sustainable wood product approved by Owner, tropical hardwood not permitted. If weathering steel is used, it must be treated with muriatic acid and peroxide to induce rusting and then sealed to prevent staining of concrete.

Picnic Table with Benches

A. Character zone: campus-wide
B. Placement: Intimate seating areas with crusher fines or concrete pad. Strategic placement required to deter skateboarding.
C. mmcite ‘Tably’ table, 6’ long park table with ‘Vera Solo’ 6’ long park benches on solo leg, without backrest or arms. Resysta boards with CO2 lacquer finish. RAL 9007 powdercoated steel supports.

Harvest Table

A. Character zone: Central and South campus

B. Placement: Pedestrian gathering areas with crusher fines or concrete pad (not in grass). Strategic placement required to deter skateboarding.
C. 24' length, supports to be smooth standard gray concrete, weathering steel or Corten, seats and tabletop to be sustainable wood product approved by Owner. Rainforest sourced wood not permitted. If weathering steel is used, it must be treated with muriatic acid and peroxide to induce rusting and then sealed to prevent staining of concrete.

Solar Charging Station

A. Character zone: campus-wide
B. Placement: Pedestrian gathering areas with crusher fines or concrete pad (not in grass).
C. 'Soofa Core' in custom NAU blue, or other as approved by Owner.

Bar Style Seating

A. Character zone: Central campus
B. Placement: Only where specified in Landscape Master Plan Concept Designs. Strategic placement required to deter skateboarding.
C. Swivel seating design encouraged

Skateboard Bench

A. Character zone: Central and South campus
B. Placement: Areas where skateboarding can be encouraged. Place adjacent to skateable surface. Not to be used in high traffic areas.
C. Stainless steel edge required, standard gray concrete (no color or pigment).

Double-sided Wood Deck Lounge Chair

A. Character zone: Central and South campus
B. Placement: Only where specified in Landscape Master Plan Concept Designs. Strategic placement required to deter skateboarding.
C. Sustainable wood product approved by Owner i.e. Kebony, Black Locust. Rainforest sourced wood not permitted.

Hammock

A. Character zone: Central and South campus
B. Placement: Only where specified in Landscape Master Plan on concept design plans.
C. All weather fabric that is water and mildew resistant, stainless steel or galvanized steel supports, colors: NAU custom blue or gold.
D. Hammock stand/posts preferred. Do not install at trees.

Section Number | Title

Part 3 – Execution

Generally, items should be anchored in concrete so as to not be removed.

32 39 00 Manufactured Site Specialties

32 39 13 Manufactured Metal Bollards

Part 1 – General

Manufactured metal bollards shall be collapsible when placed in fire access routes.

Part 2 – Products

As approved by Owner: is MaxiForce™ Traffic Control Bollards, manufactured by Blue Ember Technologies or equivalent. Part ID is MCSW-SS3-S, Description: MaxiForce Collapsible (MC) Bollard, Standard Style (S) Rectangular Body, Wrench (W) Operated, Standard Style 3 (SS3) Head, Simple (S) Base, One Wrench Included Per Every 10 Units. Color is Bengal Silver Drylac 049/99999 powder coat. Standard Duty Aluminum Release Insert (breakaway insert) is recommended.

Part 3 – Execution

Installation shall be per manufacturer's recommendations.

****END OF SECTION****

Section Number | Title

32 80 00 IRRIGATION

32 84 00 Planting Irrigation

Part 1 – General

A. All irrigation systems for new construction shall be designed as part of the landscaping plans and shall be considered in the topography and grading, and storm water management of the site and the surrounding areas.
   1. The Design Professional shall include adequate irrigation design for new plantings and use reclaimed water for irrigation where it is available. Design plan to include drawing for irrigation piping and related equipment.
   2. Planning shall work towards plants and designs that allow for irrigation to be phased out as landscaping becomes established after three to four seasons. With the exception of bluegrass lawn areas, at landscape maturity irrigation will be limited to climate stresses only (drought periods)
   3. Special care shall be utilized in design to avoid the possibility of wind driven mist from wetting paving and building surfaces.

B. The Contractor is responsible for all blue staking before and during the project. Do not begin any excavation until all underground utililities have been located and marked. Hand excavate where required to avoid possible damage.

C. Before proceeding with work, Contractor shall check and verify irrigation layout and site conditions and notify Owner of any discrepancies between drawings and actual conditions. Contractor to be aware of all surface and sub-surface conditions and notify Owner in writing of any circumstances that would negatively impact installation of work. Do not proceed with work until unsatifactory conditions and discrepancies have been addressed.

D. The Owner shall be informed of progress of work so that inspections occur at key times in the construction process, to include: valves, supply and lateral lines, wires, trenching, sleeving, fittings and riser review during installation; and operational test after installation of all plant material to include hydrostatic pressure, controller, and sprinkler head adjustment and coverage test.
   1. Do not backfill trenches until all required inspections are performed by Owner, or Owner may require Contractor to uncover at Contractor's expense.
   2. Any leaks which occur during test periods shall be repaired immediately by Contractor and re-tested until acceptance by Owner.

3. Any systems requiring adjustments for full and even coverage shall be done by Contractor prior to acceptance by Owner at no additional cost. Adjustments may include realignment of pipes, addition of extra heads, and changes in nozzle type or size.

E. Maintenance period for irrigation system shall coincide with maintenance period for Planting.

F. Contractor shall warrantee all workmanship and materials for two years following Owner acceptance of Substantial Completion. Date of acceptance and start of warranty period shall begin when Owner accepts that the entire irrigation system is installed as designed and specified and found to be operating correctly, supplying water to all planting and lawn areas.
   1. Any parts of the irrigation work that fail or are defective shall be replaced or reconstructed at no expense to Owner including restoring grades that have settled in trenches.
   2. Reconstruction shall include any plantings, soil, mulch or othe parts of constructed landscape that may be damaged during the repair.

G. Prior to installation Contractor shall submit to Owner for approval:
   1. Product data, to include all irrigation equipment to be used, manufacturer's brochures, maintenance manuals, warranteees and operating instructions.
   2. Documentation of installer's qualifications showing five years of successful similar irrigation system scope experience including similar climatic conditions.

H. At Owner's acceptance of Substantial Completion, Contractor to provide preliminary as-built record set of drawings to Owner preferably in AutoCAD drawing file format, so that data may be entered into campus infrastructure system. Drawings shall include all information shown on original drawings and revised to reflect changes in the work.

I. Contractor to provide controller chart, prepared and mounted on the inside surface cover of the controller. Chart to show valves, mainline, and plantings irrigated by controller. Chart to be non-fading, weather resistant irrigation diagram.

J. Substitutions of materials or equipment installed or furnished without written Owner approval may be rejected and the Contractor shall be required to remove and replace at their expense.

Part 2 – Products

A. Pipe and Fittings

1. All pipe used for main lines and auxiliary lines shall be schedule 40 PVC pipe with ratings printed on pipe.

2. All fittings shall be schedule 40, pressure rated, PVC fittings.

3. Fittings between the auxiliary (lateral) line and any sprinkler head or hose bib shall consist of swing joints to be two Black Marlex street ells with Marlex risers swing joints.

4. Specifications for piping shall include standards that all piping shall be free from cracks, holes, foreign materials, blisters, sunburn, discoloration, inside bubbles, wrinkles, dents, or any other irregularities or defects that may affect performance

5. No galvanized nipples, elbows, or other fittings shall be used with PVC pipe installations.

B. Controllers

1. The controller shall be Calsense ET3000Irrigation Controller or current model as approved by OwnerRainbird controller or approved equal may be utilized in some instances if approved by Owner.

2. For Calsense controllers, flow Sensors shall be Calsense FM Flow Sensors f] and the master valve will be EFB-CP. Must be installed per Calsense standards.

C. Controller Wires

1. Electronic controller cable to be solid copper wire, UL approved for direct burial, minimum gauge 14 UV for runs under 1000 L.F., 12 UF for runs over 1000 L.F. Control wires must be buried at least 12” (18" preferred) below finish grade.

2. Electric control wires shall be color coded so that neutrals are white, grass areas are red, shrub areas are blue, flower beds are green, and drip irrigated areas are brown.

