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Design Professional's and Contractor's acknowledgement of receiving NAU Design Guidelines and Technical Standards

On each project, the DP and the General Contractor shall acknowledge receiving, reading and following NAU Design Guidelines and Technical Standards by completing and signing below:

Project #: _____

Project Name: _____

DESIGN PROFESSIONAL:

Design Professional Firm: _____

Name of DP Signatory: _____

Signature: _____

Date: _____

GENERAL CONTRACTOR:

General Contractor Firm: _____

Name of DP Signatory: _____

Signature: _____

Date: _____

TO BE RETURNED TO NAU PROJECT MANAGER
PRIOR TO START OF DESIGN

INTRODUCTION

The Purpose of This Manual

These Design Guidelines, along with the NAU Technical Standards, cover NAU construction and renovation projects. They are intended to assist architects, engineers, other design professionals, contractors and university staff in understanding the preferences of University in the development, maintenance and repair of its facilities:

- Those persons at Northern Arizona University who manage projects, to assure that the standards and procedures outlined in this manual are implemented in the projects that are built on campus.
- Those persons involved with facilities on NAU Campus. Such persons can include, but are not limited to, administrators, user-groups, faculty, staff, trades-people, suppliers, vendors, University construction and maintenance shop personnel, etc.
- The Design Professionals, to use as their guide in preparing all necessary documents and submittals.
- The CM@R's, General Contractors, Subcontractors, Suppliers, to use as a cross-reference with DP provided Specifications and as their guide in procuring all materials for the project. In case of conflict between these Design Guidelines and Technical Standards, these entities shall bring it up to NAU Project Manager for be evaluated with the Construction Project Team.
- The Design Professionals are advised to refer to those sections of the manual that relate to their projects and to adhere to its guidelines.

These Design Guidelines and Technical Standards are intended to create a common basis for the design, construction, maintenance, renovation and general care of facilities on NAU campus. The standards are the result of years of experience in designing, building, and operating facilities on the campuses, with a historical knowledge of what has served the University well. As such, they form the preference and knowledge base for all facilities on the campus. It should be clearly understood by all persons using these standards that they are not specification documents, nor are they procedures for construction. Design and document preparation continue to be the design professional's responsibility. Means, methods, techniques, and procedures remain the Contractor's responsibility.

These standards represent the preferred construction products, materials, details and systems to use in the development of programs, plans, specifications and construction documents. Components shall be selected through pre-qualification guidelines including, but not necessarily limited to, performance characteristics, code/regulatory compliance, maintenance control, and inventory standardization.

These standards represent the intent of the University to address the following primary criteria while providing optimal life cycle cost benefit to the University:

- Safety
- Reliability
- Maintainability
- Efficiency
- Sustainability

Building Codes

The requirements in this document do not supersede any applicable building codes. These requirements are in addition to all applicable codes, ordinances, statutes, regulations, and laws. If there is a conflict with any requirements in the design guidelines or in the Technical Standards, the applicable building codes take precedence.

Refer to Div. 1 Section 01 41 13 for all applicable codes adopted by Northern Arizona University.

Requests for variance shall be evaluated by the NAU Fire Marshal (NAUFM) staff and Lead Building Inspector (NAULBI) staff, to ensure the proposed design, use, or operation satisfactorily complies with the intent of the IFC, IBC with related codes and NAU Technical Standards, as adopted by Northern Arizona University. The NAU Policy Guidelines for Variance Requests can be found on the Capital Assets and Services website under the following link: (Post link here)

Substitution to the Design Guidelines: Substitution Request

The Design Guidelines are a set of minimum requirements for design and construction at NAU. When these Design Guidelines and Technical Standards refer to a single manufacturer, it is not intended to exclude all other alternatives for all projects, proven to be equal or better, *unless specifically stated*.

Design professionals and Contractors must adhere to the Design Guidelines and Technical Standards in all cases, however, the intent of these Design Guidelines and Technical Standards is *not to limit creative solutions*. In order to deviate from these Design Guidelines and Technical Standards, a written substitution authorization must be obtained from NAU.

Substitutions to the Design Guidelines and Technical Standards must be requested in writing by the Design Professionals to the NAU Project Manager.

NAU Project Manager must then obtain written approval for the substitution from CAS Management (Manager of Planning & Design or Manager of Construction), with recommendation from NAU Trades, as necessary.

The University will consider requests for substitutions in order to provide the best benefit to the University and will typically require a life cycle cost analysis to be completed as part of the substitution process.

Written authorization shall be received prior to incorporation of the proposed substitution into the documents. The substitution must be made as early as possible but no later than completion of the design development phase.

The Product/Material Substitution Form is posted on the CAS website under the forms index (Insert web link to forms and add link here)

Updates

These Design Guidelines and Technical Standards are intended to be a continually evolving document. As new systems, components and techniques become available and they are deemed appropriate for use as a standard, they will be incorporated into these documents.
The technical content of this manual represents the culmination of input from many design, construction and maintenance professionals, included but not limited to NAU Trades Supervisors, NAU Project Managers and DP/CMARs who performed projects for the University in the past. Although it is felt that this effort produced a more up to date listing of NAU Technical Standards, it is realized that improvements are always possible and that many iterations may be required to achieve perfection.

To pursue this goal, please feel free to submit any recommendations for improvements via email to NAU, addressed to Eileen.Brown@nau.edu.

This manual will be updated as requirements and procedures of NAU and the Arizona Board of Regents (ABOR) change.

Advice to the Design Professionals

Your team has been chosen as the Design Professional team most uniquely qualified to design the project, base upon your ability to effectively communicate and demonstrate to the selection committee you team's design expertise, your understanding of the project, and your commitment to service. In order for your team to successfully exercise the highest degree of design potential afforded by the project, we offer a few words of advice in the attainment of that goal.

1. **Ask Questions**
   Although your team was chosen as best suited to the project, this may be the first project of this particular building type you have undertaken at NAU. Time spent in researching the goals NAU had in mind when preparing the RFQ, familiarity with campus infrastructures, how and why design was handled in a particular way on a similar project, and familiarity with the University and user group structure prior to the beginning of architectural programming, will be invaluable to your design team. The Project Manager assigned the responsibility to lead this project on behalf of NAU is your single best resource for the project.
   All questions and communications regarding this project, the user group or the university must be routed through the NAU Project Manager. This is the established project protocol, ad will be further detailed to you by those individuals. It is their responsibility to answer, or direct you to those that can answer specific questions regarding any topic connected with the project in a timely and professional manner.

2. **Communication Ground Rules & Documentation**

The project budget, schedule and your compensation will allow for both a successful design and a successful business partnership provided the following items are observed:

- Under no circumstance should verbal approval be accepted or given. Any inquiry or direction that potentially affects project scope, budget, schedule or your compensation should be made in writing and responded to in kind.
- Assume nothing. Assumptions made by your team without written clarification in the form of letters, meeting minutes, sketches or written telephone conference logs will promote misdirection, miscommunications, design errors and subsequently lost time. It is your responsibility to ask for and receive clarification.
- Direction, approvals, clarifications, etc. that do not originate or go through the Project Manager, no matter what the lever or area, are not acceptable and are not binding.

3. Contingencies

Some Design Professionals may be under the impression that project contingencies (design, construction and inflation) are for the use of design "extras". This is an erroneous and dangerous impression. NAU is mandated by the Arizona Board of Regents to carry contingencies based on level of functional and construction difficulties and total project duration. Contingencies shall only be utilized to attain the projects critical, functional and quality parameters, or "base" scope, as defined by the architectural program and subsequent schematic design.

4. Expectations

The design team is required to be within the particular design phase budget, and if the project estimate at the completion of a particular phase indicates the design is over budget, the team will not gain the approval necessary to enter into the next phase. The team will then be required to expend the necessary time and effort to be within that budget, at the design team's expense.

It is easy to recognize that the further over budget the design is, the more time and effort will be required to bring the project within the budget. This is time that will not be compensated. It is therefore in the best interest of the design team to obtain the highest degree of detail appropriate to all phases of design, to recognize all cost ramifications to particular design intent, and avoid promotion and pursuit of design elements that can neither be justified by the program nor afforded by the particular phase budget.

It is the University's expectation that by following the guidelines, procedures and advice as presented in this manual, the design team will produce a facility that not only meets program, budget and schedule, but also achieves a quality of design excellence.

PROJECT TEAM / STAKEHOLDERS

Below are the different groups that shall be involved in every project's design and construction, with a brief description of their responsibilities. These groups will participate in the Plan Review process prior to issuance of a Building Permit.

1. NAU PLANNING AND DEVELOPMENT GROUP

NAU Project Manager

The Project Manager, referred to as "NAU PM", guides each project form programming through project close out and warranty. The NAU PM works with the User Group and CMAR to review the DP's work for compliance with program requirements, schedule, budget, and for conformance to required codes and NAU standards and procedures.
The NAU PM is the direct contact person for the DP, CMAR, and other project consultants once the project has completed programming. After project programming is complete, all project work, information, and correspondence is directed to the NAU PM. The NAU PM is the liaison for the user group as well as other NAU departments. The NAU PM is also responsible for monitoring project activities during design and construction through occupancy.
The responsibilities of NAU PM include, but are not limited to, the following:

a) Insures the appropriate development and conformance of the project to the program, budget, schedule, and NAU standards.

b) Manages all meetings between NAU User Groups, DP, and CMAR after project programming.

c) Recommends approval of all payment to DP and CMAR.

d) In conjunction with NAU Contracts Administration, manages the negotiation for a GMP.

e) In conjunction with NAU Contracts Administration, develops the contract for construction (Design/Bid/Build, CMAR).

f) Manages the construction contract.

g) Evaluates the DP and CMAR performance for construction phase.

h) Manages warranty issues.

NAU Plan Record/Vault

CAS has been assigned the responsibility to keep all documentations related to the University's past projects, regardless of size and importance. All Construction Drawings, Specifications, RFI, ASI, Submittals, Shop Drawings, As-Built Drawings, Owner's Manuals, etc… that have been turned over to the University since the Campus has been created in the beginning of the 20th Century are kept at CAS. The documentation kept by NAU CAS is only as good as the documents provided to the university at completion of a project and as you get involved in projects

involving renovation of existing building(s), you will have to appreciate the fact that documents available to you are only as good as those you will turn over at the end of a new construction project. NAU encourages all DP and Contractors to be most vigilant when it comes to the Close-Out process and ensure that complete and accurate documentation is provided for record keeping.

2. NAU CAS OPERATIONS AND MAINTENANCE

Capital Assets and Services (CAS) Operations and Maintenance is responsible for all NAU physical facility maintenance and operational activity, and therefore has a vested interest in the maintainability and long term of operational cost of every physical addition to the NAU campus. The NAU PM attends all scheduled project meetings in both the design and construction phases, and may elect to include other CAS personnel as their experience and technical expertise is required.

During the Plan Review process, NAU Trades Supervisor will assist in the plan review effort by bringing up questions/comments regarding longevity, maintenance requirements, accessibility of construction materials and building systems.

3. NAU USER GROUPS

The NAU User Groups are those colleges, organizations or departments that will be the actual occupants or the direct beneficiaries of the project. User groups can be compromised of several colleges, organizations or departments or a single uniform group.
The User Group acts in an advisory and informational capacity to the project design team regarding programming/design function and space parameters.

