DIVISION 2 – SITEWORK

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02000 SITE WORK

General

This section applies to all new buildings, building expansions, utility expansions, parking structures, surface parking lots, campus mall amenities, or any other design/construction activity that materially changes or affects the current features found on campus. Areas incorporated in this section are civil surveys, archaeological studies and utility mapping.

Design Standard

All existing built site features shall be noted as to their disposition during and after construction, i.e., removed, relocated, demolished, stored, etc. Contractor is to provide record photographs, prior to the start of construction, documenting the condition of site features to remain.

All landscape material (trees, shrubs, etc.) and irrigation supply devices shall be noted as to remain, stored, relocated or demolished. If existing plant material is to remain or be stored for future project use, it shall be noted as the GC's responsibility to maintain such plant material for the duration of construction. Unless noted otherwise all existing landscaping shall be returned to original or better condition.

Any existing site feature (built or plant material) shall clearly be identified as to whom will remove, relocate, demolish or store it (the GC or NAU).

02010 Subsurface Investigation

Any project requiring subsurface investigation work shall be coordinated through the Capital Assets office. Such work shall be performed by an independent testing agency. DP to provide list of testing required. Identify the type of test, # of tests, frequency of tests, requirements of tests, etc.

02012 Standard Penetration Tests

02016 Seismic Investigation

02050 Demolition

The Contractor shall ensure that all applicable notifications are completed and submitted to the Arizona Department of Environmental Quality (ADEQ) as outlined in 40 CFR 61.145(b), EPA's asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP) regulation. Notification(s) must be completed prior to all demolition or renovation work as a result of construction activities that impact asbestos-containing materials (ACM).

All demolition and renovation construction activities involving ACM must be in compliance with all applicable NESHAP regulations. The current State of Arizona NESHAP coordinator located at ADEQ can be reached at (602) 771-2333.

Construction Site Stormwater Runoff Control

The Contractor shall apply to the Arizona Department of Environmental Quality (ADEQ) for a construction general permit prior to site work. Upon issuance and approval of the general permit from ADEQ, the Contractor shall submit a copy to the NAU Project Manager for review and recordkeeping purposes.

The Contractor shall develop, implement, and enforce a site-specific Storm Water Pollution Prevention Plan (SWPPP) to reduce pollutants in any stormwater runoff to the Municipal

Separate Storm Sewer System (MS4) from construction activities that result in a land disturbance of greater than or equal to one acre. Reduction of stormwater discharges from construction activity disturbing less than one acre must be included in the program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more.

The Contractor shall incorporate erosion and sediment control in the site-specific SWPPP. In addition, describe the procedure to control and properly dispose of wastes, such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality.

Work may not commence until all site plans or SWPPPs have been reviewed for potential water quality impacts, including erosion and sediment control, control of wastes and their accumulation, and any other potential adverse stormwater impacts that must be examined according to the requirements of the Stormwater Management Plan. Before ground is broken at the construction site, NAU Project Management staff and/or Safety and Environmental Services (SES) staff shall review the site plans or SWPPP and verify (in written communication with the construction site operator) that the BMPs for the site are appropriate.

After work has commenced, the Contractor shall implement procedures for regular site inspections and enforcement of stormwater runoff control measures; these may be incorporated into the SWPPP or may be a separate procedure outlined by the Contractor. The Contractor shall implement ongoing inspections and recordkeeping until project completion. If the Contractor, NAU Project Manager, or NAU SES discover a compromise to stormwater runoff controls or a non-compliant condition arises in reference to the site-specific SWPPP, the Contractor shall immediately implement corrective action. Insufficient corrective action may result in a temporary “cease work” project condition.

Post-Construction Stormwater Management in New Development and Redevelopment

The Contractor shall develop, implement, and enforce the installation of structural or non-structural stormwater controls to address post-construction stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, and discharge into the small MS4. The Contractor shall develop and implement strategies that include a combination of structural and/or non-structural controls appropriate for the community and ensure that the controls are in place and would prevent or minimize water quality impacts from post-construction stormwater runoff.

The Contractor shall incorporate the post-construction controls in a site-specific SWPPP or in the blueprint plans. Work may not commence until post-construction control measures have been reviewed for potential future water quality impacts to the community. Before ground is broken at the construction site, NAU Project Management staff and/or Safety and Environmental Services (SES) shall review the blueprints or SWPPP and verify (in written communication with the construction site operator) that the control measure(s) for the site are appropriate and will not adversely affect the community.

After work has commenced, the Contractor shall be responsible for the proper installation of post-construction stormwater management controls at the site. If the Contractor, NAU Project Manager, or NAU SES discover a compromise to stormwater runoff control installation, the Contractor shall immediately implement corrective action. Insufficient corrective action may result in a temporary “cease work” project condition.

Contractor to restore or repair any damaged sidewalks, curbs, utilities, or plant material. The Owner to review

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repair work with the Contractor and approve prior to final acceptance and payment.