3. All connections to valves and all splices shall be made with "SNAPTITE" connectors and PT55 sealer, or approved equal.

D. Valves

1. Valves shall have a minimum size of 1". EFB-CP Series Rainbird.

2. Ball valves to be installed before all control valves for isolation.

E. Sprinkler Heads

1. Heads for lawn or native grass areas 20 to25 feet wide shall be Hunter I-20 or approved equal.

3. Heads for 15'-20' wide areas, use Hunter PGJ rotaries or approved equal

4. Heads for areas less than 15' and shrub or groundcover beds shall be Rainbird 1800 series with adjustable nozzles or approved equal

5. Heads for open areas 25 feet or wider with few trees shall be Hunter I-40 or approved equal.

F. Drip Irrigation

1. Rainbird multi-port emitters without box and cover.

2. Provide drip irrigation boxes at end of line flush tubes or isolation valves. Do not use boxes at multi-emitters.

G. Backflow Prevention

1. Backflow preventers shall be reduced pressure type and shall be installed at all connections to domestic water distribution mains.

2. Owner has pre-approved the following manufacturers to be in compliance with these standards: FEBCO and WATTS. Reclaimed water mains will require pressure reducing valves (PRV).

Part 3 – Execution

A. Trenching: Cover Requirements:

All pipe and wire under pavement (sleeves)	18"
Pressurized Lines (mainline)	18" -24" (18" minimum; 24" preferred)
Non-pressurized lateral lines	12"- 18" (12" min.; 18" below paved areas in sleeves)
Non-pressurized drip laterals	8"
Control Wire	12"-18"

1. Trench depth shall be as specified above from the finish grade to the top of the pipe.

2. Lines bordering curbs and sidewalks shall be held 12" away to allow for maintenance and access to the lines.

3. Contractor shall refrain from trenching within the outer canopy edge of any existing tree to remain.

4. Bedding and backfill around and over pipes shall be with sandy soil, clean and free from clods and rocks over 1/8" in diameter. Masonry or coarse and shall befree of organic material, loam, clay or other substances not suitable for intended purposed. Sleeves to be bedded on all sides with 6” depth of material. Pipes 4” of material all sides. Under no circumstances shall PVC pipe rest on concrete, rock, wood, construction debris or similar items.

5. Pipe and control wiring and tubing under walks, roads and other hard surfaces shall be installed in schedule 40 sleeves that are two times the size of the pipe. Sleeves shall extend a minimum of 12" beyond the hard surface

6. Lateral lines shall be 4 inches deeper than the bottom of the head being used.

7. Pipe, drip tubing and control wire being routed under walks, roads or other hard surfaces shall be installed in schedule 40 sleeves. Sleeves to be 12-18” depth.

B. Pipe and Fittings

1. All main lines shall be looped whenever possible so as to improve pressure and flow.

2. Glued joints shall set for 24 hours before pressure is applied to lines.

3. If pipe is stored outside, it shall be protected from direct sunlight.

4. PVC joints shall be glued according to manufacturer’s recommendations.

C. Control Wires

1. Zone irrigation system according to plant water requirements, grouping plants with similar water requirements. Lawn native meadow; planting

beds with shrubs, ornamental grasses, groundcover, perennial or annual flower beds; and trees shall be valved separately and have separate stations on the time clock.

2. All splices shall be made in valve boxes.

D. Valves

1. All valves shall be EFB-CP Series Rainbird valves or approved equivalent. Avoid locating valves in pavement areas. Locate valves in planting areas as much as feasible.

2. Main valves should be located, when possible, in a grassed area, five feet from sidewalks curbs, or other traffic areas. Ball type isolation valves installed vertically before all control valves.

3. Valve boxes shall be set at finished grade, before sod, with valve stems 4" below top of the box. Each valve box or group of valves shall have a quick connect on the pressure side of the valve.

4. Valves to be separated where possible.

5. All valves shall be placed in valve boxes so to allow access for servicing. 3" of gravel shall be placed under all valves (electric, gate and sectional).

E. Controllers

Controllers shall be mounted on the exterior of buildings or any other proximate built structures as approved by Owner.

F. Heads

1. Adjust placement of heads to not overspray onto walks, roads and buildings or conflict with berms or trees.

2. Heads shall be installed so that the top of the head is flush with the finish grade

3. All sprinkler heads shall be set perpendicular to finish grade unless otherwise directed.

4. All lines shall be flushed before the heads are installed.

G. Drip Irrigation

1. Bury tubing 2” below soil (below mulch or gravel is not sufficient bury depth).

2. Locate equidistantly around plant at edge of rootball. Do not locate at plant trunk or main stem.

H. Backflow Prevention

1. All backflow preventers shall be assembled with pipe fittings and risers of galvanized steel, or copper.

2. Immediately downstream of the back-flow preventer shall be a master valve and flow sensor per Calsense specifications.

I. Valves and flush end caps (blow out tubes) shall be placed so the entire system may be winterized. Manual drain valve shall be placed at the end of the irrigation water main line and at the end of each system line.

J. Reclaimed Water System

Where irrigation system uses reclaimed water, all products, including valve boxes, lateral and main line pipe, etc. shall have purple color designation.

1. Contractor shall be responsible for providing and installing all necessary signage for reclaimed water systems.

2. Signage to be metal, 12” x 18” portrait orientation, white background with purple text to read, “RECLAIMED WATER! We are conserving drinking water resources by irrigating with reclaimed water. Please do not drink from the irrigation system! No tome agua del sistema de riego!”.

3. Signage to be installed at existing light poles as approved by Owner.

K. Warning Tape

All main lines shall have tracer wires for efficient locating. Provide warning tape in the trench with irrigation lines where they are 2” diameter and larger, 12 inches above the line and provide detectable warning tape with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector for irrigation mains, conduit or other underground services outside of building line. Provide detectable warning tape (“water” blue for domestic and potable water and “reclaimed” purple for reclaimed water) with metallic core encased in a protective jacket for corrosion protection for irrigation mains, conduit or other underground services outside of building line.

L. When the existing irrigation system is altered as part of project scope of work, test existing mainline, control valves, lateral lines, sprinklers drip lines and wiring prior to alterations. Contractor shall provide continuous supply of water to all areas of existing landscaping on site, which may include hand watering or use of watering trucks.

M. Locations of irrigation components are diagrammatic. Final site conditions and existing and proposed plantings shall determine final irrigation system locations, which may be adjusted as necessary and as directed by Owner to meet existing and proposed conditions with complete water coverage. Contractor shall obtain Owner approval prior to relocation of any items, and shall remove and relocate such items at their expense if Owner approval is not obtained.

N. During installation, keep site free of trash, pavements reasonably clean and work area in orderly condition. Once installation is complete, wash all soil from pavements and other structures. Repair all ruts and any damages to work at site, and remove all materials, packaging and excess soil brought to the site by the Contractor.

O. At end of maintenance period (at Owner acceptance of Substantial Completion), Contractor to provide equipment familiarization and instruction on total operations of system to Owner, and shall turn over all operations logs, manuals, instructions, schedules, keys and any other equipment necessary for operation of irrigation system. Owner shall provide winterization of system at end of season.

32 90 00 PLANTING

Refer to the following sections for information regarding planting:

01 56 39	Tree and Plant Protection
31 37 00	Riprap Boulders and bedding
32 91 13	Soil Preparation
32 92 23	Sodding
32 93 00	Planting
32 94 00	Planting Accessories and Mulch

32 91 00 Planting Preparation

RESERVED

Section Number | Title

32 91 13 Soil Preparation

Part 1 – General

A. This section includes work related to labor, materials, and supplies necessary for and incidental to performing operations in connection with furnishing, delivery, and installation of planting soil and/or modification of existing site soil for use as planting soil.

B. Related sections:
   1. 32 92 00 Turf and Grasses
   2. 32 93 00 Planting
   3. 32 96 00 Transplanting

C. Contractor shall adequately protect the work and re-execute any work that fails to conform with requirements, due to faulty materials or workmanship, at the soonest time that can be coordinated with other work and seasonal conditions.

D. Schedule pre-installation meeting with Owner at least seven days before beginning work.

E. The installer of the work in 32 93 00 Planting shall be the same firm installing work in this section.

F. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify Owner in writing, of any circumstances that would negatively impact health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected. Owner may request Contractor to make corrections to unsatisfactory conditions.