4. NAU BUILDING OFFICIALS

CAS includes in its organization the NAU Fire Marshal and the Lead Building Inspector, both in charge of verifying that all new construction and renovation projects meet all applicable codes as adopted by the University. Combined together, they have authority to perform Plan Reviews, issue Construction Permits, perform Field Inspections and issue Substantial Completion Certificate in conjunction with the DP.

The University is now issuing Certificate of Occupancy, and depending on the scope and size of the project, you might be subject to it. Please refer to Lead Building Inspector to confirm if you will be issued a Certificate of Occupancy.

5. NAU POLICE DEPARTMENT

The responsibility of this department is to review the project for life safety, security and fire conflicts or inconsistencies.

6. NAU PARKING SERVICES

This group must be consulted when a project affects any pedestrian and vehicular access, flow, density, direction or parking on campus, either on an interim or permanent basis. This group

shall review and sign-off on the site plan and construction staging plan prior to design completion thru NAU CAS formal Plan Review process. The DP is responsible for submittals and incorporation of any comments received. If required, this group will advise the DP in regards to campus pedestrian and vehicular circulation and use patterns.

7. NAU AFFIRMATIVE ACTION/DISABILITY RESOURCES

CAS has signed a Memo Of Understanding with the CDAD Committee (Commission for Disability Access and Design). A CDAD representative will review the project for ADA Compliance. The DP is responsible for submittals and incorporation of any comments received during the design review.

8. NAU TV SERVICES AND TELECOMMUNICATIONS

TV Services and Telecommunication encompasses all voice and data communication and transmission design for NAU. TV Services and Telecom reviews and assists all project design engineering regarding telecommunications and data for conformance with NAU standards. The DP is responsible for submittals and incorporation of any comments received. If required, this group will advise the DP in the design phases regarding NAU telecommunications and data interfacing, serviceability and maintenance.

DESIGN GUIDELINES

1. CAMPUS MASTER PLAN

Northern Arizona University Campus Master Plan was last updated in 2010.
Please refer to the website listed below for a complete report:
https://www4.nau.edu/cas/Plan-Dev/2010%20Campus%20Master%20Plan.html

2. PRE-CONSTRUCTION DESIGN DELIVERABLES

Design professionals are required to provide the utmost complete drawings and specifications set to allow for minimum request for information during construction.
Contractors are expected to do a thorough review of these documents prior to construction for coordination purposes and to report any conflicts, incomplete information, etc… to also prevent last minute changes in the field during construction.

At a minimum, the Design Professional and the Contractor shall provide, during the Pre-Construction Phase, the following:

A. PROGRAMMING PHASE

FROM OWNER/NAU:

- Space programming
- Project Criteria

FROM DESIGN PROFESSIONAL:

- Required size, use, occupancy, finishes, and furnishings/equipment requirements for all spaces;
- Required relationships of spaces to other spaces;
- Required utility services and other infrastructure needs for all spaces and investigations into available utilities;
- Environmental requirements for all spaces;
- Traffic/circulation requirements within and without the building and building service requirements;
- Tabulation of all net assignable areas;
- Explanation of probable required non-assignable spaces;
- Calculation of probable gross building area(s);
- code analysis;
- Site analysis, including utilities, circulation, service, orientation, adjacent structures, etc…
- Program Cost Estimate (Statement of Probable Construction Cost based on the foregoing).

FROM CM@R:

- Project Management Plan
- Project Schedule
- Value Analysis, Constructability and Bidability Reviews
- Cash Flow Projection

- ☐ Programming Estimate
- ☐ Subcontractor Bid Package strategy
- ☐ Review of programming design
- ☐ Advice on site use, improvement
- ☐ Advice on material selection, building systems and equipment
- ☐ Long lead time items

B. <u>SCHEMATIC PHASE</u>

FROM OWNER/NAU:

- ☐ Geotechnical Soil Report
- ☐ Land Survey
- ☐ Asbestos & other Haz' Mat' Survey

FROM DESIGN PROFESSIONAL:

- ☐ Preliminary architectural site plan
- ☐ Survey of site conditions pursuant to subsection 5.3.1
- ☐ Report on subsurface investigations pursuant to subsection 5.3.2
- ☐ Structural plan(s) showing proposed bay arrangements, materials
- ☐ Typical interior framing details, showing intended materials
- ☐ Typical exterior framing details
- ☐ Typical column/foundation schedule
- ☐ Vibration isolation review
- ☐ Section(s)
- ☐ Schematic floor plans
- ☐ New work, all floor levels
- ☐ Remodeled areas of existing structures, if any, including demolition
- ☐ Existing building drawings for remodeled areas
- ☐ Exterior elevations
- ☐ Diagrammatic building sections
- ☐ Typical wall sections to show materials, relationships, construction intent
- ☐ Typical key architectural details
- ☐ Room material and equipment outline
- ☐ Schematic narrative of design rationale, proposed construction, code analysis, structural systems
- ☐ Preliminary mechanical equipment room layouts (major equipment only)
- ☐ Preliminary one-line HVAC duct layouts and/or preliminary mechanical piping diagram
- ☐ Preliminary one-line electrical distribution diagrams
- ☐ Preliminary draft of Project Manual including outline specifications

- ☐ Narrative descriptions of proposed alternative mechanical, electrical and special systems
- ☐ Estimate of Probable Construction Cost based on the foregoing, with area Breakdowns (net and gross) and analysis
- ☐ Communications and data transmission system infrastructure

LEED RELATED ITEMS:

- ☐ LEED Points checklist – Strategy

FROM CM@R:

- ☐ Updated Project Schedule
- ☐ Value Analysis, Constructability and Bid Ability Reviews
- ☐ Updated Cash Flow Projection
- ☐ Conceptual Estimate
- ☐ Updated Subcontractor Bid Package strategy
- ☐ Review of conceptual design (drawings and outline specifications)
- ☐ Updated Advice on site use, improvement
- ☐ Updated Advice on material selection, building systems and equipment
- ☐ Updated Long lead time items

C. DESIGN DEVELOPMENT PHASE

FROM OWNER/NAU:

- ☐ Commissioning Report on 100% DD
- ☐ 3rd party Estimate on 100% DD

FROM DESIGN PROFESSIONAL:

- ☐ Site survey and annotated site survey showing items for demolition, removal or relocation
- ☐ Site plan
- ☐ Final contours/grading
- ☐ Paving, sidewalk, curb, fence, parking and other site improvements (showing location and overall dimensions)
- ☐ Retaining walls and details
- ☐ Foundation plans
- ☐ Footing and foundation sizes, reinforcing, elevations
- ☐ Below grade concrete wall thickness
- ☐ Waterproofing, dampproofing, drainage - standard details, types
- ☐ Structural framing plans, including:
- ☐ Horizontal and vertical member size, sample reinforcing

- ☐ Typical floor and construction details, thicknesses
- ☐ Typical exterior wall supports, bracing, ties, reinforcing
- ☐ Lateral bracing methods, location
- ☐ Fireproofing - N.F.P.A. designation
- ☐ Vibration isolation or other special details
- ☐ Design live and dead loads tabulated for all floors, areas, roofs
- ☐ Exterior wall elevations, all plans
- ☐ Typical wall sections
- ☐ Typical roofing and sheet metal details
- ☐ Floor plans, all levels and roofs:
- ☐ Partition type identification
- ☐ Smoke and fire compartimentation
- ☐ Built-ins and fixed equipment shown and noted
- ☐ 1/4" scale furniture and movable equipment layouts, for ALL spaces
- ☐ Stair and elevator details, types
- ☐ Room finish and door schedule for typical areas/spaces
- ☐ Miscellaneous specialties and equipment schedule
- ☐ Fixed equipment schedule, locations, service requirements
- ☐ Plumbing work plans:
- ☐ Fixture schedule, locations
- ☐ Equipment schedule, locations
- ☐ Waste and vent riser diagram with types, locations, key sizes
- ☐ Water piping, locations (sizes for pipes larger than 1")
- ☐ Roof drainage system, locations, key sizes
- ☐ Fire protection systems
- ☐ Mechanical systems including:
- ☐ Equipment schedule, locations, sizes, types
- ☐ Chilled, condenser, hot water, steam, and condensate piping systems, locations, riser diagrams
- ☐ Equipment connections and supports– standard details
- ☐ HVAC piping, locations (sizes for pipes larger than 1")
- ☐ Power distribution diagram including:
- ☐ Power distribution equipment schedule, locations
- ☐ Feeder sizes
- ☐ Emergency generator size, locations
- ☐ Uninterruptible power supply equipment size, locations if required
- ☐ Grounding - standard details (A/E)
- ☐ Interior lighting and power, plans and details
- ☐ Fixture and switch locations with identification
- ☐ Typical receptacle and power outlet locations
- ☐ Special requirements noted

- ☐ Motor control schedule with starter and circuit sizing
- ☐ Communication, data transmission and alarm systems
- ☐ Proposed cash allowances
- ☐ Current update of Project Manual
- ☐ Description of proposed alternates and cost estimates for each
- ☐ Estimate of Probable Construction Cost based on the foregoing, with area breakdowns (net and gross) and analysis.

SUSTAINABILITY RELATED ITEMS:

- ☐ LEED Points checklist
- ☐ Energy Model
- ☐ Life Cycle Cost Analysis for MEP systems
- ☐ Life Cycle Cost Analysis for Architectural system

FROM CM@R:

- ☐ Updated Project Schedule
- ☐ Value Analysis, Constructability and Bidability Reviews
- ☐ Updated Cash Flow Projection
- ☐ Design Document Estimate
- ☐ Updated Subcontractor Bid Package strategy
- ☐ Review of conceptual design (drawings and outline specifications)
- ☐ Updated Advice on site use, improvement
- ☐ Updated Advice on material selection, building systems and equipment
- ☐ Updated Long lead time items

D. CONSTRUCTION DOCUMENT PHASE:

Same requirements as for the Design Development Phase, with more details provided. Also refer to Plan review, Permit and Inspection procedures.

3. DRAWING NUMBERING

The intent of these drawing numbering standards is to provide a set of documents that are consistent with the needs of Northern Arizona University for both Capital Assets and Services and future construction, and are consistent from one project to another.

ELECTRONIC FILE FORMAT

- Facility documentation drawings and construction project drawings must be submitted to CAS in full compliance with AutoCAD software (file extension = .DQG)
- Northern Arizona University shall not accept any drawings in the Drawing Interchange Format (DXF) or any other format that .DWG. If any drawing translators are used prior to submittal, the results of such translation shall be 100% complete. It is the responsibility of the Design Professional to cross-check translated drawings for errors and omissions.

TEXT

- Text size must be legible and appropriate to the graphic information presented and the intended plotted scale of the drawing. Text must be in all upper case letters throughout the drawing.
- Text usually should not touch other graphic objects, and must be placed with enough space around it to be legible when the drawing is plotted and reproduced.

TITLE BLOCKS

The title block should be placed in paper scale, with its insertion point inserted at a coordinate location of (0, 0, 0), and at a scale of 1:1. Depending on the purpose of the drawing, whether it is for facility documentation or construction, the drawing's title block should contain certain essential information that CAS needs, to store and retrieve each drawing in its library.