02080 Asbestos Removal

General

All asbestos-containing materials (ACM) are to be removed prior to any renovation or demolition activities. Abatement shall be conducted following procedures outlined in the Occupational Safety and Health Administration's (OSHA) asbestos in Construction Industry Standard 29 CFR 1926.1101 and/or EPA NESHAP (40CFR 61, subpart M) and AHERA (40CFR 763, subpart E) standards. ACM is to be properly contained and disposed of in compliance with all applicable Federal and Arizona regulations.

The asbestos removal contractor will be responsible for the safety and health of its own employees. Compliance with applicable OSHA and EPA regulations will be enforced by the contractor.

The asbestos removal contractor must meet the minimum qualifications and insurance coverage required to perform work on University property. If the asbestos removal contractor is a subcontractor, the primary contractor shall either confirm the minimum qualifications and coverage of the asbestos removal contractor, or shall maintain those qualifications and coverages themselves for the duration of work.

The University, or an asbestos consultant acting upon the University's behalf, will ensure that all contract specifications, approved work plans and applicable regulations are complied with. The University will visually inspect all removal areas. When required, the University or oversight consultant will conduct clearance air monitoring using AHERA guidelines. If residual contamination is found, the Contractor will be required to perform additional cleaning until acceptable levels are achieved, at no additional cost to the University.

The University or Asbestos Consultant will have the authority to stop work immediately if conditions are not within the specifications for controlling exposure to asbestos.

Other non-asbestos demolition or remodeling work in the abatement area is prohibited until the area has either been completely abated and cleared for demolition by the NAU Asbestos Program Office; or the Asbestos Office approves limited demolition which will not disturb asbestos or create an exposure hazard for workers or building occupants.

Description of Work

All fees paid to the contractor shall be based on unit prices determined in advance using a competitive proposal process.

The successful contractor will be required to respond in a timely manner to all requests, within three (3) working days of the notice.

Asbestos is commonly present in the following materials: acoustical ceiling tiles/panels, resilient vinyl flooring materials, transite panels, pipe wrap (lagging) and elbows, asphaltic roofing materials, sprayed or troweled-on wall texture materials. But asbestos may be present in any building materials except wood, metal, and glass, and all building materials except these three shall be treated as suspect until proven to be non-asbestos through analytical means. The NAU Asbestos Program maintains a database of analytical data on existing materials throughout the university and may clear many items based on these existing test results.

Coordination of Work

It is the responsibility of the construction or demolition contractor to furnish an accurate work schedule to the University in order to allow for timely abatement and good coordination between vendors. The

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construction/demolition contractor may be held accountable for additional fees incurred by the university due to improper scheduling or communication on the part of the contractor.

If required in the project specifications or contract, the construction/demolition contractor may be required to subcontract abatement services. In this case the abatement scope and specifications must be provided, or approved by the NAU Asbestos Program office. Closeout documents shall be provided to both the NAU Project manager, and NAU Asbestos Program office to maintain proper regulatory records of the abatement and disposal of asbestos in the work area.

Applicable Regulations

The contractor shall comply with the regulations specified in section 01120 of the Division 1-General Requirements.

The Contractor shall submit, as part of the close-out requirements, an asbestos removal affidavit.

*** * * END OF SECTION * * ***

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02100 SITE PREPARATION

02110 Site Clearing

Contractor to restore or repair any damaged sidewalks, curbs, utilities, or plant material. The Owner shall review the repair work with the Contractor and approve prior to final acceptance and payment.

02115 Selective Clearing

02140 Positive Drainage

The DP is responsible for specifying and the Contractor is responsible for maintaining positive drainage away from structures, around all foundation elements within the project boundary. Contractor assumes all liability if positive drainage is not maintained.

02200 EARTHWORK

02210 Grading

General

This section defines earthwork as rough and finish grading required to grades to design grades for proper site drainage, lawns, shrub and ground cover beds. This section also includes criteria for building and site storm water retention, which shall be confined on-site in retention areas, ponds or drywells.

Design Standard

Fill:

Foundation wall waterproofing **must** be backfilled within 3 days of placement.

Conceptual grade elevations shall be considered and noted on the schematic site plan and soil fill material shall comply with the following:

- soil material shall comply with ASTM D 2487 soil classification groups GW, GP, GM, SM, SW and SP;
- sub-base material shall be specified as naturally or artificially graded mixtures of crushed gravel, stone, slag or sand;
- base course material shall be specified as naturally or artificially graded mixtures of crushed gravel, or stone, conforming to MAG specification 702, Type B;
- backfill and fill materials shall be specified as soil free of clay, rock, or gravel larger than 4", debris, waste or other deleterious material;
- top soil shall be specified as natural, friable, loamy soil, which produces heavy vegetative growth, free from subsoil, weeds, sods, stiff clay and stones larger than 3/4", with a soil Ph not exceeding 8.00 nor less than 6.5, total soluble salts in saturation not exceeding 2,000 parts per million; and,
- all compaction requirements shall conform to applicable MAG specifications.