G. Do not mix, deliver, place or grade soils when site conditions create frozen or saturated soil conditions.

H. Coordinate delivery and storage of bulk materials and amendments with Owner and confine to neat piles.

I. Submit all product submittals no more than four weeks prior to start of soil work, including product data and certificates, and recent analysis by a recognized agricultural soils testing laboratory. Submit planting soil for testing after topsoil and compost have been approved. If tests fail to meet specifications, obtain other sources of material, retest and resubmit until accepted by Owner. All soils testing to be at Contractor's expense.

1. For compost products submit:
   a. pH
   b. Salt concentration (electrical conductivity)
   c. Particle size distribution
   d. Physical and chemical contaminants
2. For sand to be used at Low Impact Development (LID) basins submit:
   a. pH
   b. Particle size distribution
3. Soil testing for imported and existing topsoil, and for planting soil mix:
   a. pH
   b. Particle size analysis and USDA soils texture
   c. Planting soil mix to also include percentage of gravel, sand, silt and clay
   c. Percentage of organic matter content
   d. Cation Exchange Capacity (CEC)
   e. Soluble salt by electrical conductivity
   f. Nutrient levels for phosphorus, potassium, magnesium, manganese, iron, zinc, nitrogen, and calcium
   g. Testing laboratory recommendations for supplements to soil for optimum growth of plantings specified

J. Owner shall be informed of progress of work and may request soil compaction testing or additional agricultural soils lab testing after delivery or installation of planting soil.

K. Substantial Completion Acceptance: date at the end of the planting, soil preparation and irrigation installation where Owner accepts this work is substantially complete and warranty period begins. This date may be different than date of substantial completion for other elements of the project.

L. End of Warranty Acceptance: the date when Owner accepts that the plants and work in this section meet all requirements.

Part 2 – Products

Existing Soil

Following completion of required testing and submittals to Owner, modifications to be made shall be determined in consultation with Owner and reference to Owner's Design Guidelines, Section 14. Landscape and Exteriors.

Imported or Existing Stockpiled Topsoil

A. Topsoil shall be friable, fertile loam, free from construction materials, sticks and stones over 2" in diameter, roots larger than 1" diameter, refuse, noxious weeds or weed seeds, heavy or sticky clay, or any other material deleterious to plant growth. Topsoil is subject to inspection and acceptance by Owner, accompanied by required soils analysis. Topsoil shall meet following criteria:

   1. Loam, sandy clay loam, or sandy loam soil texture (USDA classification), with 15% to 25% clay content and combined clay/silt content no more than 55%.
   2. pH between 5.5 and 7.0.
   3. Percent organic matter to be between 2.0% and 5.0% by dry weight.
   4. Soluble salt level: less than 2 mmho/cm
   5. Soil chemistry suitable for growing plants specified.

B. Imported topsoil organic content and particle size distribution to be result of natural soil formation, without addition of compost, sand or chemicals, and without screening to meet requirements.

C. Provide one gallon sample of topsoil source from a mixture of random samples taken from the source or stockpile with required testing results.

Compost Amendment

A. Compost to be blended and ground leaves, wood or other plant-based material, fully composted to break down materials and contain no solid particles greater than ½" length or diameter, and free of uncomposted materials and toxic materials harmful to plants or humans. Source to be yard waste trimmings blended with other plant or manure-based material designed to produce compost.

B. Compost to be commercially prepared or as specified in this section, with a pH between 5.5 and 8.0, accompanied by certification from the manufacturer for pH, salt concentration (electrical conductivity), particle size distribution, and physical and chemical contaminants.

C. Provide one gallon sample with manufacturer's literature and certification as fully composted.

Sand (to be used at LID basins)

A. Sand to be clean, washed, natural coarse sands, free of toxic materials and free of limestone, shale and slate particles.

B. pH to be lower than 7.0.

C. Provide one gallon sample with manufacturer's literature and product certifications.

Part 3 – Execution

A. Prior to installation of Planting Soil from stockpiles or mixes, examine site to confirm existing conditions are satisfactory for work in this section to proceed.
   1. Confirm subgrades are at proper elevation, compaction, and drainage slopes required by drawings.
   2. All areas to be installed with Planting Soil shall be free of construction debris, refuse, biodegradable materials, stones greater than 2 inches diameter, soil crusting, standing water, and any other conditions detrimental to plant growth.
   3. Subgrade to be scarified at areas to receive planting soil to a depth of 3-6 inches with backhoe, loader bucket, tiller of other equipment. In event that loosened area becomes compacted, loosen area again prior to installation of Planting Soil.
   4. Confirm positive drainage from all areas towards inlets, drainage structures and edges of planting beds.
   5. Notify Owner of any unsatisfactory conditions to determine corrective action prior to proceeding with work.
   6. Owner shall approve condition of subgrade prior to installation of Planting Soil.

B. Confirm grades and contours conform to drawings during installation of planting soil.

C. Follow requirements for modifying site soils as indicated in Design Guidelines, Section 14 Landscape and Exteriors, as specified by Design Professional and as approved by Owner.

D. In the event that project construction work has damaged existing soil where designated for planting to the point where it is no longer suitable to support plants specified, Owner may require modification including removal and replacement with soil of quality equal to soil that existing before construction. Examples include compaction, contamination, grading, creation of hard pan or drainage problems, and loss of topsoil horizon.

E. Install Planting Soil in 12-18 inch lifts to required depths. Compact each lift as soil is installed. Scarify the top of each lift prior to adding more Planting Soil.

F. Maintain moisture conditions within Planting Soil during installation or modification to allow for satisfactory compaction. Suspend operations if Soil becomes wet; apply water is Soil is overly dry.

G. Contractor to install Planting Soil at higher level than final grades on drawings to anticipate settlement of approximately 10-15% of soil depth over the first year.

H. Limit travel over installed soil to reduce impact of compaction, including compaction caused by other sub-contractors.
   1. Use equipment with 6 inch long teeth to scarify soil that becomes compacted in upper 6 inches.
   2. Contractor shall protect planting and soil preparation work from damage and shall maintain protection during installation until date of Substantial Completion Acceptance.
   3. Surface tilling is not adequate to reduce compaction at levels 6 inches or greater below finished grade. Soil that becomes over compacted at a depth greater than 6 inches shall by dug up and re-installed at no additional expense to Owner.

I. Installation of compost till layer at Planting Soil Mixes: After Planting Soil Mixes are installed at planting bed areas and just prior to installation of plant material, spread 3-4 inches of compost over beds and roto till into top 4-6 inches of the Planting Soil.

****END OF SECTION****

Section Number | Title

32 92 00 Turf and Grasses

Part 1 – General

A. This section covers work related to furnishing, delivery, installation and maintenance of turf lawn sodding and seeding, and native grass plugging and hydroseeding.

B. Related sections:
1. 01 56 39 Tree and Plant Protection
2. 32 84 00 Irrigation
3. 32 91 13 Soil Preparation

C. Installation of new bluegrass turf lawns may only be specified for areas that can be maintained with normal access (no inner courtyards or areas that are not directly accessible) for irrigation, mowing, fertilizing, and pest control operations.
1. New lawns should not be installed in areas that cannot be actively programmed for use unless otherwise directed by Owner.
2. Bluegrass blend turf shall not be used in any planting strip less than 36" wide.

D. Lawn areas and native grass meadows shall be designed open and clutter free to maximize usability and simplicity, absent of boulders or other items.

E. The same firm shall install planting soil and turfs and grasses.

F. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify Owner in writing of any circumstances that would negatively impact health or installation of turf and grasses.

G. Submit all product submittals prior to installation of materials.

H. Substantial Completion Acceptance: acceptance of work prior to start of warranty period. Landscape work may have different date for substantial completion than other elements of project.

I. End of Warranty: the date when the Owner accepts turf and grasses and all work in this section meet all warranty requirements.

J. Contractor shall adequately protect the work and may be responsible for remedying any subsequent damages due to failure to protect work.