Project Information

- Project Number - assigned by the CAS Planning and Development Department
- Project Name - assigned by the CAS Planning and Development Department
- Firm Name - representing the drawing author
- Building Name and Building Number - specify only if the project name does not include this information already, and the project is building specific.

Drawing Information

- Drawing Title - indicating the drawing content, e.g. floor plan, section, detail, etc.
- CAS Project Number – shall be referenced on all sheets
- Drawing Number
- Date of Drawing – original drawing date including significant revision dates

- Drawing Scale – representing the intended plot of the drawing with title block
- North Arrow
- Electronic File Name and Effective Date

STANDARD SHEET SIZES AND FORMATS

All sheet sizes are to be limited to five standard formats. Required sheet size is specific to each project and is under the discretion of the University. They are as follows:

- A Sized Plot 8 /1/2" x 11"
- B Sized Plot 11" x 17"
- D Sized Plot 24" x 36" (preferred format)
- E 1 Sized Plot 30" x 42"
- E Sized Plot 36" x 48"

CAD FILE TRANSMITTAL

The content of electronic drawings must match the delivered original hard copy set. To ensure the integrity of the electronic drawing set upon delivery the CAS:

- Ensure the drawings adhere to the guidelines presented in this document.
- Include a transmittal sheet (electronic and hard copy) with all submittals indicating the CAS project number, project name and complete listing of all materials submitted, including file names and sheet numbers for each item included in the submittal. File names shall contain the sheet number they represent. This ensures the completeness of the drawing set and assists in archival procedures.
- Electronic data deliverables (.DWG and .PDF format) are required at all submittal stages.
- The Project Manager shall withhold final payment until all closeout documents have been received from all parties.

CD-ROM LABELING

All CDs are to be labeled as follows:

- DATE – The date when the submittal was delivered to the campus for final acceptance.
- PROJECT – Title of the project name and project number.
- SUBMITTAL – Project submittal phase (i.e. 50% schematic, etc.).
- BLDG NUMBERS – Building number identified by the campus specific to the project.
- COMPANY – Name of design professional firm for the project.

SUBMITTAL REQUIREMENTS

- All submittal documentation forwarded to CAS shall be submitted in a timely fashion, coinciding with the needs of the project and the CAS Planning and Development Staff.

The delivery of submittal documentation during various stages shall be timed appropriately to ensure CAS receives the most accurate information available.

- Ensure the CAS Project Number is located on all drawing sheets (including the cover sheet) and all other submitted documentation, i.e. Specifications and Operations and Maintenance Manuals. The CAS project number should be located in the title block of all drawings, and in the header or footer of Specifications and Operations and Maintenance Manuals, and any other submitted items.
- The following documentation shall be delivered to CAS at the following project milestones:
    - Review Sets (Programming Package, 100% SD, 100% DD)
    - 100% Construction Documents (final CDs not for review), i.e. Bid Set
    - Completion of Civil Utilities Installation (Utilities As-builts)
    - Completion of Site Work (Site As-Builts)
    - Record Documents (Building As-Builts)

VALIDATION OF DELIVERED MATERIALS

- CAS will validate the CAD data and other materials submitted by Design Professionals. If submittals do not conform to the CAS Drawing Numbering Standard Guidelines, CAS may return the materials to the Design Professional. The Design Professional is responsible for revising the materials to make them conform to the CAS Drawing Numbering Standard Guidelines.
- The NAU Project Manager shall withhold final payment until all closeout documents have been received from all parties.

4. ROOM NUMBERING

Step by step procedure:

Before beginning with numbering obtain the building number and address from NAU PM in charge of the project.

All drawings issued for construction shall contain accepted room numbers so that all affected equipment including but not limited to doors, electrical panels, telephone backboards, air distribution devices, as-built information, and air balance reports will not have to be cross-referenced or revised during construction or after occupancy of the space.

New buildings and additions shall adhere to the following room numbering protocol:

1. Room numbers shall begin at the elevator or main floor access: assigned sequentially in a counterclockwise fashion from right to left.
2. Room numbers consist of 3 primary digits.
3. The first digit shall identify the floor level, with the ground floor always level 1. Basement levels will be treated as a special case.
4. The second and third digits shall be used to sequentially identify rooms on a floor level (01 to 99).
5. A fourth digit may be employed as a suffix to the 100 level to describe restrooms, electrical and mechanical rooms, elevator control rooms, custodial and storage closets or stairwells.

a. Offices on a corridor shall be numbered using an alphanumeric fourth digit.
b. Executive and administrative offices shall not be identified using a fourth alphanumeric digit but shall receive a unique 3 digit room number.

6. Corridors, vestibules, and open office areas shall be numbered as rooms.
7. Rooms within a room (second order) shall be consecutively labeled alphabetically in a counterclockwise manner from right to left (i.e. 302A, 302B, etc.). Additional interior rooms (third order) shall be sequentially numbered in the same fashion (i.e.302A1, 302A2, etc.).
8. Rooms with specific uses and unique spaces may be designated by their room type followed by a number or an alpha numeral per the building user's request (i.e. "Studio A"). These designations shall be determined in schematic design if possible.

An effort shall be made to maintain consistent room numbers for similar elements on each floor (i.e. for restrooms occurring in the same location on each floor use a common room number format and the same ending digits).

INTERIOR DOOR NUMBERING

Scheduled door number references should match the room number to which it enters. For rooms with more than one doorway, drawings shall designate unique reference numbers for all doors associated. Door reference numbers may use -00 suffix as needed.

EXTERIOR DOOR NUMBERING

Use three digits: zero plus the building number (i.e. 016 for Building 16). Any building numbers with an alpha numeric character will carry four digits including the alpha (i.e. 016A for Building 16A).

In every case, a suffix is used to indicate the floor level preceded by a dash. Door order for multiple doors to the same floor shall be appended with a dash, (i.e. 016-1-1). Mechanical rooms that have only exterior doors will use 01 order notation (i.e. 016-1-01).

At completion of the 100 percent Design Development (DD) drawing set, the design team shall contact Ramon Bazurto and the NAU PM to review room/door numbering for final approval prior to the start of the Construction Drawing preparation.

5. STORM WATER DRAINAGE DESIGN & SURFACE WATER PROCEDURES

DESIGN INTENT

In the Southwest and at Northern Arizona University, attitudes toward storm water drainage is changing. Previous efforts to manage site storm water drainage have consisted of collecting and channeling storm water as quickly and efficiently to drainage ways to remove any water from a site. Water was metered into drainage ways to minimize flooding with flows limited by the calculated predevelopment peak flows for the site. Large storm water drainage ways were constructed and during storm events, these drainage ways flow swiftly and remove potentially useful water from the campus.

Now storm water is considered a resource. The new goal is to provide the structures necessary to make use of storm water through harvesting; and infiltrating water, keeping water onsite wherever possible.

Storm water drainage management also includes the LEED goals of water collection and onsite reuse. The entire project area needs to be considered for opportunities to collect and store storm water for irrigation. These features must also be designed to withstand the stress of freezing and thawing that are a reality on our Flagstaff Mountain campus.

Within a project's design process, managing the storm water drainage should be a key part of the integrated site design promoting proactive solutions that are consistent with or exceed regulatory standards. Given current limited storm drain and land capacities, some of the mitigation of past and future storm water drainage issues at the Northern Arizona University should occur on a project by project basis.

Projects will be expected to include retention and infiltration facilities to contain the first inch of precipitation at a minimum. Additional retention may be added to address problems elsewhere on campus. The designer is to consult with the Northern Arizona University CAS Director of Utilities for guidance on providing retention on a site by site basis.

Ways to store and reuse storm water may include such elements as mini retention basins or large retention basin, designed as landscaped areas to promote students gathering and shall not include any concrete.

GENERAL STORM WATER GUIDELINES

Preliminary siting studies for the project shall consider information related to the existing drainage conditions of the site, using the most recent campus-wide drainage study as a reference. The preliminary siting studies shall consider, at a minimum:

- The existing site area and adjacent areas within 500 feet of the project, and include all areas which may contribute storm water (watershed) to the proposed site.

- The general area where the site is located, for example, the campus historical core, North Campus, South Campus, etc.
- Evaluation of existing landscapes, plant palette, formal, informal, historic, ornamental and introduced plants.
- Evaluation of the contextual setting of the site.
- Utility (below/at grade) corridors, emergency routes, pedestrian and automobile core circulation routes.
- Identified project building expansion and proposed expansion adjacent to the project site.
- Evaluation of adjacent facility parking, vehicular and service accesses.
- Whenever possible, site development should not diminish the quality or increase the quantity or rate of storm water drainage flow that leaves the site in its existing condition. Potential increased storm water drainage flows should be mitigated on-site if possible.
- Downstream conveyance impacts must be evaluated and mitigated to prevent the hazards associated with overflows, ponding and ice formation.
- Wherever possible, site development should include strategies such that the storm water flow does not diminish in quality or increase in quantity when compared to the level of the original natural condition of the site. This can be achieved through the use of landscape features and water harvesting.
- Opportunities for water harvesting should be specifically discussed in conceptual narratives in early design stages. ***"The City of Flagstaff Low Impact Development: Guidance Manual for Site Design and Implementation, 2009"*** should be used for the design basis.(http://www.flagstaffstormwater.com/index.aspx?NID=8)
- Site development should meet or exceed all applicable regulatory standards. The intent is to meet at a minimum the current City of Flagstaff storm water drainage standards and exceed them where possible, and to demonstrate innovative techniques for which the City may not have applicable standards.
- Retention of storm water: the conveyance and retention capacity shall be sufficient to collect and store the first inch of precipitation that falls onsite for a typical rainstorm.
- Plans will incorporate: conservation of natural areas, minimizing disturbance of natural drainages, minimizing and disconnecting impervious surfaces, and minimizing soil compaction. Many of these points require consideration of construction methods, site access and control of the site areas that are not intended for development, during construction.
- All project sites shall include areas designed to collect and infiltrate water which may include swales, buffer strips, porous pavements, bio-retention, sedimentation and extended detention basin designs.
- Provide a Storm Water Drainage Report. This report, to be prepared for each project will be based on the format and technical standards of the City of Flagstaff Engineer's Design Report.

- Wherever possible, site development should occur such that all flows exiting the project site remain in the current watershed sub-basin so as to not impact drainage patterns in adjacent watershed sub-basins.
- Flood Prevention: Proposed building ground floor elevations and any apertures into the building should be 1' or more above the 100 year flood plain. Sunken access ways or patios leading to building levels below the natural grade of the site are not permitted when adjacent to a 100 year floodplain, and discouraged in other areas. Soil should be graded so that water drains away from the building at a minimum of 2%, subject to other site criteria, such as accessibility. Elevations of underground utilities shall be considered in the grading layout.
- Design and construction activity must be in compliance with the current Northern Arizona University Master Plan Update, located at https://www4.nau.edu/cas/Plan-Dev/2010%20Campus%20Master%20Plan.html

Site development must be done in a way to avoid the following conditions:

- Ponding of a duration that may allow mosquito breeding, in access ways which may create a nuisance for pedestrians, or within 10' of building foundations (to prevent infiltration that may cause indoor mold or structural problems).
- Any water catchment not draining within 24 hours
- Retention (groundwater infiltration) facilities not draining within 12 hours.
- Surface water that is wasted, e.g., by running down the street.
- Surface water that is routed in a way which inappropriately distributes sediment or chemicals.
- Channelized or concentrated water conveyed over sidewalks
- Water running off of irrigated turf areas.
- Water that puddles in areas where freezing may cause a pedestrian or vehicular hazard or damage to hardscape.