Grading and Retention

Calculation and design of site retention and flows shall conform to the most recent City of Flagstaff standards and MAG specifications.

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All surface areas shall be graded to drain by natural gravity flow.

Site grades shall direct site water away from all portions of the building, parking lots and walks at slopes that disperse the run-off at a rate that will not allow pooling or ponding.

The use of drywells should only be used as a back-up means of site water retention, and should not be relied upon to satisfy total storm water requirements. NAU does not have a maintenance program to clean and inspect drywells for proper design percolation and sediment removal.

The use of sump type pumps for exterior surface drainage is not allowable.

All grading shall be such that all surface areas will drain by natural gravity flow. Sumps shall not be used for exterior surface drainage disposal. The general guidelines for the amount of slope shall be as follows:

	Grade	Ratio
maximum unsupported cut	100%	1:1
maximum unsupported fill	50%	2:1
maximum practical landscape	40%	2.5:1
maximum lawn slope	33%	3 :1
maximum walk ramp	15%	
maximum handicap ramp	12%	
maximum drive slope	12%	
maximum/ minimum large flat areas	2% to 1%	
minimum landscape or paved areas	1%	

All areas to be planted with grass or ground cover shall receive a minimum of 4" top soil. All finish grades shall be a minimum of 1/2" below adjacent walks, drives, curbs, mow strips and paving.

Any existing site area affected by rough or finish grading activity shall be restored to its original existing condition. Special care should be exercised in design to evaluate any affects new sitework or building will pose on existing site features, retention, travel or aesthetics.

02220 Excavating, Backfilling & Compacting

General

This section includes consideration for any anticipated excavation support systems, including all underpinning, sheeting and tiebacks necessary to protect existing structures, workmen, general public, utilities, pavement, etc. during future project development and the construction process.

Design Standard

All excavation and shoring shall be done in conformance with OSHA Construction Standards for Excavation (29CFR Part 1926.650-652 subpart P) requirements and any other applicable law, rule or statute governing construction excavation and shoring activities on the State of Arizona property.

Any excavation or shoring occurring in close proximity to pedestrian or vehicular circulation; depth and widths greater than 4'; or remaining open longer than 30 calendar days, must be clearly identified on the plans and brought to the attention of the Project Manager by the DP prior to the start of construction, for appropriate action. The Contractor shall notify the Capital Assets Project Manager who in turn shall notify Capital Assets Management, Blue Stake and the City of Flagstaff (if applicable) no later than 48 hours prior to any excavation activity;

Any area to be excavated or shored extending six feet or greater below adjacent natural grade, must be barricaded or fenced (if appropriate) from pedestrian or vehicular traffic.

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Excavated material not used for backfill of the project shall be transported off-site at the time it is excavated. Material used for backfilling may be stock-piled within the construction staging area (or other area deemed feasible by NAU).

The General Contractor shall be responsible for dust control measures during excavation, stock-piling or transport of material on campus, as required by section 01560.

Transport of all excavated material shall be coordinated with the Project Manager, the City of Flagstaff, or Coconino County as applicable. Special time-of-day restrictions in the transport of material may be necessary depending on the project, and should be specified and coordinated with the Project Manager.

NAU on occasion has use for good quality excavated material, and the DP should specify as a bidding option in such cases, direct transport of such material to other NAU project sites or areas.

All compaction requirements shall conform to applicable MAG specifications.

02225 Rock Clause

Rock removal or hard dig is defined as any excavation that would require a hammer attachment and any excavation that can't be done using a 320 trackhoe excavator. Owner reserves the right to:

1.) Negotiate price with contractor and issue a Construction Change Directive (CCD)
2.) Owner to self perform work

02230 Base Course

02270 Slope Protection and Erosion Control

02280 Soil Treatment

Termite Control

Termite control is required on all new construction and renovation building projects where there is structure to ground contact. Certificates of treatment application by a licensed professional are required. Submittal required: Record of Treatment that includes the date, time, location of treatment (specific area / grid section), weather conditions, product used. Payment for services shall not be approved until documentation has been submitted and approved, including warranty.

02350 PILES AND CAISSONS

02360 Driven Piles
02380 Caissons

*** * END OF SECTION * * ***

Section Number	Title
02500	**PAVING AND SURFACING**

02510 Asphaltic Concrete Paving

General

This section defines general design parameters for paving, curbs and traffic markings. The DP is required to obtain all information regarding parking stall layout, flow and stall dimensioning from NAU's Parking and Shuttle Services, along with formal written approvals of the design concept from this entity at the completion of the 30%, 60%, and 90% drawings. All handicapped parking stall dimensioning shall be according to "Universal" design, 16' overall 11' space plus 5' access aisle.