K. Schedule pre-installation meeting with Owner preferably seven days before beginning work.

32 92 16 Native Grass Plugging

Part 1 – General

A. At high visibility areas for short and tall grass meadows, native grass plugs to be installed in conjunction with hydroseeding to reduce establishment period.

B. Submit seeding operations and grass plug planting schedule to Owner for approval prior to start of work.

C. If seeding/planting operations do not occur during July when natural monsoon moisture and warm temperatures are present, hand watering and/or a turf-type annual rye nurse crop may be required.
1. Hand watering frequency required would be three (3) times per week for one (1) month to root in plugs and germinate seed if monsoons are not active with sufficient moisture.
2. Contractor to be responsible for supplying supplemental water as needed during the entire construction period and up to Substantial Completion Acceptance by Owner. Additionally, Contractor may be requested to provide supplemental water throughout warranty period.

D. Weed control in all native grass meadow areas shall be addressed by the Contractor during the entire construction period and up to Substantial Completion Acceptance by Owner.

E. All requirements of Section 32 91 13 Soil Preparation shall apply. Follow requirements for modifying site soil, soil testing, and planting soil as indicated in Section 32 91 13, to be specified on drawings or as directed by Owner based on site conditions and required testing recommendations.

F. Protect newly installed plug areas for up to one year with temporary construction fencing and signage unless otherwise directed by Owner.

G. Grass plugs to be warrantied for one year. Owner to inspect plugs at end of warranty period for Final Acceptance.
1. Contractor shall replace plugs with same species, size and quality as original installation where there are bare areas larger than two square feet.

2. Warranty period to reset with replacement planting, starting on the day the replacement planting is approved by Owner.
3. Immediately remove dead or defective plugs and replace unless required to plant in the succeeding planting season.

Part 2 – Products

A. Tall Meadow Mix – grass plugs

Botanical Name	**Common Name**
Festuca arizonica	Arizona Fescue

B. Short Meadow Grass – grass plugs

Botanical Name	**Common Name**
Bouteloua gracillas	Blue Grama

C. Plastic mesh protection fencing: heavy duty green or orange plastic mesh fencing fabric 48" wide. Provide three-foot-wide gate for each fenced area. Provide 8.5 x 11-inch corrugated plastic signs with white background and black text in Arial font with two-inch high letters, attached to plastic mesh fencing every 50 feet, unless otherwise directed by Owner. Signage to read, "NATIVE GRASS ESTABLISHMENT PROTECTION AREA – PLEASE KEEP OUT." Owner may elect to provide alternative landscape establishment signage for Contractor installation.

D. Soil Preparation Materials as described in Section 32 91 13 Soil Preparation, Part 2 – Products.

Part 3 – Execution

A. Hydroseed to be applied prior to plugging to prevent plug grasses and perennial foliage from being matted to soil.

B. Plant plugs 12" on center, triangular spacing, throughout area, in addition to hydroseed mix, unless otherwise specified.

C. Owner to approve layout of plugs prior to installation. When adjacent to pavement, hold first row of plugs 6" minimum off of edge of pavement.

D. Remove plug "sock" completely at installation Top of plug soil to be flush with adjacent soil surface. Do not scarify plug root system.

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E. Confirm adequate soil moisture at time of installation at planting area. Do not install at saturated or overly dry soils.

F. Protect grass plug installation area at all times from vehicular and pedestrian traffic.
   1. Install plastic mesh protection fencing around plug installation area, to remain up to end of one year warranty period.
   2. At end of warranty period or when requested by Owner, remove fencing and signage.
   3. Make all repairs to grades, ruts and other damage.

G. Weed control within plug installation and fenced protection area shall be accomplished by hand-pulling at least once per month during growing season, including final weeding at end of construction period. Herbicide may only be used in cases of a weedy infestation, if approved by Owner.

32 92 21 Turf Lawn Seeding

Part 1 – General

A. At Owner's discretion, turf lawn seeding may be specified in lieu of sodding.

B. Submit seeding operations and grass plug planting schedule to Owner for approval prior to start of work

C. All requirements of Section 32 91 13 Soil Preparation shall apply.

Part 2 – Products

A. Blend of Kentucky Bluegrass (3 cultivars minimum) and Perennial Ryegrass, or custom blend (i.e. Low Grow/Low Mow or Alternative Lawn) as specified by Design Professional or Owner. Submit to Owner for approval prior to seeding.

B. Soil materials as specified in Section 32 91 13 Soil Preparation.

Part 3 – Execution

A. Turf Renovation
   1. Owner will require Contractor renovation of existing turf where turf is damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

2. Re-establish turf where settlement or washouts occur or where minor regrading is required.
3. Modify, install and test soil as specified on drawings, in accordance with all requirements of Section 32 91 13 Soil Preparation.
4. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
5. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel and other construction materials and replace with new planting. oil per requirements of Section 32 91 13.
6. Mow, dethatch, core aerate, and rake existing turf.
7. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required and only as approved by Owner. Do not use pre-emergence herbicides.
8. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
9. Till stripped, bare, and compacted areas 30"x48" or larger thoroughly to a soil depth of 6 inches. Additional modifications may be determined per Section 32 91 13.
10. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 6 inches of existing soil. Mix at tilled areas only. Aerated, non-tilled areas to receive topdressing application for amendments and fertilizers. Install planting soil to fill low spots and meet finish grades.
11. Soil Amendment and fertilizer: Per soils analysis lab recommendations.
12. Apply seed and protect with fiber mulch as required for new turf.
13. Water newly planted areas and keep moist until new turf is established throughout entire duration of project and up until Substantial Completion Acceptance by Owner.

B. Turf Maintenance to be provided throughout entire duration of project and up until Substantial Completion Acceptance by Owner. Substantial completion may extend into subsequent growing season and may vary from other project elements.
   1. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
   2. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.

3. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch as required.
4. Submit treatments to Owner prior to application to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
5. Watering: If irrigation for the renovated area is precluded from watering schedule coordination with Owner. Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
    a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
    b. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
6. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height: 2.5 to 3.5 inches.
7. Turf Postfertilization: Apply slow-release fertilizer after initial mowing and when grass is dry. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.
8. Turf Maintenance Service: provide full maintenance by skilled employees of landscape installer. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
    a. Lawn Seeding: 60 days from date of seeding application or until satisfactory turf is established and accepted by Owner, whichever is greater.
    b. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

C. Satisfactory Turf
1. Turf installations shall meet with following criteria as determined by Owner:
    a. Satisfactory Seeded Turf: At end of maintenance period, up until time of Substantial Completion Acceptance by Owner, a healthy, uniform, close stand of grass has been established, free of weeds

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and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5”x5”. Areas beneath the dripline of evergreen trees are excluded.

b. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

D. Cleanup and Protection

1. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks or other paved areas.
2. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner’s property.
3. Erect temporary fencing (4’ high green or orange plastic mesh fencing s as required to protect newly planted areas from pedestrian traffic. Maintain fencing and barricades throughout entire construction period up until Substantial Completion Acceptance by Owner and remove after satisfactory turf is accepted by Owner.
4. Remove nondegradable erosion-control measures after grass establishment period.

32 92 22 Hydroseeding

Part 1 – General

A. Submit seeding operations schedule to Owner for approval.

1. Preferred dates are June-July during monsoons, or October-November as dormant seeding application.
2. If seeding operations do not occur during July when natural monsoon moisture and warm temperatures are present, hand watering and/or a turf-type annual rye nurse crop may be required by Contractor.
3. Hand watering frequency required would be three (3) times per week for one (1) month to germinate seed if monsoons are not active with sufficient moisture.

B. Weed control in all native grass meadow areas shall be addressed by the Contractor during the entire construction period and up to Substantial Completion Acceptance by Owner.

C. All requirements of Section 32 91 13 Soil Preparation shall apply. Follow requirements for modifying site soil, soil testing, and planting soil as indicated in Section 32 91 13, to be specified on drawings or as directed by Owner based on site conditions and required testing recommendations.

D. Protect newly installed hydroseed areas for up to one year with temporary construction fencing and signage unless otherwise directed by Owner.

E. Hydroseed areas to be warrantied for one year. Owner to inspect areas at end of warranty period.

F. Native grass areas should be full stands, 98% weed free. Bare areas to be overseeded prior to Substantial Completion Acceptance by Owner.