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

- All projects will have a Storm Water Pollution Prevention Plan (SWPPP) no matter what their acreage. If a project is less than one acre of disturbed area, an AZPDES permitting will not be necessary. On all project, Best Management Practices shall be followed by the contractors to ensure that existing storm water drainage systems are not polluted during construction.
- If 1 acre or more is disturbed a Storm Water Pollution Prevention Plan (SWPPP) will be required and an Environmental Protection Agency AZPDES Storm Water Construction General Permit must be secured. The Northern Arizona University Office of Regulatory Compliance may be contacted (http://www.orc.nau.edu/) for guidance in securing this permit and filing the associated EPA Notice of Intent (NOI). A copy of the permit shall be provided to NAU Office of Regulatory Compliance and NAU Capital Assets and Services Project Manager prior to any construction work on site. (A copy of the SWPPP

Guidance Checklist can be found at http://www.azdeq.gov/environ/water/permits/download/cswppp.pdf.)

- All SWPPPs shall be prepared by the Civil Engineer of record.
- The General Contractor shall secure permits with ADEQ.

STORM DRAIN DISCHARGES

- Water discharged (e.g., storm water drainage, condensate) from sources that must be pumped to a location for conveyance/disposal should not be directed to roadways/hardscape. Such discharges should be directed to planted areas except when the water quality would be detrimental to plants.
- Storm water drainage shall not be directed into the sewer collection system. Use of the sewer system in this way is considered a prohibited discharge by City of Flagstaff.
- Sewer manholes are not allowed in low lying areas and/or known watercourses to prevent waters from infiltrating through perforations in the manhole cover.

ROOF DRAINAGE

- Roof drainage outlets and landscape surface materials must be designed to prevent landscape erosion.
- Ponding within 10' of the building edge is prohibited.
- Roof leaders/scuppers should be of a small enough diameter so as to divide roof runoff into a series of outlets with a low enough volume/velocity that will allow water to be harvested equally throughout the site (i.e., broken into small volumes for smaller basins/swales). Large diameter outlet pipes convey too much water at too high velocity to capture in small-scale landscape swales. Proper clean outs should be provided to allow necessary maintenance of smaller diameter pipes.
- Roof Drain pipes are prone to freezing during the winter.
- Roof drainages should flow freely even under freezing conditions, new construction shall include interior or insulated and heated roof drains with temp sensor switches to prevent warm weather operation. Renovations of roofing where roof drains are a problem will include correction of the problem through similar design solutions.
- Depending on the project site, the Design professional should review with NAU Manager of Utilities the strategies to drain the roof (day-lighting versus tie-in to storm water drainage underground).

ANCILLARY WATER SOURCES AVAILABLE ON OR NEAR SITE

- Water sources such as mechanical condensate, process water, gray water, drinking fountain water, and other sources identified shall be considered as part of passive and active water harvesting systems.
- Such water may be used, if deemed appropriate, for landscape irrigation, return to central plant for other uses, supplementing water for pools or water features, or other uses to be determined.

SOILS

- Site soils need special consideration during the design process for effective use of LID technologies.

PLANNING

- Soils evaluation should begin with planning for site areas where soils are to be used for structural and vegetative support and for water collection and infiltration. Areas considered for infiltration should be evaluated for soil characteristics especially percolation rates, prior to designating these areas for natural infiltration. If soils are suitable, these areas need special planning and protection because construction activities will change the nature of the soils and potentially destroy their useful characteristics.
- Site planning for soil protection should be treated with the same level of attention as protection of existing vegetation and provision of structurally appropriate soils for building support. Soils that are to be used in the final LID structures or in landscaping must be protected from contamination and compaction by construction equipment. Evaluation of the trade-offs between removal and replacement of soils, gravels and non-structural earth and protection of this resource onsite shall be part of the design.
- Cost effectiveness of different solutions should be evaluated and presented as part of the design effort.

TESTING

- If possible, soils testing should be conducted at the time of or prior to preparation of the initial draft of the Storm Water Drainage Report that will be prepared for a project. Such reports should investigate not only structural characteristics but also percolation rates.
- A soil percolation test is required after rough grading of major/regulatory detention and retention facilities to verify that site development activities have not negatively impacted percolation rates. If reduction in percolation rate is identified, mitigation may be required.

SUBSURFACE PREPARATION

- Structural soils should be explored for use under large expanses of hardscape or other areas with limited percolation.
- Soils beneath/adjacent to French drains, and other sub-surface structures should be over-excavated and replaced with an engineered soil designed to absorb or accept water.

COMPACTION

- Soil beneath the bottoms of all water harvesting areas should be loosened to a depth of at least 18” prior to trenching and installation of irrigation lines.

- Specified compaction required for buildings, streets, and other structures shall be maintained within specified distances around such structures. Beyond these compaction zones, soil should be loosened to a depth of at least 1' prior to planting within all landscaped areas.
- All construction debris and waste material must be removed from the soil within landscape and basin areas.
- Once compaction is achieved and completed, soils should not be disturbed as to not affect soil compaction.
- Acceptable limits of compaction must be maintained through completion.

SOIL GRADING

- The finished grade of all landscaped areas that are designed for use as catchments should be recessed downward from adjacent paved surfaces. Maximum reveal at edge of pedestrian circulation paving shall be 1/2" to minimize the risk of injury. Shoulders are to be consistent with the landscaping portion of Division 32 00 00 Northern Arizona University Technical Standards.

GROUND COVER MATERIALS

- All materials shall be consistent with landscaping standards 32 90 00 and approved for use by the CAS Project Manager through reviews by the Capital Assets and Services Grounds Department.
- Within areas conveying significant storm flows, ground surfacing should consist of a material that is able to withstand scouring. This includes hardscape paving, rock mulch, graded or sized rock, riprap, fractured rock, and turf in some situations. Bare soil, decomposed granite, or other loose forms of mulch are not suitable for this application. Filter fabric placed with 12" minimum toe downs at edges shall be used under all rock, mulch, and riprap within conveyance areas.
- Fine grades of decomposed granite should not be used within or adjacent to basins or water harvesting areas. Landscape areas which shed water rather than capture it should receive ½"+ crushed gravel with no fines, preferably with a mixture of sizes and some color variation to reflect the native desert surface.
- The bottoms of landscaped basins should receive ¼" pea gravel or ½"-1" sized/graded crushed rock that has been washed to remove all fines or organic mulch.
- Colors samples of all proposed rock types shall be submitted for approval.
- Organic mulch is encouraged in locations where the vegetation, water collection, erosion, and slope characteristics make it appropriate.
- Turf, as a surface material in large regulatory basins, is only permissible when combined with a low-flow landscaped area which allows a majority of the turf to drain within a short time. It is preferable to utilize turf predominantly on the bottom rather than sides of large basins for ease of irrigation and mowing and to allow the turf to be watered by sheet-flow runoff. Based on project-specific considerations, turf panels may include a shallow retention catchment (6" or less) which shall include a prepared

soil bed that will rapidly absorb retained rainfall. Extensive subsurface soil preparation will be required for turf in basins which collect greater volumes.

RIP-RAP

- Where required, utilize rough, non-angular, owner approved stone (samples should be provided by Contractor for size verification by Design Professional/ Civil Engineer). Filter fabric should be included under riprap used for erosion protection in a conveyance channel, and any gaps in riprap shall be fully filled with pea gravel or sized/graded rock that is swept in the gaps to prevent erosion.
- Rip-rap to be sized per City of Flagstaff Storm Water Management Manual and Civil Engineer shall included calculation in report.

SNOW MANAGEMENT

In all designs and site planning, snow management must be considered and provided as follows:

- Parking areas need to allow for efficient snow removal operations and include appropriate turning radii for snow plows and heavy equipment.
- Snow storage areas adequate for a typical winter storm (2 feet of snow in 24 hours) shall be included in parking lot design.
- Snow melt drainage from the storage areas and for areas around the building will be designed with special consideration for access to snow melt drainage conveyances for maintenance activities as needed.
- Evaluation and design of areas that are prone to collect snow or ice with special attention to the areas on the north side of buildings and structures where refreezing of melted snow or ice causes hazardous conditions to pedestrian and maintenance vehicle traffic.
- Evaluation of snow melt and melt storage shall include coordination with Capital Assets and Services Grounds Department to determine if deicing materials or chemicals are being used on snow and ice and if runoff will need special handling to prevent damage to landscaping through use of the water or clogging of infiltration systems by cinder fines or other materials.

STORMWATER EVALUATION PROCEDURES

Depending on the nature of the project and site, an independent Storm Water Drainage study (as a precursor to the Storm Water Drainage Report described below) may be required and completed prior to the start of the project for the purpose of understanding site issues, budgeting, or other needs. CAS will determine if an independent study is required and contract for this initial work if necessary. This independent study could be part of the programming and sustainability evaluation.

Project Design Process

The Design Professional's scope of work will require compliance with the storm water drainage

standards found above. As a result of project specific design guidelines identified in the independent storm water drainage study, storm water requirements may be developed which call for unique conveyance features or other special requirements.

The project design should be informed by project specific site development guidelines, The Northern Arizona University Design Guidelines and Technical Standards, site soils tests, and other regulatory considerations. For projects located in South Campus, review the *NAU Assessment of South Campus Storm Drainage.* These resources shall guide the preparation of a Storm Water Drainage Report and design solutions, as required in the project scope of work and described below.

The Northern Arizona University Manager of Utilities is available to the Design Professional throughout the project to review these standards and guidelines and to discuss and provide guidance on detailed storm water drainage design solutions.

The Design Professional is responsible for insuring that all applicable sub-consultants understand the studies, plan sets, details, and specifications each sub-consultant will need to prepare in order to meet these standards. Sub-consultant fees should appropriately reflect the work necessary to meet these standards.

During the first design stage where site development concepts are being investigated there should be a demonstration of how existing drainage impacts the site along with conceptual options for how storm water drainage may become an integral part of the project design. At each subsequent plan review phase the submittal set shall include designed storm water drainage elements which are responsive to the Concepts and Mitigation section of the Storm Water Drainage Report described below and are developed to a level of design commensurate with the rest of the project.

Appropriate soils tests will be completed as early in the design process as possible to inform the final storm water drainage design solutions. These tests shall include measures needed to understand the suitability of the soil for the infiltration needed for retention/detention, in addition to structural and other characteristics as described in Section 2.6.2 above.

Storm Water Drainage Report

During the first design stage where site development concepts are being investigated, a draft Storm Water drainage Report will be prepared by the Design Professional. The report will have two main components: an Existing Conditions Analysis section, and a Concepts and Mitigation section.