Design Standard

In areas where asphalt concrete paving is being proposed for vehicle parking, patching of existing parking areas and new roadways or drives, the design specification shall comply with the following:

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;

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.

Painted traffic markings to be 4" wide.

No asphaltic concrete curbing or driveway aprons are allowable.

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

Asphaltic concrete pedestrian walkways shall conform to the same MAG and ASTM specification sections cited above, with a 4" aggregate base course, 1" bituminous binder course and 1" surface course.

Dead end driveways are highly discouraged, but if site restrictions mandate this design approach, there shall be a minimum of 20' of unobstructed pull in length; width equal to the driveway.

02515 Unit Pavers

Concrete paving stones are the University preference. 2 3/8" interlocking paving stones, in "N.A.U. Triblend" colors. Unit pavers used in walkways shall have bands of "Finetta" I.P.S. Spacing of bands shall be equal to walkway width. (Reference the pedway for example of the above criteria).

02525 Curbs

Concrete Curbs

Precast Concrete Curbs

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

02540 Synthetic Surfacing

Section Number	Title

02545 Surfacing

Aggregate Surfacing - Chipseal

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.

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 # _____"

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

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.

Bituminous Surface Course

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

02575 Pavement Repair

02580 Pavement Marking

Roadway and Parking Marking

*** * * END OF SECTION * * ***

Section Number	Title
02600	**PIPED UTILITY MATERIALS**

General

All electric water sewer and gas subsurface utility pipes shall be buried with metal detector tape. Such tape shall be buried a minimum of 12" and a maximum of 16" below grade.

Trace wire shall be required on all newly installed utilities that extend outside of the building to the point where contract boundaries end. If tying into an existing utility and that utility will not come above ground, (tying into and existing sewer for example), then the trace wire shall be brought to the surface and terminated in a small underground j-box directly above newly installed utility. J-box lid shall be marked "trace wire," and what utility the trace wire is for. If a utility comes above ground, (fire hydrant for example), then the trace wire shall come above ground with same utility.

02605 Manholes and Cleanouts

02610 Pipe and Fittings
Cast-Iron Pipe
Ductile Iron Pipe
Mineral Fiber Reinforced Cement Pipe
Plastic Pipe
Steel Pipe
Vitrified Clay Pipe

02640 Valves and Cocks
Valve Boxes

02660 Water Distribution

All water systems shall be protected from main City of Flagstaff supply by backflow preventers. All backflow preventer installations shall be required to be inspected by certified backflow preventer inspectors.

02665 Domestic Water Systems

Fire Water Systems

Fire hydrant flow tests are required with written test results submitted, prior to payment. Tests shall be paid for by the Contractor, performed and witnessed by the Fire Marshal, NAU Risk Management and NAU Project Manager.

Heating Water Systems

02675 Disinfection of Water Distribution Systems

*** * * END OF SECTION * * ***

Section Number	Title

02680 Fuel Distribution

02685 Gas Distribution System

NAU is considered an Owner Operator and all ACC regulations apply.

In addition to the requirements listed below, the Contractor shall follow the Northern Arizona University Gas Distribution Line Instructional Guide, available at NAU Capital Assets and Services website: https://www4.nau.edu/cas/Plan-Dev/TechStandards.html

All electric water sewer and gas subsurface utility pipes shall be buried with metal detector tape. Such tape shall be buried a minimum of 12" and a maximum of 16" below grade.

All underground pipe shall be:

- Schedule 40 black iron steel, factory coated and protected with cathodic protection - U.S. domestic made pipe.
- All gas lines into building need to have insulating unions installed to isolate building pipe from underground piping.
- All underground pipe shall be buried a minimum of 24" deep with alternate shading and with metal detector tape. Tape shall be installed a maximum of 6" below grade.
- Any abandoned gas line shall be removed or purged by the contractor. Any such removal must be noted and dated on the as-builts. The contractor shall submit a dated written statement of purging.

Submittals

- Mandatory: 30 days prior notice of any construction (in writing) involving gas pipe line main distribution systems with proposed plans involving gas distribution system.
- Installer of gas system must provide to the Arizona Corporation Commission (ACC) and the University, paperwork showing the welder's certification, the welding procedures to be used on installation and verification that the welder has used these procedures within the past six months, and test results confirming the procedures to be used.
- All pressure tests on lines, shading of ditches, coating of pipes, cathodic protection, tracer lines and open ditches must not be removed or covered until the ACC has been notified and performed visual inspection.
- As-built prints shall be provided showing the accurate location of all utilities.

02695 Steam Distribution System

Northern Arizona University maintains two central plants on campus, one supplying steam and chilled water to north campus buildings and one supplying 250^{o} HTHW (High Temperature Hot Water) to south campus buildings. In addition, there are several buildings with natural gas fired furnaces or hot water boilers.