Part 2 – Products

Blends to be as specified below or as modified and approved by Design Professional and Owner. Submit to Owner for approval prior to seeding.

A. Tall Meadow Blend

Botanical Name	Common Name	% of Blend
Bouteloua gracillas	Blue Grama	40
Blepharonuron trichloepis	Pine Dropseed	10
Bouteloua curtipendula	Side Oats Grama	15
Festuca arizonica	Arizona Fescue	10
Koeleria macrantha	Prairie Junegrass	10
Muhlenbergia rigens	Deer Grass	10
Panicum virgatum	Switch Grass	5

B. Short Meadow Blend

Botanical Name	Common Name	% of Blend
Bouteloua gracillas	Blue Grama	50
Festuca idahoensis	Idaho Blue Fescue	10
Festcua ovina	Sheep's Fescue	10
Muhlenbergia montana	Mountain Muhly	10
Poa fendleriana	Mutton Grass	10
Sporobolus crytandrus	Sand Dropseed	10
Bouteloua dactyloides	Buffalo Grass	

1. Add Buffalograss (*Bouchloe dactyloides*) to short meadow blend for high traffic areas.
2. When adding Buffalograss, use 30% Buffalograss at 6 lbs/acre, 30% Blue Grama and evenly distribute remaining varieties in the mix.

C. Riparian Grass Blend for PLD (LID) Basins with seasonal moisture

Botanical Name	Common Name	% of Blend
Bouteloua gracillas	Blue Grama	40

Festuca arizonica	Arizona Fescue	20
Muhlenbergia rigens	Deer Grass	20
Muhlenbergia wrightii	Spiked Muhly	20

1. For areas with year-round moisture, add:

Carex aquatillis	Water Sedge	10
Carex microptera	Smallwinged Sedge	10

1. For areas with year-round moisture, reduce Blue Grama to 30% with even proportions of remaining species.

D. Sow meadow mixes at 10 lb/acre unless otherwise approved by Owner; obtain seeding rates from seed supplier based on percentage of mix listed. Seed tag germination testing dates to be 12 months or less from date of sowing.

E. Refer to Landscape Master Plan (Principles and Design Standards Section), for perennials that can be added to short and tall grass blends, and riparian blend in high visibility areas. Use equal proportions of perennials added.

F. Plastic mesh protection fencing: heavy duty green or orange plastic mesh fencing fabric 48" wide. Provide three-foot-wide gate for each fenced area. Provide 8.5x11 inch corrugated plastic signs with white background and black text in Arial font with two-inch high letters, attached to fencing every 50 feet unless otherwise directed by Owner. Signage to read, "NATIVE GRASS ESTABLISHMENT PROTECTION AREA – PLEASE KEEP OUT." Owner may elect to provide alternate landscape establishment signage for Contractor installation.

G. Soil Preparation Materials as described in Section 32 91 13 Soil Preparation,

H. Hydroseed mix to include native seed mix as specified, wood fiber mulch, plant, cellulose-based trackifier (Plantago or equal), and 3-2-1 organic fertilizer at a rate of 1.5 LB nitrogen/1000 s.f., unless otherwise directed by Owner or as recommended by soils testing results.

Part 3 – Execution

A. In small areas where hydroseeding is not practical, treat with ½" layer of compost raked into to 2" of loosened soil, and cover with 1" layer of organic mulch after seeding. Apply 3-2-1 fertilizer watered in.
   1 Soil preparation may be modified if determined per requirements of Section 32 91 13 Soil Preparation.

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B. Multiple seeding applications may be necessary to ensure adequate control of weedy species between seeding applications and in instances of seed washout prior to Substantial Acceptance by Owner.

C. Confirm adequate soil moisture at time of installation. Do not install hydroseed at overly saturated or overly dry soils.

D. Protect hydroseed areas at all times from vehicular and pedestrian traffic.
1. Install plastic mesh protection fencing around hydroseeded area, to remain up for one year period unless otherwise directed by Owner.
2. At end of warranty period or when requested by Owner, remove fencing and signage.
3. Make all repairs to grades, ruts and other damage.

E. Contractor is responsible for maintenance of seeded areas, including watering during dry periods, weed removal, monitoring of germination, and reseeding to ensure full stand of grass without bare spots not exceeding 18” x 18”.
1. Provide full maintenance for 60 days from date of seeding application or until satisfactory stand is established, whichever is greater.
2. When initial maintenance period has not elapsed before end of planting season, or if grass stand is not fully established, continue maintenance during next planting season.
3. Weed control shall be accomplished by hand-pulling at least once per month during growing season.
4. Broadleaf herbicide may only be used in cases of a weedy infestation, following first application of seeding, and only if approved by Owner.

32 92 23 Sodding

Part 1 – General

A. Sod is required at new bluegrass turf areas; seeding bluegrass areas is not acceptable to establish new lawns.

B. Warranty sod for a period of one (1) year from date of acceptance. During warranty period, replace sod that has died or is in unsatisfactory condition.

C. All requirements of Section 32 91 13 Soil Preparation shall apply. Follow requirements for modifying soil, soil testing, and planting soil as indicated in Section 32 91 13, to be specified on drawings or as directed by Owner based on site conditions and required testing recommendations.

Part 2 – Products

A. Sod shall be Arizona-grown bluegrass rye mix blend having a healthy, vigorous root system. Blend shall contain a minimum of two (2) improved bluegrass varieties and no more than 25% of rye. Sod shall be tolerant of drought, sun to shade and foot traffic is preferred. Sod soil base to be similar to NAU campus soil types. Sod grown on a sandy loam soil will not be accepted. Owner has pre-approved the following source to be in compliance with these standards (due to similar soil base): Northland Sod in Chino Valley. Alternative sources are to be submitted to Owner for approval. Sod with excessive weed content will be rejected.

B. Sod is subject to inspections and acceptance. Owner reserves the right to reject at any time prior to acceptance, any work and sod which in the Owner's opinion fails to meet the requirements herein. Rejected sod shall be promptly removed and replaced at Contractor's expense.

C. Sod shall be healthy, thick turf having undergone a program of regular fertilization, mowing and weed control; free of objectionable weeds; uniform in green color, leaf texture and density; healthy, vigorous root system; inspected and found free of disease, nematodes, pests and pest larvae.

D. Each piece of sod shall have a soil base that will not break, crumble, or tear during installation. Root base shall be 1" thick. Thatch not to exceed ½" compressed. Sod shall be cut in strips or slabs no more than twenty-four (24) hours prior to delivery.

D. Deliver inorganic or chemical fertilizer(s) to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, warranty and conformance to state law.

E. Planting soil, modifications and amendments shall be per Section 32 91 13 Soil Preparation and subject to inspection and acceptance by Owner, accompanied by required soils analysis.

G. Use selective herbicides, insecticides and fungicides as approved by Owner and adhere to local environmental laws.

Part 3 – Execution

A. Landscape contractor to verify site conditions are as specified prior to beginning sodding work. Report unsatisfactory conditions in writing to Owner. Beginning of installation means Contractor's acceptance of conditions.

B. Soil preparation to be per Section 32 91 13.

C. All sod must be in place prior to October 15th and warranty must be provided for one (1) year from the date of Substantial Completion. If irrigation is winterized prior to one month from time of installation of sod, provide alternative water source by coordinating with Owner and/or supplying water.

D. Sod shall be delivered on pallets with root systems protected from exposure to sun, wind, and heat in accordance with standard practice and labeled with botanical and common name of each grass species in accordance with federal seed act.

E. Sod to be protected from dehydration, contamination and heating at all times. Store sod moist and under shade or covered with moistened burlap. Do not drop sod rolls or slabs from carts, trucks, or pallets. Do not stack more than 24" deep. Install sod within twenty-four (24) hours of delivery. Remove soil base netting/mesh from rolls.

F. Place approved planting soil fill material required to adjust the fine grade to meet drainage requirements or to match adjustment surface fine grades. Soil levels shall be 1" down from adjacent grades including walks, curbs, mow strips or other adjacent paving to allow for sod root base. Remove weeds, debris, and rocks larger than ½" which may hinder sodding. Dispose of debris off-site. Provide smooth, well-countered surface prior to sod installation.