Existing Conditions Analysis: this report section analyzes and documents existing storm water drainage conditions on the project site. The form and methods used for this report should conform in general to City of Flagstaff standards, e.g., use the format of the City of Flagstaff

Storm Water Management Design Manual to create a Drainage Report.
South Campus technical analyses shall be built on the *NAU Assessment of South Campus Storm Drainage.*

Concepts and Mitigation: each subsequent draft of this report section should include increasing specificity and technical documentation on proposed storm water drainage features and mitigation which emerge from the initial vision/concepts. This report section shall include, at a minimum, the following two elements:

- Storm water drainage vision and concepts for the project, presented in narrative and graphic form, conveying how storm water drainage may be incorporated in the project design. Include specifics concepts such as existing drainage patterns and proposed pathways, infiltration, detention, and storage. Evaluation of required, recommended, and anticipated storm water drainage features shall be included, along with topics such as defining finished floor elevations relative to flood levels and evaluating other storm water drainage sources in the vicinity for potential use within the project site. The final Report shall include a water budget for the proposed landscape, including an analysis of water sources available to meet the budget. Proposed concepts and features shall come from a collaborative process involving all applicable team members. At a minimum this should include the project's Landscape Architect, Civil Engineer, and the Project Architect.

- Assessment of anticipated storm water drainage impacts of the project on the surrounding area including the watershed above the site, adjacent storm water drainage relationships and downstream areas potentially affected and likely mitigation needed. Maps should indicate how the site/project interfaces with its own and adjacent watersheds.

Storm Water Drainage Report Submittals
Each draft of the Storm Water Drainage Report will be reviewed by the Northern Arizona University CAS Manager of Utilities. Following is a summary of each report draft:

- First Draft: The first draft of the Storm Water Drainage Report shall be included with the projects programming design submittal. The storm water drainage conditions, concepts, features, and mitigation described within the report are to be included in the presentation. All subsequent project presentations and submittal sets shall include these storm water drainage elements developed to a level of design commensurate with the rest of the project.

- Second Draft: A second draft of the Storm Water Drainage Report shall be due with the schematic and design document phase submittal set. This draft shall include

updated/refined graphic and narrative descriptions of storm water drainage concepts, features, and mitigation.

- Final Report: The final version of the Storm Water Drainage Report shall be submitted with the construction document submittal and will include updated modeling and analysis of designed features and mitigation. It shall be sealed by a registered Civil Engineer and shall include calculations, model outputs, assumptions made, and any other relevant information to provide a comprehensive report. An executive summary is to be provided which includes, among other information, a statement from the project Civil Engineer noting in both technical and layman's terms ways in which the project design varies from and/or meets NAU Standards.

REFERENCES:

[1] NAU Design Guidelines and Technical Standards (latest revision).

[2] The City of Flagstaff Low Impact Development: Guidance Manual for Site Design and Implementation (latest revision).
http://flagstaff.az.gov/index.aspx?NID=1464

[3]City of Flagstaff Stormwater Management Design Manual (latest revision).
http://www.flagstaffstormwater.com

6. CAMPUS SUSTAINABILITY

Northern Arizona University is committed to a leadership role in promoting sustainability on our campus and in our design and construction practices. The University is actively pursuing policies that provide for a sustainable future.
In February 2004, President Dr. John Haeger approved the Northern Arizona University Campus Environmental Sustainability Plan.
http://www.environment.nau.edu/CampusSustainability/NAUCampusEnvironmentalPlan.pdf.
The plan includes a description of the goals for advancing sustainable building including "providing incentives to use Leadership in Energy and Environmental Design (LEED) standards and other green building practices in the development of facilities".
The University recently adopted a *Carbon Neutrality Climate Action Plan* (2010) for reducing emissions of carbon dioxide to neutrality by 2020 (http://home.nau.edu/sustain/)
https://www4.nau.edu/cas/Utils/Documents/Northern%20Arizona%20University_Climate%20Action%20Plan%202010.pdf
Much of the reduction in emissions is proposed to come from energy conservation efforts and improved efficiency of new and renovated buildings. These Design Guidelines are part of the effort described in the Sustainability Plan to "phase in a high performance facilities program that makes energy and water conservation objectives and green building design services part of planning all new or renovated facilities."

The NAU Campus Sustainability Design Guidelines have been created to assist in advancing sustainable design on all Northern Arizona University campuses. The guidelines are intended to be applied to new construction and major renovation projects. Design Professionals, Contractors, and third party Developers of NAU projects shall be required to incorporate the guidelines into their projects. The goal is to meet as many of the guideline objectives as possible. Deviations shall be identified by the project team for review and discussion with the University (NAU PM). Where applicable, a Total Cost of Ownership (TCO) analysis may be required, to include environmental, economic and social costs and benefits. Project teams are encouraged to submit a TCO analysis with their initial review package for any proposed design elements with an initial first cost greater than a conventional solution.

The DP team shall also provide the following items:

- Simple, bulleted list of the sustainable design features (upon completion of construction documents)
- One-year post occupancy report (indicating how sustainable design goals have or have not been met; what worked and what didn't work; hindsight evaluation - what would you do differently, etc.)

The ability to achieve NAU's sustainability goals as delineated in the guidelines shall be a significant factor in the selection of Design Professionals, Contractors and Developers for ASU work.
Design Professional teams are expected to incorporate the development sustainable systems within the context of construction and renovation to meet the goals of the University.
This is a suggested process for meeting the goals and requirements.

- Establish project specific benchmarks:
  Discuss, record, and document the specific goals for the project during programming and during all phases of design. Most projects will adhere to the benchmarks provided herein but in some cases projects may have more stringent requirements or focus on a certain area. Include the benchmarks selected in the Programming documentation.
- Model the building energy and site systems:
  During programming and schematic design, the project team will develop a baseline energy model to identify key areas for focus during alternative evaluation. The baseline energy model will be used for alternative evaluation.
- Develop and compare alternatives:
  During Design Development, the project team will test alternative systems using Life Cycle Cost Analysis . Proposed alternatives will be presented; recommended alternatives discussed and selected alternatives documented in an energy model report included in the design development documents.
- Sustainable Construction:
  Construction will be monitored and documented per the LEED certification process to assure that the methods used during the construction and all project changes are consistent with sustainability goals and requirements of the construction documents.

6.1 DESIGN CRITERIA

General: sustainable design precepts appropriate for the Northern Arizona mountain environment should be incorporated – water conservation, building orientation, sun exposure, and snow and ice accumulation are issues of special concern in mountain environments.

- Appropriate passive solar design techniques should be incorporated and where the project scope and budget support it, solar water heating and photovoltaic systems should be considered if determined to be economically viable.
- Appropriate landscape design, water harvesting techniques and use of the University's reclaimed water system should be incorporated (only where available).
- Appropriate day lighting design should be considered to minimize the requirements for artificial lighting and to promote the interior/exterior connection of the building.

Innovation and Creativity in achieving the sustainable design goals are encouraged. Additionally, design aesthetics shall be considering in all aspects of the building design, including sustainable design components. The State of Arizona mandate for all state facilities to achieve LEED Silver certification is the minimum standard for NAU. NAU's goal is to excel in sustainable design in as many ways as possible.

General Project Planning & Design: The design shall manifest NAU's commitment to sustainability to the greatest extent possible. Sustainability shall be addressed comprehensively as an integral aspect of the design philosophy and in all aspects of the building design.

Building Size & Footprint: Minimize the overall building size (square footage and footprint) while meeting the building program requirements. The goal is efficient use of space to reduce overall resource consumption; including embodied energy, operational energy, and building materials.

Design for Future Use: Plan for a "100-year Building" through flexibility of use and future reuse; no "throw away" buildings. Design interior spaces that are flexible and allow for changes in use. Use standard furniture wherever possible. Minimize use of custom millwork, custom building systems (door frames, doors, interior windows etc.) to maximize reuse in the future. For retrofits, analyze current space requirements for space efficiency, function, and use proximity.

Building Life Expectancy: Appropriate use of construction materials, mechanical, electrical and plumbing systems should be selected that result in a building with an intended useful life of 100 years, and also respond to the attributes of the Northern Arizona mountain environment.

Programming & Space Planning: Group spaces or activities with similar energy requirements and times of use to allow for zoning efficiency of passive and mechanical energy systems. The goal is to reduce demand and optimize operational efficiency.

Service Areas: Service areas shall support efficient operations, program, and building management for NAU sustainability initiatives; such as recycling collection, trash compaction, water capture, service vehicle access, etc.

Transition spaces: Provide sufficient exterior screening, transition courtyards, exterior atrium spaces, shade trellises, etc., to allow the building occupant the opportunity for eye adjustment from bright to low light and from low to bright light.

User Involvement: Survey building occupants/users for sustainable design, maintenance and operations suggestions; utilize the recommendations in the design as practicable

Existing Landscaping: Protect significant natural and historic landscaping and incorporate those elements into the new landscape design.

New Landscaping/Site Planning: Program the site to create a "sense of place" through the design of a variety of experiences and activities with micro-climates appropriate to desert climate conditions. Maximize opportunities to create landscape shading and cooling for the building, exterior spaces, and walkways while also specifying low maintenance *and* desert-appropriate plant materials.

Carbon Neutrality: A zero carbon emission campus is the NAU goal.

Building Envelope: Design the building envelope to minimize heat loss and gain. Exceed the current ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) building envelope performance baseline standard by 30% or more. Avoid thermal bridging by providing thermal breaks in the exterior building envelope.

Climate-Responsive and Passive Systems Design: Design buildings in a climate-responsive manner to reduce energy demand, maximize passive heating and cooling, and minimize mechanical HVAC requirements (through building form, orientation, articulated shading, natural ventilation, glazing, interior thermal mass, blinds, controls, geothermal energy, earth tempering, etc.)

Window Glazing: Select glazing size and materials appropriate for the orientation of the windows. Use double or triple glazing wherever possible. Thermal breaks shall be included in window frames at all exterior glazing.

Window Shading: Every exterior window shall be shaded appropriately for the window orientation. Consider cleaning and maintenance of windows and shading devices in the design. Provide a shading analysis for review. Insure that operable interior shading is accessible to the building occupants.

Mechanical Systems: Specify energy-efficient HVAC and electrical systems. Coordinate systems and controls with other building systems to optimize building operation and reduce energy consumption on a life-cycle basis. Provide motion sensors, daylight-responsive dimming, and electronic ventilation controls. Consider using low carbon technologies (heat pumps) or central plant system design. Consider extended life cycle maintenance and material costs in mechanical systems design. Use natural sinks for cooling (the ground or natural water bodies). Use heat recovery systems wherever possible to minimize energy usage.

Energy Commissioning & Monitoring: Provide building energy commissioning beginning in schematic design to establish energy goals, and ending with a post-occupancy energy

analysis. Provide permanent energy metering on all buildings for monitoring each type of energy use, utilizing the NAU Campus monitoring standards for water, lighting, other electrical, gas, etc. Provide the capability to monitor and analyze post-occupancy performance in comparison to energy analysis predictions. Provide a 1-year and 2-year post occupancy energy/carbon use analysis. Use Smart Meters for all spaces or groups of spaces as appropriate to monitor energy use and educate users on their affect on energy consumption.

Landscape Maintenance: Reduce maintenance and potential problems caused by landscape debris. Specify plants appropriately for their purpose and location. Avoid overplanting. Consider mature landscape growth potential to insure appropriate integration with lighting and other site systems.

Climate-Responsive Materials: Specify materials that are durable under desert climate conditions (UV radiation exposure and extreme heat).

Embodied Energy: Minimize the use of high embodied-energy materials.

Reused & Repurposed Materials: Present opportunities for installation of reused and repurposed materials, including the building shell, structural materials, finishes, fixtures, etc. Utilize Green Globes[3] reference guidelines for baseline standard.