*** * * END OF SECTION * * ***

Section Number	Title
02700	**Sewers and Drainage**
02720	Storm Sewage Systems

The hydraulic grade line shall be computed at all junctions. At all inlet junctions the hydraulic grade line shall be below the flow depth limits per MHDUD (City of Flagstaff Manual for hydraulic Design for Urban Drainage). Hydraulic grade lines shall be shown on the construction plans.

The design and capacity flows shall be shown on the storm drain profile for each reach of the system.

The minimum size for drain pipe shall be 18" or equivalent arch pipe.

All storm drains shall be designed to have a self-cleaning minimum velocity of 3fps at the design storm.

The minimum cover for storm drains shall be one foot as measured to subgrade, or to finish grade if no subgrade is involved.

Trench details for storm drains shall comply with MAG specifications.

Manhole spacing shall be at a maximum of 500 feet and at horizontal deflections per the table below:

Pipe Size	**Deflection**	**Manhole Required**
18" to 42"	O^o to 22 1/2^o	No
18" to 42"	> 22 1/2^o	Yes
> 42"	0^o to 45 ^{o}	No
>42"	> 45^o	Yes

Any vertical deflections will require manholes. Manholes will be placed as close as possible to the point of deflection, with allowance for manufactured bends etc. If the manhole cannot be placed at the point of deflection, then it should be located immediately upstream from the deflection.

Where utility access hatches/vaults/manholes are installed within 2 feet of sidewalks, they shall be 1 inch below top of finished sidewalk to accommodate snow removal with damage to boxes or lids.

Where utility access hatches/vaults/manholes are installed in sidewalks, patios, concrete steps, or any other structure where snow removal shall occur, the top of the access hatches shall be a minimum of ¼" and a maximum of ½" below finished surface of concrete to accommodate snow removal without damage to boxes or lids.

02730 Sanitary Sewage Systems

02760 Restoration of Underground Pipelines

02762 Inspection of Pipelines

02764 Sealing Existing Pipelines

02780 Power and Communications

02785 Electrical Power Transmission

02790 Communication Transmission

*** * * END OF SECTION * * ***

Section Number **Title**

02800 **SITE IMPROVEMENTS**

02810 Irrigation Systems

Trenching: Cover Requirements:

All pipe and wire under pavement	24"
Pressurized Lines	18"
Non-pressurized lines	12"
Non-pressurized drip laterals	8"
Control Wire	18"

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

Backfill around and over pipes shall be with sandy soil free from rocks over 1/8" in diameter. Where existing soil does not meet this requirement, sandy soil shall be imported for backfilling.

CINDER SAND SHADING LEGEND

	Bottom	Sides	Top
Chilled Water	6”	6”	12”
Sewer	6”	6”	12”
Gas	8”	8”	8”
Domestic Water	6”	6”	12”
Electrical	6”	6”	6”
Storm Drain	6”	6”	12”

Before any installed utility is covered/backfilled, contractor shall call for an “ok to cover and backfill” inspection. Failure to comply with will result in contractor unearthing utilities for said inspection.

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.

Heads, bubblers, and drip lines shall maintain a minimum of 2' 0" setback from walks, drives or building faces. Special care shall be utilized in design to avoid the possibility of wind driven mist from wetting paving and building surfaces.

Pipe and Fittings

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

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

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

Fittings between the auxiliary (lateral) line and any sprinkler head or hose bib shall consist of rigid PVC full circle swing joint, "Lasco" brand or pre-approved equal.

Specifications for piping shall include standards that all piping shall be free from cracks, holes, and foreign materials, blisters, inside bubbles, wrinkles, and dents.

Section Number **Title**

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

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

PVC joints shall be glued according to manufacture's recommendations.

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

Control Wires

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 18" below finish grade.

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.

Lawn, shrub, flower beds, desert and drip areas shall be valved separately and have separate stations on the time clock.

All connections to valves and all splices shall be made with "SNAP-TITE" connectors and PT-55 sealer (RAINBIRD), or approved equal.

All splices shall be made in valve boxes.

Valves

Avoid locating valves in areas where curbs and walks come together.

Main valves should be located, when possible, in a grassed area, two feet from sidewalks curbs, or other traffic areas.

Where underground valve boxes or utility access boxes are installed within 2 feet of sidewalks, they shall be 1 inch below top of finished sidewalk to accommodate for snow removal with damage to boxes or lids.

Where underground valve boxes or utility access boxes are installed in sidewalks, patios, concrete steps, or any other structure where snow removal shall occur, the top of the boxes shall be a minimum of ¼" and a maximum of ½" below finished surface of concrete to accommodate for snow removal with damage to boxes or lids.

Valves shall have a minimum size of 1".

Valve boxes shall be set at finished grade with valve stems 4" below top of the box. Each valve box or group of valves shall have a hose bib on the pressure side of the valve.

Where possible, control valves shall be manifolded together.

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).

Clocks

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Clocks shall be RAINBIRD "MAXI" computer control compatible and shall be capable of maxi-operation. Rainbird, ISC, or SBM 1230, electro-mechanical system.