G. Adjust irrigation heads and valve boxes to be flush with finish grade (not turf blade height).

H. Install sod between spring and fall: April 15th – October15th. Do not install on frozen or saturated soil.

I. Sod which is laid shall be slightly moist. Lay sod with longest dimension parallel to contours and in continuous rows. Tightly butt ends and sides of sods together. Stagger rows by 2' minimum and compact vertical joints between strips or slabs so sod will be incorporated into ground surface, ensuring tight joints between pieces. Sod shrinkage is grounds for rejection.

J. When soil and sod are moist, hand-roll sod lightly as soon as possible after laying. Ensure positive drainage of storm and irrigation water will occur without ponding after sod installation.

K. Protect sodded areas against damage from pedestrian and vehicular until acceptance by Owner.

L. First application of fertilizer to sodded areas shall be starter fertilizer applied per manufacturer's recommendations. Water turf thoroughly following applications.

M. Prior to sod installation, remove annual weeds by tilling and perennial weeds by applying herbicide one (1) week before soil preparation and as needed, but no sooner than three (3) weeks after emergence. Contractor to provide seventy-two (72) hour notice prior to application. Herbicides to be pre-approved by Owner.

N. Compact grade at sod areas to 80% SPD with 2% optimum moisture.

O. Maintenance period shall begin immediately after each area is sodded and continue for 60 days or until satisfactory turf is established and Substantial Acceptance by Owner, whichever is greater. When initial maintenance period has elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season. During this time, be responsible for watering, mowing, fertilizing, spraying, weeding, aerating and all related work as necessary to ensure that sodded area is in a vigorous growing condition. Furnishing all supervision, labor, material and equipment to maintain turf areas.

P. Initially water sod upon completion until the irrigation system can be operated under full control. Water sod sufficiently to moisten subsoil at least 4" deep.

Q. Mow to maintain turf at 2 ½" height. Do not remove more than 33% of grass leaf in single mowing. Remove clippings from pavement areas.

R. Resod spots larger than one square foot not having healthy, uniform stand of grass and resod or overseed (using like for like soil) joints which separate ½" or more.

S. Maintenance for new or re-established turf areas shall be as follows:
   1. Maintenance period shall be for 2 mowings or an agreed upon time frame

depending on season of the year. New sod shall be mowed in ½" increments.

2. Spray heads shall be initially set at finish grade of soil **BEFORE** sod installation. During the warranty period additional height adjustments by the Contractor may be required once turf is established. Irrigation shall not result in wilting, puddles or runoff.
3. After 3 weeks, fertilize with a fertilizer that provides one-pound available Nitrogen per 1000 sf.
4. Final acceptance will occur with a satisfactory stand of grass (solid, healthy growth, without bare spots) at the end of the maintenance period.
5. Berms and swales shall be formed as continuous, smooth landforms with no obvious top or bottom to slopes or grade change from berm to swale.
6. Provide positive drainage away from buildings and structures. Direct runoff water to planting areas.

T. Where existing lawns have been damaged by construction they shall be repaired by the Contractor, via resodding, or refurbishment per the Owner's discretion/direction in accordance with Section 32 92 21 Turf Lawn Seeding.

32 93 00 Planting

Part 1 – General

A. This section includes work related to furnishing, delivery, installation, maintenance, and warranty of plant material.

B. Related sections:
1. 01 56 39 Tree and Plant Protection
2. 32 84 00 Irrigation
3. 32 91 13 Soil Preparation
4. 32 94 00 Planting Accessories and Mulch
5 . 32 96 00 Transplanting

C. Schedule pre-installation meeting with the Owner at least seven days before beginning work.

D. Contractor shall adequately protect the work and shall be responsible for any damages or injury due to their actions.

E. Contractor shall re-execute any work that fails to conform to the requirements and shall remedy any defects due to faulty materials or workmanship at the

soonest possible time that can be coordinated with other work and seasonal weather conditions.

F. It is preferable that the same firm shall install the planting soil, plant material, and mulch.

G. Toward the end of the warranty period, Owner shall inspect the work completed in conformance with this section to ensure it meets all requirements of the warranty.

H. Submit all product submittals prior to installation of materials including sources of all plants.
   1. Submit requests for substitutions of species or size to Owner for approval prior to purchase. Substitution requests shall be accompanied by a list of a minimum of three nurseries contacted in the search.
   2. The Contractor may suggest a substitution for a different size of the specified plant or different variety of species.
   3. Requests for substitution will be reviewed and a written response provided by the Owner. The Contractor shall not proceed with ordering or installing any requested substitutions until receipt of written approval is received.

I. Substantial Completion Acceptance: acceptance of the work prior to the start of the warranty period. Once the contractor completes installation of all items in this section, Owner will inspect for Substantial Completion Acceptance.
   1. Any plants deemed defective shall not be accepted. All plant materials shall look vibrant and healthy. Plants that look weak, sickly, or unhealthy will be rejected.
   2. Owner shall have option of inspecting plants prior to purchase. Provide five days inspection notice to Owner. Inspection prior to purchase does not waive Owner's option of rejection of any plant materials deemed unacceptable upon delivery to the site.
   3. Plant material to conform to the standards set forth in the *American Standard for Nursery Stock*.
   4. Owner will provide Contractor written acknowledgement of date of Substantial Completion Acceptance and the beginning of the Warranty Period (to begin on same date). Date of Substantial Completion Acceptance of landscaping may be different than date of substantial completion for other elements of the project.

J. Maintenance: Contractor shall maintain all plantings during work period and until Owner's Substantial Completion Acceptance of landscaping.

1. Maintenance operations shall include: watering, mulching, tightening or adjusting of tree stakes, re-setting plants to proper grade and upright position, fertilization, pruning, weeding, and plant pest control. Planting areas to be kept reasonably free of weeds by hand removal. Chemical weed and pest control is permitted only with approval of Owner.
2. When the work is accepted in parts, the maintenance period shall extend from each of the partial Substantial Completion Acceptances to the last date of the last Acceptance period. Thus, all maintenance periods shall terminate at one time.

K. Plant Warranty: Contractor shall replace defective work and defective plants. Owner shall make final determination if plants meet these specifications or that plants are defective.
1. Trees shall be guaranteed for two full years. During the warranty period, the Contractor is recommended to hand water evergreen material after irrigation system is winterized. In order to maintain healthy trees, it is recommended the Contractor check evergreens biweekly during the winter to determine water needs, unless there is snow accumulation or ground is frozen.
2. All other plant materials, including shrubs, groundcover, and perennials, shall be guaranteed for one full year.
3. Replacement material to be subject to original warranty period starting on the day the replacement planting is approved by Owner. The warranty period resets with replacement material planting(s). Replacement material shall be replaced at Contractors' expense.
4. At any time during the warranty period, the Contractor shall remove or replace, without cost to the Owner, all plants not in a healthy and flourishing condition as determined by the Owner. Include the following remedial actions as a minimum:
    a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
    b. Replace plants that are more than 25% dead or in an unhealthy condition at end of or during warranty period.
    c. Replacement materials shall meet all specifications of original materials.
5. When the work is accepted in parts, the warranty period shall extend from each of the partial Substantial Completion Acceptances to the last date of the last warranty period. Thus, all warranty periods shall terminate at one time.
6. During and by the end of the warranty period, remove all tree wrap, ties and guying and staking unless agreed to by Owner to remain in place.
7. At end of warranty period, Owner shall inspect all warrantied work.

L. Inspection of plant material: Owner may inspect all plants to approve size, health, quality, character, etc.
   1. Plant installation processes and maintenance after planting shall be reviewed by Owner. Any plants not installed according to Owner's technical standards shall be removed and re-installed. Follow Owner standard planting details.
   2. Contractor is responsible for plant corrections, including corrections to root systems.

M. It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to notify the Owner in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
   1. Contractor shall notify Owner in writing stating conditions and submit proposal covering cost of corrections.
   2. If Contractor fails to notify Owner of conditions, they shall remain responsible for plant material warranty.