Maintenance: Specify low maintenance materials. Material and building maintenance, and special cleaning procedures, shall be reviewed with NAU Trades (CAS) in the design development phase for integration into the NAU sustainable cleaning program standards.

Building Construction Supervision: Schedule on-site quality control inspections to check for/assure freedom from heat bridges.
- Assure that insulation layers are continuous, and without air pockets.
- Check joint details for air tightness while they are accessible.
- Have a building shell pressure test performed as part of the building commissioning.

6.2 ASHRAE 189.1

New construction must adhere to the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) ASHRAE 189.1 and provide the minimum requirements for site planning, design, construction, and operational planning for green commercial and institutional buildings.

Design elements include site sustainability, water use and management, energy use, indoor environmental quality, plus the building's impact on the atmosphere, materials and resources. Under energy: mechanical equipment performance, insulation, controlling

air leakage, day-lighting, solar gain, occupancy-controlled lighting and ventilation, as well as on site renewable energy are included.

The designs presented and approved must meet or exceed the ASHRAE 189.1 requirements and incorporate the LEED requirements as listed below.

Following these Design Guidelines and ASHRAE 189.1 Standard, should lead to achieving LEED Silver Certification. The DP should do their best to design a building that will be as sustainable as possible when taking into account life cycle cost analysis, total cost of ownership, and energy consumption. The University is relying on its DP to do what is right for the environment and what will benefit the overall University Maintenance and Energy budgets. As decisions are being made, the University requires to be involved (through its Project Managers) in all material selections and the DP might be requested to provide justification of their selections (carbon impact, maintenance and energy costs)

USGBC LEED CERTIFICATION

The University has established a goal, wherever appropriate, to acquire LEED Silver Certification as established by the United States Green Building Council on all projects as defined below:

- **New Buildings** - A minimum of LEED Silver Certification for all new construction.
- **Building Expansions** - Major building expansions should achieve LEED Silver Certification for the expansion, and if the project scope and budget support it, for the entire building. This goal will be established during project programming phase.
- **Renovations** - Renovation projects are defined as those projects involving the alteration of a portion of an existing building. Renovations range from simple aesthetic improvements to complex physical reconfigurations and systems' replacement. Due to the potential range of existing conditions – and the ability of a renovation project to address such conditions – it is incumbent that each renovation project undergoes an evaluation early in the budgeting and programming phases to determine if LEED certification can be achieved.

All projects will adhere to LEED V2009 or the latest accepted version of the standards. Projects will use the most recent LEED project management software to register, document and certify projects.

In general, for minor renovations or room specific renovations, requirements for LEED Certification will not be part of the project scope. For projects where major renovation is part of the scope, inclusion of LEED Silver Certification should be anticipated. For example, in major renovation projects that affect entire floors or buildings, LEED Silver Certification should be anticipated.

When considering which points will be required to obtain University LEED objectives, the Design Professional should be aware of the potential design impacts carried across the

major design disciplines. At the time of this revision for these guidelines, the following list was compiled of potential design issues that may carry over to the Mechanical, Electrical, and Plumbing disciplines and is based on the potential LEED credit categories defined in LEED-V2009 version. While these issues may not apply to all projects and there are obviously more coordination and design issues involved with a LEED design, the following list is provided to spur awareness of design elements and coordination effort that may be required. In addition, the following list is not intended to limit the Design Professional's responsibility or creativity in providing a successful and functional LEED design.

The University has identified the following LEED points (LEED silver certified) for mandatory inclusion:

NEW CONSTRUCTION

SITE DEVELOPMENT

- **Prerequisite SSp1 - Construction Activity Pollution Prevention**
  Prepare a Storm Water Pollution Prevention Plan regardless the size of the site (under or over 1 acre), to ensure that construction debris and earthwork will not be infiltrate the Campus existing storm water drainage system.

- **Credit SSc2 - Development Density and Community Connectivity**
  Development Density and Community Connectivity consistent with the campus Master Plan.

- **Credit SSc4.1 - Alternate Transportation: Public Transportation Access**
  Due to the fact that NAU operates a bus system throughout Campus, and local bus system (NAIPTA) has several bus stops located nearby Campus, this credit should be achievable on all projects.

- **Credit SSc4.2 - Alternate Transportation: Bicycle Storage & Changing Rooms**
  Public transportation access, consistent with the Campus Master Plan.
  Provide ample bike rack space to accommodate both staff and student use of the building. Consider need for roof, area drains and lighting for bicycle storage areas/racks. Consider snow removal and bike storage. Faculty, Staff and Students will continue to ride their bikes in the winter if they have good access to bike storage and if it is somehow protected from the elements.
  Consider special requirements for changing rooms:
    a. Showers
    b. Lavatories, urinals, water closets,
    c. Domestic water heater,
    d. Toilet room and shower exhaust

- **Credit SSc6.1 - Stormwater Design: Quantity Design**
  Consider stormwater collection for non-potable uses such as Landscape irrigation, flushing urinals and/or toilets, cooling tower makeup (incorporate with existing fin water recovery system).
  Design collection systems with enough capacity to maintain volume of existing stormwater system.
  Consider volume of water collection and storage location
  If multiple tanks are utilized, special consideration of the following will be required:
    a. Inlet pipe size,
    b. Tank arrangement,
    c. Pipe materials,
    d. Tank equalization
    e. Access for cleaning

  Consider required treatment:
    a. Settling area to remove heavy solids
    b. Cyclone filters to remove lighter solids
    c. UV lights to prevent bacterial growth

- **Credit SSc7.2 - Heat Island Effect: Roof**
  Coordinate with project Architect to establish roof requirements.
  Material/product selection should be accounted for in load and energy models.
  Material/product selection may place limitations on equipment locations and roof penetrations.

- **Credit SSc8 - Light Pollution Reduction**
  Consider public safety requirements.
  Comply with the City of Flagstaff Dark Sky Ordinance.
  Consider requirements for unexpected lighting fixture layouts in perimeter areas within the building.
  Lighting layout within the building may affect layout of air distribution.

WATER EFFICIENCY

- **Prerequisite WEp1 - Water Use Reduction**
  Use a modified waterless urinal (water urinal with removable handle to allow occasional cleaning flush by Custodial crews only), low flow toilet, low-flow showers as applicable, non-potable water use for toilets

- **Credit WEc1 - Water Efficient Landscaping: No potable water use for irrigation**
  Coordinate with Landscape Architect to verify water quantities (impact to water service). Consider impact to storm water collection system.
  May require other “recycled” water sources.
  Landscaping: Reduce demand on all systems. Utilize appropriate low water use

desert and indigenous landscaping materials, balancing that with the creation of shaded micro-climate areas and comfortable, usable outdoor spaces. Utilize dense canopy trees for shading walkways and creating desert "oasis" areas utilizing captured water.
Irrigation: Maximize gray water use for landscape irrigation and other purposes as the law allows. Consider use of captured rainwater or gray water for landscape irrigation. Use irrigation cisterns for water features in lieu of continuous potable water fountains. All emitters for trees and landscape shall be designed for easy modification to reduce the amount of water used (to initially establish a desert landscape) over time to conserve water as plants become established; and to be easily modifiable to move the system farther out over time to encourage root spread.

- **Credit WEc2 - Innovative Wasterwater Technologies**
  Consider use of high efficiency fixtures.
  Consider use of "recycled" water sources (condensate water), lavatory and shower drainage (onsite grey water).
  Consideration of treatment, storage, and separate waste piping.
  Water Capture: Provide a site location for collection opportunities for current and/or future water capture and reuse. Provide opportunities for rainwater harvesting and condensate collection.

ENERGY & ATMOSPHERE

- **Prerequisite EAp1 - Fundamental Commissioning of the Building Energy Systems**
  Coordinate closely with the Commissioning Agent.
  Commissioning Agent will require assistance with developing the Basis of Design.
  Document The Commissioning Agent will provide specifications to incorporate in the Construction Documents and will be involved in design reviews.

- **Prerequisite EAp2 - Minimum Energy Performance**
  Must comply with both mandatory and the prescriptive requirements of ASHRAE 90.1
  Proof of compliance will be based on data output from LEED approved computer load/energy estimating programs only.

- **Prerequisite EAp3 - Fundamental Refrigerant Management**
  No use of CFC refrigerants.

- **Credit EAc1 - Optimize Energy Performance**
  34 % Improvement in building performance beyond ASHRAE 90.1 requirement is the preferred minimum level for new University facilities.
  Additional improvements may be required based on LEED objectives.

- **Credit EAp2 - Onsite Renewable Energy**
  Incorporate solar and renewable energy systems into the building design, such as photovoltaic panels which replace other building materials such as roof and wall finishes and shading elements; and/or prepare the building to receive solar equipment (conduit stub-outs, grouping of other rooftop equipment, space for solar equipment in the building, etc.). Ensure that the building and roof are "solar ready." Investigate and propose all possible viable options for renewable energy generation. Consider impact to electrical distribution/service & to mechanical systems.
  Use of onsite renewable energy - 5 % min or minimum 4-6 kbtu/sf to meet ASHRAE 189.1 requirements.

- **Credit EAp3 - Enhanced commissioning**
  Coordination required for additional design document reviews by Commissioning. Agent Coordination required for additional reviews by Commissioning Agent of submittals, RFI's, change orders.
  Commissioning Agent may also require assistance with development of a Systems Manual.

- **Credit EAp4 – Enhanced Refrigerant Management**
  Select refrigerants that do not deplete ozone or increase global warming
  Perform maximum threshold calculation

- **Credit EAp5 - Measurement and Verification**
  Develop and Implement a M&V Plan, providing means of energy consumption measurements.

MATERIALS & RESOURCES

- **Prerequisite MRp1 - Storage & Collection of Recyclables**
  Specialized equipment may be implements such as crushers/compactors, consider requirements for water and waste services for area washdown and power requirements.
- **Credit MRc2 - Construction Waste Management**
  Divert 50% from disposal

- **Credit MRc4 – Recycled Content**
  Recycled content – 10% combined post-consumer + ½ pre-consumer

- **Credit MRc5 – Regional Materials**
  Regional materials - 10% extracted processed and manufactured regionally
  Select materials that are readily serviceable from the USA (parts available locally)
  Select materials that are manufactured as close as possible and avoid materials coming from oversea with long procurement lead-time. Take into account not only

where the finished materials are manufactured but also where the raw materials are coming from. Think globally about the total carbon footprint of the selected materials.

- **Credit MRc6 – Rapidly Renewable Materials**
  Material U-values may not be readily available.
  Consult with University prior to incorporating organic insulation materials for approval. Treatment and prevention of mold growth in and on organic insulating materials will need to be provided.

- **Credit MRc7: Certified wood**
  Select certified wood products.

INDOOR ENVIRONMENTAL QUALITY

- **Prerequisite IEPp1 – Minimum IAQ Performance**
  ASHRAE 62.1 minimum requirements must be met.
  Requires system percentage of outside air high enough to meet requirements of the "critical" zone.

- **Prerequisite IEPp2 – Environmental Tobacco Smoke Control**
  The entire building shall be designated as "Smoke Free" area

- **Credit IEPc1 – Outdoor Air Delivery Monitoring**
  Requires direct measurement of outdoor air quantities serving non-densely populated spaces, AND requires monitoring of CO2 concentrations within densely populated spaces. Control system must be capable of taking corrective action when necessary.