Clocks shall be mounted outside the buildings or any other proximate built structure.

Heads

Heads for lawn areas less than 25 feet wide shall be Hunter I 10 or Hunter I 20 or approved equal.

Heads for strips and shrubs shall be Rainbird 1800 series, Rainbird 1400/1500 bubblers or approved equal.

Heads for open areas 25 feet or wider shall be Hunter I 25 or approved equal.

Heads for large areas with few trees shall be RAINBIRD SAMS or Hunter I40 or approved equal.

Placement of heads shall be influenced by prevailing wind direction, location of mounds and placement and location of trees.

Provide diagrams for all head installation.

All lines shall be flushed before the heads are installed.

A non-fading, weather resistant copy of the irrigation diagram and controller name-label shall be affixed to the inside of the controller cabinet door. The irrigation diagram shall show all valves operated by the controller, valve sizes and type of plantings irrigated.

Backflow Prevention

Backflow preventers shall be reduced pressure type and shall be installed at all connections to water distribution mains. Preferred manufacturers are FEBCO, WATTS or pre-approved equal.

All backflow preventers shall be assembled with pipe fittings and risers of galvanized steel.

Valves and drains shall be placed so the entire system may be winterized.

*** * * END OF SECTION * * ***

Section Number	Title

02830 FENCES AND GATES

Chain Link Fences and Gates

Ornamental Metal Fences and Gates

The University has a standard design for the masonry pillar/ornamental iron fence that surrounds the campus. The DP shall obtain this design standard from the Capital Assets project manager for projects which require additions to this fence.

The University has a standard design for the masonry pillar/ornamental iron fence that surrounds the campus. The DP shall obtain this design standard from the project manager for projects that require additions to this fence.

Wood Fences and Gates

02840 Walk, Road and Parking Appurtenances

Bicycle Racks

Guardrails

Parking Barriers

Parking Bumpers

Signage

Prior to specifying exterior or interior signage the Design Professional must request a copy of the NAU Signage Policy Manual.

02860 Playfields and Equipment

Recreational Facilities

02870 Site and Street Furnishings

Trash and Litter Receptors

Tree Grates

*** * * END OF SECTION * * ***

Section Number **Title**

02900 LANDSCAPING

General
All plantings shall be guaranteed by the Contractor for a minimum of one year after substantial completion

All specified planting materials shall be of species that has a proved history of resilience in this Northern Arizona locale. Preference shall be given to designs that center around a xeriscape approach and utilize drip irrigation

Planting List

The following trees and shrubs have been identified and labeled as focus plant material to be utilized in campus planting:

Trees

Acer Platanoides	Red Maple
Malus	Flowering Crabapple
Pinus nigra	Australian Black Pine
Picea Pungens	Colorado Blue Spruce
Populus Tremuloides 'Kaibab'	Kaibab Aspen
Robina pseudoacacia	Black Locust

Shrubs

Fallugia paradoxa	Apache Plume
Juniperus spp	Juniper
Mahonia aquifolium	Oregon Grape
Pinus mugo mugus	Dwarf' Mugo Pine
Potentilla Fruticosa	Potentilla
Rhus spp	Sumac
Ribes spp	Currant
iburnum Opulus	Snowball Viburnum

The following trees and shrubs may be utilized on campus with the approval of the Manager of Planning and Design and the Grounds Supervisor:

Acceptable Plant Material (Trees)

Abies Concolor	White Fir
Abies Lasiocarpa Arizonica	Corkbark Fir
Acer ginnala	Amus Maple
Acer Saccharum	Sugar Maple
Acer Negundo	Boxelder
Acer Saccharinum	Silver Maple
Betula Pendula	European White Birch
Fraxinus Americana	American Ash
Catalpa spp	Catalpa

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Fraxinus Pennsylvanica	Green Ash
Gleditsia Tracanthos	Honeylocust
Picea Abies	Norway Spruce
Picea Engelmannii	Englemann Spruce
Pinus Aristata	Bristlecone Pine
Pinus Flexilis	Limber Pine
Pinus Sylvestris	Scotch Pine
Platanus spp	Sycamore
Populus Tremuloides	Quaking Aspen
Prunus spp	FloweringPlum
Prunus spp	Flowering Cherry
Pseudotsuga Menziesii	Douglas Fir
Pyrus Calleryana	Bradford Flowering Pear
Quercus Gambelli	Gambel Oal
Quercus Rubra	Northern Red Oak
Salix matsudana	Globe Willow
Sequoidendron Giganteum	Giant Sequoia
Tilia spp	Linden

Acceptable Plant Material (Shrubs)