Part 2 – Products

A. Quality Assurance
   1. All plants shall be healthy, true to species and variety/hybrid/cultivar specified, and nursery-grown in accordance with good horticultural practices and under climatic conditions similar to campus. Material to meet full size of specifications (no recent shifts to larger container).
   2. Trees and shrubs shall be trained in development and appearance to be superior in form, compactness and symmetry. Trees with multiple leaders, unless specified otherwise, and shrubs with damaged or cut main stem(s), will be rejected.
   3. Trees and shrubs with a damaged, cut or crooked leader, abrasion of bark, sunscald, frost crack, disfiguring knots, insects (including eggs and larvae) or insect damage, cankers/cankerous lesions or fungal mats, mold, prematurely-opened buds, or cuts of limbs over 3/4" (1.9 cm) diameter that are not completely callused will be rejected.
   4. Trees and shrubs shall have healthy, well-developed root systems, and be free from physical damage or other hindrances to healthy growth.
   5. Balled and burlapped plants shall be delivered to site with solid balls of a diameter not less than that recommended by the *American Standards for Nursery Stock*, and of sufficient depth to include both fibrous and feeding roots. Balls shall be securely wrapped with burlap, and tightly bound with rope or twine. No plant shall be bound with rope or wire in such manner

as to damage bark or break branches. The root flare should be within the top 2" (5.1 cm) of the soil ball.

6. Balled and burlapped plants will not be accepted if the ball is dry, cracked, or broken before or during planting.
7. Containerized plants are to be well-established within the container, with a root system sufficiently developed to retain its shape and hold together when removed from the container. Soil within the container should be held together by the roots, in form and whole. Plants shall not be pot-bound, nor have kinked, circling, or bent roots. Refer to Execution, H.4. of this section for corrections if needed.
8. Bare root plants are to have a healthy, well-branched, and adequately spreading root system.
9. Leaves: the size, color and appearance of leaves shall be typical for time of year and stage of growth of the species or cultivar. Trees shall not show signs of prolonged moisture stress or overwatering as indicated by wilted, shriveled, or dead leaves.
10. Root systems shall be free of injury, insects and pathogens, and free of stem girdling roots over the root collar or kinked roots from nursery production practices. Root ball shall be moist throughout upon delivery to site. Roots shall not show signs of excessive moisture as indicated by stunted, discolored, distorted or dead roots.

B. Measurement

1. Plants shall conform to the measurements specified within the contract documents. Specified height and spread dimensions will refer to the main body of the plant, and not from branch tip to branch tip. Plants meeting a specified measurement, but judged to lack the balance between height and spread characteristic of the species, will be rejected.
2. Plants shall be measured when branches are in their normal position.
3. If a range of size is given, no plant shall be less than the minimum size specified, and no less than 50 percent of the plants shall be as large as the maximum size specified.
4. Plants larger than specified may be used if acceptable to Owner. Use of such plants shall not increase contract price.
5. Measure the trees and shrubs with their branches, canes, and trunks in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
6. Containerized shrubs may be measured by height and width for conformity with the plant list.

7. Perennials shall be measured by pot size, not by top growth.
8. All other measurements, such as number of canes, ball sizes, and quality designations, shall conform to *American Standards for Nursery Stock*.
9. Unless otherwise approved by Owner, minimum sizes for material as follows:
   a. Deciduous trees: 2" caliper
   b. Aspen shall be single stem, no clump or multi-stem form permitted unless approved by Owner.
   c. Evergreen trees: 6'-8' height
   d. Shrubs and ornamental grasses: 5 gallon
   e. Perennials: 1 gallon

C. Plant Palette and Identification
   1. Refer to Landscape Master Plan for complete list and description of plant materials for each character zone. Materials that are not on the approved Landscape Master Plan list are not permitted unless approved in writing in advance by Campus Landscape Architect.
   2. All plants and trees shall be identifiable to Owner to verify species with the plant tag. All plant tags, pricing, identifiers, and care labels to be removed by Contractor at Substantial Completion Acceptance.
   3. Refer to Section 32 92 16 (Plugging) and 32 92 22 (Hydroseeding) for Tall and Short Meadow Grasses.

D. Planting Soil shall refer to soil at the planting site, or imported as modified and defined in 32 91 13 Soil Preparation.

E. Mulch, Tree Staking and Gravel: Refer to Section 32 94 00 Planting Accessories and Mulch.

Part 3 – Execution

A. Examine surface grades and soil conditions to confirm requirements of 32 91 13 Soil Preparation, and soil, drainage and grading modifications have been completed. Notify Owner in writing of any unsatisfactory conditions prior to work.
   1. Trees and shrubs shall not be planted until all construction work in the area has been completed, final grades established, and planting areas are properly graded and prepared as specified.

B. Where plant material will be placed in soil beneath that was previously beneath pavement, especially asphalt pavement, or other condition where soil sterilant or other treatment potentially harmful to plant material may have been applied, area shall be tested for the presence of any such chemicals or

condition. Affected soils shall be treated and/or excavated and disposed of in accordance with local codes.

C. When applicable and specified on drawings, planting pit percolation rates to be determined prior to planting at tree pits, in the presence of Owner. If pit (filled with water) does not drain in 30 minutes, inform Owner to determine adjusted location or correction of drainage condition.

D. Protect materials from deterioration during delivery and storage. If planting is delayed more than 24 hours after delivery, set plants in protected location and provide adequate water. Owner shall approve duration, method and location of plant storage on site.

E. Planting operations shall be performed when weather and soil conditions are suitable and as approved by Owner.
   1. Do not install material into saturated or frozen soils, or during inclement weather, such as rain or snow or during extreme heat, cold or windy conditions.
   2. If irrigation is winterized prior to one month from time of planting, provide alternative water source by coordinating with Owner and/or providing water truck.
   3. In the event Contractor requests planting outside of installation season dates below, approval does not change requirements of warranty.
      a. Trees and shrubs: Install between April 15th and October 15th.
      b. Perennials: Install between April 15th and September 15th.

F. Coordinate location of any paved surfaces, utilities, or irrigation lines and heads that are in conflict with tree locations. Do not alter root balls to fit around lines. Coordinate size of planting pits and planting areas with project work to provide adequate root growth area, including planning for mature trunk flares and proper subgrade materials at pavement areas. Notify Owner of any conflicts encountered.
   1. Maintain access to manholes for equipment and/or safety gear when locating new trees and other plantings. Location of new trees from the centerline of sanitary and storm sewer utilities to be as follows:
      a. Deciduous ornamental trees: 6’ minimum
      b. Deciduous shade trees: 8’ minimum
      c. Evergreen trees (full size): 10’ minimum
      d. Dwarf variety evergreen trees: 6’ minimum
   2. Aspen trees should not be planted in lawn areas and should be five feet (5’) minimum from paved surfaces.

3. Preferred minimum distance for deciduous trees from paved surfaces (walks and mowing edges) is six feet (three feet minimum with approval by Owner).
4. Evergreen trees to be planted no closer than two feet greater than the anticipated mature radius of branching from paved surfaces.

G. Planting Layout and Sequence: on-site mockup layout of planting bed areas, trees and plants shall be approved by Owner prior to installation.
   1. Notify Owner preferably one week prior to layout. Owner to approve layout prior to planting.
   2. Relative positions of all plants and trees are subject to Owner's approval. Minor adjustments in layout may be required as planting plan is installed. Make adjustments as required by Owner including relocating previously installed plant material.
   3. Trees to be installed before other plants where possible.
   4. Plant material planted in rows shall be uniform in size and shape.