- **Credit IEPc2 – Increase Ventilation**
  Requires 30% more outside air compared to ASHRAE 62.1 minimums.
  Consider impact to energy savings (and Credit EAc1) before implementation of this measure. Utilizing MERV 8 filters on AHU's during construction

- **Credit IEPc3.1 – Construction IAQ Management Plan: During Construction**
  Requires protecting all ductwork during construction to stop dust from collecting inside the ductwork.

- **Credit IEPc3.2 – Construction IAQ Management Plan: Before Occupancy**
  Requires flush of building (14,000 cf per sf), or baseline air testing
  HVAC system must be designed to accomplish the flushing (via air economizer cycle)
  Either flushing or air testing requires schedule time for the contractor

- **Credit IEPc4.1 – Low-Emitting Materials: Adhesives & Sealants**
  Consider use of alternate adhesive & sealant products for items such as ductwork, insulation, pipe dope, etc.

- **Credit IEPc4.2 – Low-Emitting Materials: Paints & Coatings**
  Consider alternates for paints and coating utilized with mechanical and electrical equipment, piping, insulation, etc.

- **Credit IEPcIE5 – Indoor Chemical & Pollutant Source Control**
  Requires isolation of pollutant rooms: laundry rooms, janitor's closets, printer rooms, etc. Negative pressure (exhaust) will be required in such spaces. Will required printers to be in dedicated rooms. MERV 13 filters will be required

- **Credit IEPc6.1 – Controllability of Systems: Lighting**
  Consider special requirements for controllability for all shared multi-occupant spaces

- **Credit 6.2 – Controllability of Systems: Thermal Comfort**
  Requires individual HVAC controls for minimum of 50% of the occupants.
  Consider impact to HVAC system zoning (e.g. terminal box placement for VAV systems). Provide opportunities for reasonable individual control of thermal comfort, including lighting, heat, shading, and natural ventilation within the parameters established for the space by CAS. Insure that controls are such that occupants have a sense of and understand the control of their thermal and visual environment.
  HVAC zoning coordination required for commonality of control interface locations (alignment of HVAC zones with lighting zones preferred).

- **Credit IEPc7.1 – Thermal Comfort: Design**
  Meet requirements of ASHRAE 55 Thermal Comfort Conditions for Human occupancy and demonstrate design compliance.

- **Credit IEPc7.2 – Thermal Comfort: Verification**
  Building comfort must be assessed over time.
  Requires a survey over time and corrective action if great than 20% of the occupants are dissatisfied.

- **Credit IEPc8.1 – Daylight & Views: Daylight 75% of Spaces**
  Utilize natural daylight and views to enhance building occupant comfort.
  Provide adequate operable shading where necessary to reduce heat and glare.
- **Credit IEPc8.2 – Daylight & Views: Views for 90% of Spaces**
  Will required coordination with HVAC air distribution layout, light fixture placement and lighting controls.

EXISTING BUILDING RENOVATION:

- **Optimize energy performance by 34 %**
    a. Lighting retrofit and motion detection switching
    b. Evaluation of existing building insulation and addition of insulation
    c. Replace windows
    d. Replace roofing
    e. HVAC upgrades with better air handling units (AHU)
- **HVAC upgrades to cover the following**:
    f. Enhanced commissioning
    g. Enhanced refrigerant management
    h. Building management systems
    i. Measurement and Verification
- **Controllability of systems – lighting**
    j. Motion detection switching

6.3 ENERGY MODELING

Energy modeling is essential to understanding the contribution of an element to the system function efficiency. Energy modeling captures the advantages of certain materials in reduction of energy during facility operation. The systems included are primarily mechanical, electrical and plumbing as well as heating, ventilation and cooling (HVAC). For the elements included in the building envelope: subflooring, walls, roof, insulation, and glazing the cost/benefit is realized in energy savings due to better performance of the material for insulating, moisture management, and heat transfer. The energy model provides information that the building owner needs to properly evaluate different design alternatives.
The final energy model will be based on LEED requirements for the baseline building.

If the proposed HVAC system is not the NAU preferred HVAC system described in Specification Section 23 00 00 (variable air volume, single duct, with terminal reheat), an additional alternative to the LEED baseline HVAC system will be modeled. The additional alternative to the baseline system will be the single duct variable air volume system. The University requires the energy savings data between the LEED baseline HVAC system, the University preferred HVAC system and the proposed HVAC system. The model inputs and reports will be submitted at the design development stage.

The requirements of ASHRAE 189.1 shall be implemented during Design Documents and Construction Documents phases and shall be incorporated in the final construction documents. Modeling based on ASHRAE 189.1 is not required.

The energy model should capture the role of components in the system performance. A life cycle analysis of components that are part of an energy system without an appropriate

model included will be deemed incomplete and inconclusive. A complete energy model will be included as part of the 100% design development documentation for each project.

6.4 BUILDING LIFE CYCLE COST (BLCC) ANALYSIS AND BUILDING COMPONENT SELECTION

- **"Total Cost of Ownership"**

Throughout the process of scoping, design, and sometimes during construction, building components are selected and included in the building design. Rather than base decisions for inclusion of components in the project solely on the construction budget and initial installed cost, elements included in the project must be evaluated for building life cycle cost (BLCC). The BLCC analysis includes the costs and benefits for the lifetime of a building for a product or a system including but not limited to: the initial cost of material and installation, energy savings, maintenance costs, and product life. BLCC analyses provide the owner with a true cost of alternatives under consideration. These analyses can then be used to compare acceptable construction materials and to differentiate the actual cost of materials to the building owner.

- **Building Life Cycle Evaluation Process and Procedure Guidelines**

The project team will identify the elements to be evaluated for BLCC Analysis based on the performance goals established for the building and the available options. Any alternatives considered shall be viable options acceptable to NAU CAS. BLCC Analysis shall be formally documented in the reports as required in the project development, schematic design and design development. Final selections will be made by the project team as part of construction plan completion and BLCC may not be the sole criteria used to perform selection of building systems and building materials.
Energy escalation rates and the discount factor will be derived from the latest *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis, Annual Supplement to NIST Handbook 135,* or as directed by the University's Manager of Utilities.The University recognizes that proposed alternatives may not prove cost effective based on Life Cycle Cost Analysis but the alternative may be deemed necessary to meet the energy reduction goal and minimize the carbon footprint of the building. This situation occurs predominately in the Optimize Energy Performance credit of the LEED certification process. The Life Cycle Cost Analysis and LEED energy savings impact will be evaluated on a case by case basis.

The following building systems shall be considered for BLCC Analysis:

1. Energy systems
2. Electrical Systems
3. Building Envelope
4. Sitting/Massing Strategies
5. Structural Systems
6. Mechanical Systems

7. Water Systems
8. Interior Materials

Goals shall be established for each of the systems as listed. Each project requires that at least six life cycle comparative studies be presented and updated for each design phase. Specific required studies include: roofing alternatives within the building envelope category, HVAC system alternatives within energy systems, and flooring as part of interior materials. No more than three studies shall be completed within the same category.

- **Resources**

The following resources were identified as potential methods for BLCC Analysis:

- The US Department of Energy provides a life cycle cost analysis program through The National Institute of Standards and Technology (NIST) and provides a program to assist in BLCC Analyses.
- BLCC conducts economic analyses by evaluating the relative cost effectiveness of alternative buildings and building-related systems or components. Typically, BLCC is used to evaluate alternative designs that have higher initial costs but lower operating costs over the project life than the lowest-initial-cost design. It is especially useful for evaluating the costs and benefits of energy and water conservation and renewable energy projects. The life-cycle cost (LCC) of two or more alternative designs are computed and compared to determine which has the lowest LCC and is therefore more economical in the long run. BLCC also calculates comparative economic measures for alternative designs, including net savings, savings-to-investment ratio, adjusted internal rate of return, and years to payback.
- The software can be used to evaluate projects for both new and existing buildings. While BLCC is oriented toward construction-related decisions, it can be used to evaluate alternative designs for almost any project type in which higher capital investment costs lead to lower future operating-related costs (NIST website, 2009).

Designers are expected to be well versed in modeling and to have the ability to demonstrate the accuracy of the proposed model using existing facilities and locally and regionally appropriate data.

6.5 OPERATION & MAINTENANCE

- **Building "Owner's Manual":** Provide a Building Owner's Manual (in digital format) on how to operate and maintain the building and site to optimize the building systems and design.

- **Operation & Maintenance Education**: Conduct a building owner/user/CAS workshop prior to occupancy to review the "Building Owner's Manual" and direct building users

on how to optimize the building systems and design.

- **Post-Occupancy Evaluation:** Post-occupancy evaluations will be performed by the Design Professional (DP) or a consultant retained by the DP at the end of the first year of occupancy. The evaluation shall include performance and satisfaction assessments of building comfort, HVAC systems operations & controls, water and energy use, lighting, etc.

6.6 BUILDING EDUCATION

- **Resource Usage Information Display:** Buildings are not static in nature and therefore it is important to provide feedback to the users on their effect on energy, water and other resource consumption as they use the buildings. Provide smart meters to educate and influence user behavior with the goal of reducing energy consumption.

- **Interpretation:** Buildings should be an educational opportunity for the users, to educate the users on energy savings and resource saving features of buildings. Provide innovative ways to educate users about the sustainable building design, through the use of signage, displays (green screen or other form) and any other appropriate communication device to explain design strategies, techniques, technologies, etc.

7. CAMPUS METERING

Utility metering is required for all new construction and renovation projects that include energy or water consuming components. Utility meters shall be designed and specified by the Design Professional. Contractor shall furnish and install all utility meters. Utility meter commissioning shall be a joint effort between the Contractor, Design Professional, Commissioning Agent, (where applicable) and the University. The University will not accept any utility meter until it has been shown to be fully functioning and operational. Refer to section 23 05 19 for Mechanical Meter Standard and 26 09 13 for Electrical Power meters.

South Campus:
Heating water flow in GPM, totalized energy in BTU's

North Campus:
Steam flow in lbs./hr., totalized energy lbs

Both Campuses
Chilled water flow in GPM, totalized in BTU's
Domestic water totalized in gallons
Reclaimed water in gallons
Natural Gas in SCF
Electric use totalized in kW hrs., real time demand in kW

Utility meters shall communicate with the University's campus EMS system. Specify all necessary components and communication protocols to assure meter information can be mapped to campus Building EMS Web Page.

8. CAMPUS ACCESSIBILITY AND UNIVERSAL DESIGN

Northern Arizona University is committed to universal design in all construction projects whether they are new facilities or facility renovations. The university is committed to providing equitable access to its working, learning and cultural activities for all individuals. Universal Design serves to create usable and sustainable spaces which are usable by all members and guests of the university community.

Universal design "is not a design style, but an orientation to any design process that begins with a responsibility to the experience of the user" (Institute for Human Centered Design, 2010). It is a proactive approach to design considerations in the physical environment, as well as the information, policy, and learning environments. Considering the experience of the user prior to making design decisions can create long-term efficiencies for the institution by minimizing the need for future adaptations and retrofitting. In recognition of this potential, Northern Arizona University has established its commitment to universal design within its 2010 Strategic Plan under goal 5, which states "Foster and support universally-designed environments," and goal 7, which states, "Design products and environments to be usable by all people, to the greatest extent possible."