Agave spp	Agave
Amelanchier spp	Serviceberry
Amorpha fruticos	Indigo Bush
Berberis thunbergii	Japanese Barberry
Chamaebatiaria millifolium	Fernbush
Cowania Mexicana	Common Cliffrose
Forsythia Intermedia	Dwarf Forsythia
Ligustrum Vulgare	Privet
Locicera Involucrata	Twinberry Honeysuckle
Robinia neomexicana	New Mexico Locust
Rosa spp	Rose
Rosa woodsii	Wild or Woods Rose
Spiraea spp	Spirea
Yucca spp	Yucca

Acceptable Plant Material (Groundcovers)

Scientific Name	**Common Name**
Delosperma nubigenum	Ice Plant
Lonicera arizonica	Arizona Honeysuckle
Partheocissus quinquefolia	Virginia Creeper
Sedum spp.	Stonecrop

Acceptable Plant Material (perennial flowers)

Scientific Name	**Common Name**
Archillea spp.	Yarrow
Berlandiera lyrata	Chocolate Flower
Campanula Glomerata	Clustered Bellflower
Cetnranthis ribber	Red Valerian
Chamaemelum Nobile	Chamomile

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Clematis spp	Clematis
Coreopsis spp	Coreopsis
Eschscholzia californica	California Poppy
Gaillardia grandiflora	Blanket Flower
Sempervivum tectorum	Hens and Chickens
Geum triflorum	Old Man's Whiskers
Hemerocallis spp	DayLily
Ipomopsis aggregate	Skyrocket
Iris spp	Bearded Iris
Linum perenne	Blue Flax
Lupinus spp	Lupine
Kniphofovia uvaria	Red hot Poker
Oenthera caespitosa	Tuft Evening Prim-rose
Oryzopsis hymenoids	Indian Rice Grass
Penstemon spp.	Beardtongue
Phlox spp	Phlox
Potentilla spp.	Cinquefoil
Ratibida columnifera	Mexican Hat
Salvia spp	Sage
Thymus spp.	Thyme
Zinnia grandiflora	Prairie Zinnia

Acceptable Plant Material (Flowers)
The flower list subject to approval of the Manager of Planning and Design and the Grounds Supervisor.

02910 Shrub and Tree Transplanting

All trees and shrubs shall be container grown, not balled and burlap, unless otherwise approved by NAU Grounds Department.

02920 Soil Preparation

Topsoil
Topsoil shall be friable, loam topsoil, free from sticks, stones over 1" in diameter, roots, refuse, noxious weeds or any other material toxic to plant growth.

Shall have:
- Loam and soil texture (USDA classification)
  30% to 50% sand
  10% to 25% clay
  30% to 50% silt
- PH. - 6.0 - 7.5
- Electrical conductivity (ec) - 4.0 milliohms or less per centimeter as measured on the saturation extract.
- Sodium absorption ratio of less than 5 as measured on the saturation extract.

Prior to the delivery the Contractor shall furnish the University at no additional cost, a numerical analysis and test from a soils laboratory which will include:
Nitrogen
Phosphorus
Potassium

Section Number **Title**

Electrical conductivity (ec)
Sodium absorption
PH
Percentage of sand, silt, clay, organic matter, water holding capacity

Landscape or planting areas shall not be cultivated when they are so wet as to cause excessive compaction or so dry as to cause excessive dust or the formation of large clods.

If imported soil is specified the existing soil shall be scarified to a minimum depth of 8 inches prior to placing topsoil. All clods and rocks over 1 inch in diameter, within 6 inches of the surface, shall be removed and disposed of off site. The thickness of the topsoil shall be at least 4 inches.

All in-place soil and topsoil shall be free from nut grass, refuse, roots, noxious weeds, or any material toxic or a hinderance to plant growth.

Unless otherwise specified, all in-place and/or imported soil will be prepared and conditioned as topsoil to meet the following minimum specifications:

- PH shall not exceed 7.5 or lower than 6.0
- Electrical conductivity (ec) shall be less than 4.0 milliohms per centimeter as measured on the saturation extract.
- Sodium absorption ratio of less than 5 as measured on the saturation extract.
- Shall contain approximately 1.5%, by dry weight, organic matter either natural or added.
- Soil gradation shall be in accordance with the IBC and the City of Flagstaff Engineering Design and Construction Standards and Specifications.
- Any use of manure as a soil conditioner is not acceptable.

All planted areas shall be conditioned by spreading evenly, over the areas, and thoroughly incorporating (rototilled) into the soil to a depth of 6 inches the following material, per 1000 square feet:

- 20 lbs of 6-20-20 commercial fertilizer.
- 3 cubic yards of nitrogen stabilized amendment derive from redwood sawdust, fir sawdust or finely ground bark.

02930 Lawns, Grasses, and Wildflowers

No more than 10% of the area around newly constructed facility shall be turf or other type of water intensive vegetation.

Lawns shall be specified only where maintainable with full normal access (no inner courtyards not directly accessible from outside) for irrigation, mowing, fertilizing, and pest control operations.