H. Plant Installation
   1. Submit schedule for installation 14 days minimum prior to work.
   2. Do not distribute more plants that can be planted and watered on the same day.
   3. Contractor to inspect root balls of all plant materials prior to installation to confirm plants meet quality standards established herein.
   4. Installers shall loosen root balls on all plants, trees, shrubs, etc. prior to inserting into planting holes.
      a. Remove all circling, girdling, and root matting.
      b. Remove roots and substrate above root collar, and remove substrate at bottom of rootball that does not contain roots.
   5. All rootball binding materials shall be removed, including all twine, wire, and top 2/3 of burlap minimum. Remaining burlap to be cut away and not left intact or folded down onto planting soil, subject to inspection by Owner. Soil rootballs to be kept intact except for any modifications required to roots as required.
   6. Soil excavation, backfill and loosening at tree, shrub and ornamental grass planting spaces:
      a. Excavate soil to depth of rootball (depth to be to bottom of rootball after modifications to correct problems to rootball have been made).
      b. Loosen soil a minimum of three times the diameter of the rootball at the surface, sloping to be two times the diameter of the rootball at its average depth. Loosening is defined as digging into the soil and turning soil to reduce compaction. Soil does not have to be removed from the hole, just dug, lifted and turned.

c. Loosen and recompact soil at bottom of planting space so that bottom of rootball rests on recompacted soil.
d. Where site conditions necessitate use of an auger to dig planting holes, loosen soil around top and sides of planting holes at two to three times rootball diameter.
e. Backfill space around rootball with same planting soil or existing soil that was excavated for the planting space. See 32 91 13 Soil Preparation for required modifications to soil. Place soil around base and sides in six-inch lifts using light tamping to settle backfill to maximum 85% standard proctor density. Water around rootball and allow to settle into soil when hole has been backfilled to ¾ of its depth. Allow water to soak into soil and eliminate air pockets, continuing backfill until planting is brought to grade level.
f. After water settling backfill, top of trees and shrub rootballs to be flush with adjacent finish soil grade, with no rootball exposed before installation of mulch or gravel. No soil shall cover rootball. Contractor to re-set plants if too low.
g. All soil that has been driven over where planting areas/beds shall be tilled to depth of 6” to address soil surface compaction.

7. For plants installed on slope, set top outer edge of rootball at average elevation of proposed finish. Install 4” high berm of planting soil around lower outer edge of rootball to retain water. Tamp berm to reduce leaking and erosion of saucer.
8. Perennials and groundcover materials:
   a. Assure that soil grades in beds are smooth and as shown on drawings. Construction debris and rocks larger than 2" shall be completely removed from site and shall not be buried in planting beds.
   b. Install plants in even, triangular spaced rows, unless otherwise directed by Owner. The first row shall be 6” minimum from the bed edge unless otherwise directed.
   c. Dig holes sufficiently large enough to insert root system without deforming roots.
   d. Top of rootball for perennials and groundcover to be flush with finish grade before installation of mulch or gravel. Do not plant root system in mulch. Mulch depth to be 2” depth at perennial and groundcover beds.

I. Pruning Trees and Shrubs – If, after installation, pruning is needed to address structural defects or to preserve central leader, Contractor shall ensure corrective pruning by qualified individual as directed by Owner.

J. Contractor is responsible for ensuring adequate water is provided to all plants from point of installation until date of Substantial Completion Acceptance. Adjust irrigation system and use hoses or other water source as required.

K. Existing Plant Material: See Section 01 56 39 Tree and Plant Protection for requirements, including required distances for new utilities.

32 94 00 Planting Accessories and Mulch

Part 1 – General

A. This section includes work related to furnishing, delivery, and installation of tree staking, mulch, gravel, and planting bed borders/edges.

B. Related sections:
   1. 31 37 00 Riprap, Boulders and Bedding
   2. 32 93 00 Planting
   3. 32 96 00 Transplanting

C. The same firm shall install the planting soil, plant material, and plant accessories, gravel and mulch.

D. Submit all product submittals four weeks prior to installation of materials.

Part 2 – Products

Mulch

A. Planting Bed Mulch and Mulch at Tree Basins in Lawn Areas: Shredded Western Red Cedar.
   1. Bulk sources only; bagged material not permitted.
   2. Submit one gallon sample including source to Owner for approval prior to delivery to site.

B. Alternate wood mulch product may be used beneath Shredded Western Red Cedar mulch (2” depth maximum for alternate product) to achieve full depth specified (standard depth is 4” unless otherwise specified), only with prior written approval by Owner.
   1. Submit one gallon sample and source.
   2. Mulch to be coarse, ground, free from tree and woody brush, sourced from local supplier. The size range shall be a minimum (less than 25% or less of volume) fine particles 3/8 inch or less in size, and a maximum size of individual pieces (largest 20% or less of volume) shall be approximately 1

to 1-1/2 inch in diameter and maximum length approximately 4 to 8". Pieces larger than 8 inch long that are visible on the surface of the mulch after installation shall be removed.

C. Do not use at retention or detention basins, areas with high velocity runoff, high wind areas, or slopes greater than 3:1.

Gravel

A. Gravel to be ½" or 1" diameter (size as specified on drawings or by Owner), screened 'Rock Springs Chocolate' or 'Table Mesa Brown' crushed rock.
   1. Limit use on campus; may be used at planting beds where flammability or high-wind is an issue, or at unplanted locations only as approved by Campus Landscape Architect.
   2. Do not use at retention or detention basins, areas with high velocity runoff, or slopes greater than 3:1.
   3. Submit one gallon sample including source to Campus Landscape Architect for approval prior to delivery to site.

Tree Stakes

A. Tree stakes shall be three (3) inch diameter by eight (8) feet long Lodgepole Pine, free of any weakening knots or other defect.

B. Guy wire shall be new, 2 strands 12 gauge, anodized, galvanized.

C. Chafing guards shall be new, 16" x 3" canvas strap with brass grommets and heat finished edges. Do not use rubber hose.

Planting Bed Borders and Edges

A. Concrete curb edger to be used for planting bed borders where beds abut turf or native grass meadow areas. Materials to conform to Division 03 Concrete and Landscape Master Plan standard detail: MAG Type 'B' Curb, Detail 222, 6" wide x 12" deep, modified to be flush with finished grade, standard gray concrete without pigment.

B. In instances where concrete header is not practical (i.e. installation would damage existing tree roots), planting beds shall have shovel-cut edge.

C. Do not use metal or plastic edging.

Part 3 – Execution

A. Mulching

1. After planting, ensure all grades are smoothed out between plants between mulching.
2. Place mulch to a depth of 4” thick at all planting beds before settlement. Adjust thickness of mulch at perennials to 2”. Top of mulch to be flush with adjacent finish grades before settlement. At no time shall overall mulch thickness be greater than 4 inches. Do not install with weed fabric or plastic.
3. Mulch shall be no more than one inch depth on top of tree rootball surfaces or within six inches of tree trunks.
4. Lift all leaves, low hanging stems, and other green portions of small plants to be out of mulch and not covered.
5. New trees planted in turf lawns shall be provided with four-foot diameter mulch rings, with sod free soil beyond and around the full circle of the tree, excluding large existing trees. Tree groupings within lawn areas may have one large mulch planting bed around them as approved by Owner.

B. Tree Staking and Straightening
   1. Stake deciduous trees 3” caliper and larger and evergreen trees 6’ tall and larger with 2-3 stakes equidistantly spaced in direction of prevailing wind. Allow 6” play in wire for staking. Stakes shall be driven 3’ into undisturbed soil.
   2. Maintain all plants in plumb position throughout warranty period. Straighten all trees that move out of plumb including those not staked. Plants to be straightened shall be excavated and the root ball moved to a plumb position, and then re-backfilled. Do not straighten plants by pulling trunk with guys.
   3. Remove tree guys and staking after first full growing season unless otherwise directed by Owner.

C. Install gravel 4” thick, without weed fabric or plastic, where specified on drawings. Top of gravel to be flush with adjacent grades. Ensure that adjacent surfaces are clean and free of loose gravel. Gravel thickness shall not exceed 4” at any time.

D. Bed edging: install between mulch and lawn or meadow areas in smooth neat lines. Planting beds shall have 45 degree, 6-inch-deep shovel-cut edge where concrete curb header is not present.

32 96 00 Transplanting

Part 1 – General

Salvage of existing trees from a project shall be performed by a firm approved by

Owner with at least four years of experience with this type of work. The work shall be guaranteed and conducted in a manner consistent with local practice. Owner shall designate a holding area and source of irrigation for containerized or otherwise temporarily stored trees. Owner has first right of refusal for all plantings or materials removed or transplanted from the site. Contractor is required to provide the Owner (Landscape and Outdoor Services and Project Manager) a minimum 72 hours' notice prior to any site removals or anticipated transplants and salvages.

Part 2 – Products

No specific products included.

Part 3 – Execution

Transplanting of plant materials shall be consistent with Section 32 93 00 Planting, Section 32 91 13 Soil Preparation, and Section 32 94 00 Planting Accessories and Mulch.

****END OF SECTION****