Lawn areas shall be designed open and clutter free, as far as practical, shrubs and ground cover areas shall be separated by concrete, exposed aggregate, 6"x 6" or greater treated timbers or occasionally brick headers, their tops being 1/2 inch above sod/soil level.

Lawn grass shall not be used in any planting strip less than 36" wide unless it has an extension of a continuous larger area.

Lawn soil surfaces shall be constructed 1/2 inch below walks, curbs, mow strips or other adjacent paving.

Any valve boxes installed in turfed areas shall be made flush with the **finish** grade not turf height.

Lawns may be established cut sod or by hydroseeding. In either case the soil shall be thoroughly rototilled and leveled to receive the grass.

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Single isolated posts in lawn areas shall be fitted with a concrete mow strip at least 6 inches wide around the post.

Hydroseeding

The preferred grass seed mix is a perennial rye/bluegrass mix. Submit species for approval.

Any wildflower seed mix shall be submitted to the NAU Capital Assets and Services Grounds division prior to specifying. All specified hydroseeding must be in place prior to August 1.

Sodding

Sod will be a bluegrass/perennial rye mix. It will come from an area with similar climate and soil conditions to the University. Sod grown on a sandy loam soil will not be accepted.

All sod must be in place prior to September 1.

02950 Trees, Plants and Ground Covers

Temporary Protection

Provide temporary fencing, barricades or guards to protect from damage existing trees, lawn, and other plants which are designated to remain on site.

Protect root systems by not storing construction materials, debris, or excavated material within five (5) feet of the drip line of the tree (outer perimeter of the branches). Do not permit vehicle traffic within stated area and restrict foot traffic to prevent excessive compaction of the soil over root systems.

Repair and Replacement of Trees, Shrubs and Lawn

Repair trees, shrubs and lawns damaged by construction in a manner acceptable to the Landscape Architect and/or the Capital Assets and Services Grounds Supervisor. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees, shrubs, and lawns.

Remove and replace dead and damaged trees, lawns, and shrubs, which are determined by the Grounds Supervisor to be incapable of restoration to normal growth patterns.

Provide new trees of same size and species, unless such plant is on the "DO NOT PLANT" list. Plant and maintain as specified under landscaping section of the specifications. For any trees requiring replacement due to neglect by the contractor that have a caliper greater than 4", a penalty of $1,000.00 per tree will be assessed.

Trees and Shrubs
All specified tree and shrub plant material must be in place prior to August 1.
All plant materials used shall be of types proven hardy for the area and situation. New, novel or "different" plants shall be restricted to a bare minimum. All plants shall be healthy, true to name and full size of specifications (no recent shifts to larger container).

The minimum caliper size for new trees shall be 2 inches.

Trees planted in lawns shall be provided with 24 inches of bare, sod free soil beyond and around the full circle of the tree. This area shall also be depressed (dish shaped) to help deep watering of the tree.

Deciduous trees shall be planted no closer than 8 feet from any walk or drive and evergreen trees planted

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no closer then 2 feet greater then the anticipated mature radius of branching.
Trees planted in rows shall be uniform in size and shape.

Trees and shrubs shall not be planted until all construction working the area has been completed, final grades established, the planting areas properly graded and prepared as specified.

Dig plant pocket for trees a minimum of 24" wider and 6" deeper than root ball, unless otherwise specified.

Dig plant pocket for shrubs a minimum of 12" wider and 6" deeper than root ball, unless otherwise specified.

Loosen subsoil to a depth of 4". Loosen earth on sides of pocket to break the glaze caused by digging.

Set plants at finished grade.

Fill prepared soil to 1/2 the depth of ball, pack firmly, and settle with water.

If balled and burlapped, loosen and remove burlap and all lacing from upper two-thirds of ball.
Backfill with prepared soil which, after compaction, is flush with ground level.

Cover plant pocket area with 3" to 4" of mulch.

Prune, wrap and brace as specified.

02970 Landscape Maintenance

The watering, fertilizing and treating of all existing trees, lawns, shrubs and other plant materials located within the contract limit line or construction fence of the project, will be the responsibility of the Contractor for the duration of the maintenance period. Specifications and notes on the landscape drawings shall require the Contractor to maintain and accept responsibility for all plant material for a minimum of 90 days or through to final acceptance of the work, whichever is longer.

Maintenance shall begin immediately after each portion of lawn and each plant is planted and shall continue in accordance with the following requirements:

- Lawns that have been planted shall be protected and intensively maintained by watering, mowing, fertilizing and re-planting as necessary through a minimum of 90 calendar days or longer if necessary to establish a uniform stand of the specified grasses and until acceptable.
- New planting and groundcovers shall be protected and maintained until the end of the lawn maintenance period or until final acceptance, whichever is longer. Maintenance shall include water, fertilizing, weeding, cultivating, mulching, tightening and repairing guys, removal of dead materials and resetting plants to proper grades.
- The Warranty period for all plant materials shall be a minimum of one calendar year.

*** * * END OF SECTION * * ***