The Center for Universal Design at North Carolina State University has defined universal design as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Center for Universal Design, 1997). In supporting this definition, it has identified seven primary principles of universal design for products and environments.
(see http://www.ncsu.edu/www/ncsu/design/sod5/cud/about_ud/udprinciples.htm)
These principles are:

Principle 1:	Equitable use
Principle 2:	Flexible use
Principle 3:	Simple and Intuitive Use
Principle 4:	Perceptible Information
Principle 5:	Tolerance for Error
Principle 6:	Low Physical Effort
Principle 7:	Size and Space for Approach and Use

These principles are described in detail at the Center for universal Design website listed above. This information, and other reference material, can also be found on Northern Arizona University's Commission on Disability Access and Design website at home.nau.edu/cdad.

Projects involving building/sites on the National Register of Historic Places must comply with the UD Accessibility Standards in such a way that impact is minimized and a building/site's historic integrity and character defining features are maintained. The determination of

building/site's historical integrity and character defining features shall be made by an individual meeting the Secretary of the Interior's Professional Qualification Standards for Historic Preservation.

Due to potential range of existing conditions – and the ability of renovation (or historic renovation) project to address such conditions – it is imperative that each project involving an existing building undergo evaluation early in the design process to outline the scope of accessibility compliance which can be achieved.

All construction projects – new, renovation and historic renovation – must comply with the ANSI 117.1 accessibility requirements (as a referenced standard in the IBC). In addition, must comply with the 2010 ADA Standards, as adopted by the Department of Justice (DOJ) in September 2010 and their related standards as they apply. Compliance shall also conform to the requirements of the latest editions of all state regulations and the various codes which have been adopted by the University at the time of bid.

New construction projects must comply with mandatory standards throughout both the building and site. Additions to existing buildings must comply with mandatory standards throughout the building and – if provided with new building entrances from the exterior – the site. Renovation projects must comply with mandatory standards within the physical boundaries of the renovation.
In regards to achieving accessibility as part of renovations, the University recognizes that there are some challenges renovation projects cannot overcome, such as:

- Conditions physically beyond the limits of the renovation
- Spatial/structural/technical conditions which make accessibility infeasible to achieve, and/or
- Conditions which cannot be addressed within a defined project scope or budget.

Many of the UD Accessibility Standards become preferences – rather than mandatory – when there are significant constraints to achieving accessibility. However, the University expects design professionals to bring an innovative and resourceful approach to renovation projects on campus, and strive to achieve compliance with the UD Accessibility Standards.

Section 1 - Building Basics

Reach Ranges

- The operable portion of building equipment and controls (such as electrical switches, fire alarm pull stations, above-work-surface telephone and data outlets, thermostats, elevator call buttons, etc.) shall be located no higher than 44 inches above the finished floor.
- Proximity door access card devices shall be used in areas where required for security. They will be centered no higher than 38 inches above the finished floor.

- Control plates for automatic door openers shall be centered 36 inches above the finished floor.

Section 2 - Accessible Routes

During Construction

- Renovations that temporarily eliminate building-wide accessibility accommodations (i.e. change of building entrance, access through building, accessible restrooms, elevators, etc.) shall provide comparable, temporary replacements-including temporary directional signage-for said accommodations.
- Construction fencing/staging, earthwork, temporary drainage conditions shall be designed to maintain existing accessible routes or alternative, temporary accessible routes-including temporary directional signage-shall be provided.
- Temporary ramps used during construction must comply with ADAAG regulations.

Surface Materials

- Decorative ground surface treatments (i.e. exposed aggregate concrete, unit pavers, stone paving, etc.) shall not be on an accessible route.
- Granular surface materials used to create exterior paths of travel shall provide a stable surface that is usable during all weather conditions.
- Changes in surface material-both inside and outside-shall be provided with a durable transition/threshold that will meet the change in elevation height requirement throughout the life of the building/space.
- Granular surface materials may not be used on path of travel surfaces with a slope greater that 1:20.
- The university's standard for detectable warning surface is truncated domes. (Photo 1, Photo 2)

Photo 1: Truncated dome surface

Photo 2: Truncated dome surface at walkway

Building Entrances

- The main entrance of a building shall be universally accessible via a single route.
- All building entrances shall be accessible-including employee entrances or entrances other than the main entrance.

Doors and Doorways

- Kick-plates shall be provided on non-latching/push-pull hardware-type doors.
- All latching door hardware share be lever handle type.
- In the case of Revolving doors hall being used, an adjacent single door, minimum 36 inches wide, mechanically operated, shall be provided.

Ramps

- Where changes in elevation are encountered (including courtyards and open spaces) full consideration shall be given to university accessible design that addresses elevation change.
- Where grades/space allow, sloped sidewalks (slope 1:20 or flatter) shall be used to overcome changes in elevation.
- Ramps (defined as anything steeper than 1:20 slope) shall have a maximum of 1:16 slope.

Curb Ramps (curb cuts)

- Curb ramp slopes shall be 1:12.

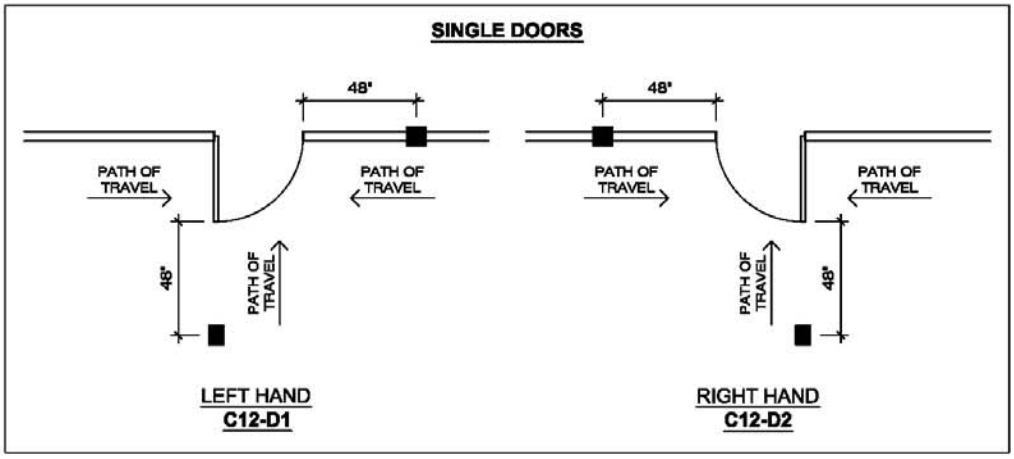
- Concrete aprons shall be provided at the bottom of the curb ramps.
- Curb ramps within sidewalks (parallel to the path of travel) shall be provided with a 1:16 slope.
- The university's standard for detectable warning surfaces is truncated domes in a contrasting color.
- The depth of detectable warning surface in the direction of travel shall not exceed 24 inches.

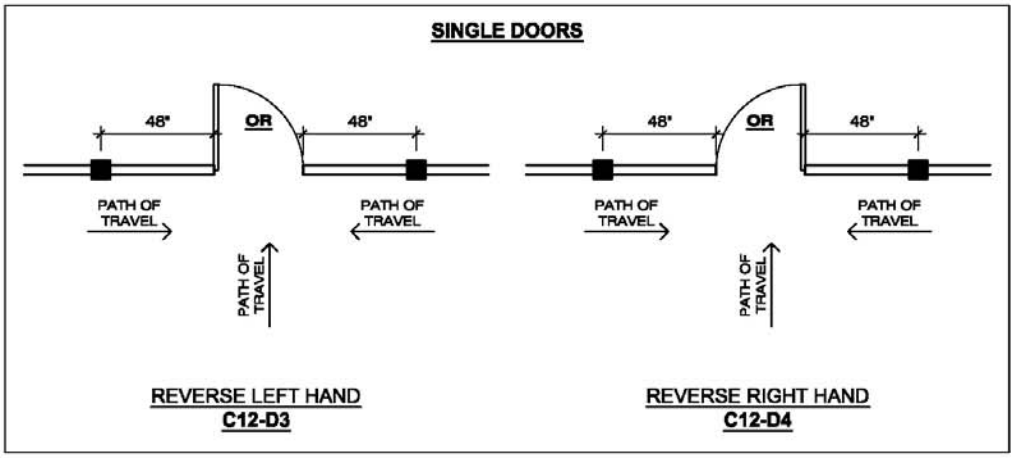
Automatic Door Operators

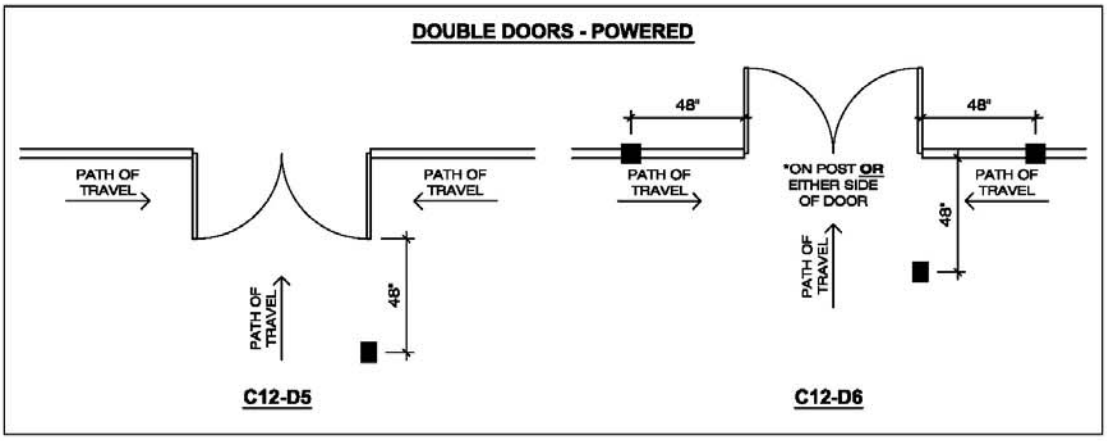
- Automatic door operators shall be installed at each entrance to a building.
- For guidance on horizontal placement of control plates for Automatic Door Operators, refer to diagrams C-12-D-1 through C-12-D-6 on next page. For vertical placement of control plate for Automatic Door Operators, refer to Section 1-Building Basics-Reach Ranges. (ADAAG 404.3).

Elevators and Lifts

- Elevator cabins shall be accessible.
- Platform lifts shall not be used.


SINGLE DOORS
48"
PATH OF TRAVEL
PATH OF TRAVEL
48"
PATH OF TRAVEL
LEFT HAND
C12-D1
48"
PATH OF TRAVEL
PATH OF TRAVEL
PATH OF TRAVEL
48"
RIGHT HAND
C12-D2


SINGLE DOORS
48"
OR
48"
PATH OF TRAVEL
PATH OF TRAVEL
PATH OF TRAVEL
REVERSE LEFT HAND
C12-D3
48"
OR
48"
PATH OF TRAVEL
PATH OF TRAVEL
PATH OF TRAVEL
REVERSE RIGHT HAND
C12-D4


DOUBLE DOORS - POWERED
PATH OF TRAVEL
PATH OF TRAVEL
PATH OF TRAVEL
48"
C12-D5
48"
48"
PATH OF TRAVEL
*ON POST OR EITHER SIDE OF DOOR
PATH OF TRAVEL
48"
PATH OF TRAVEL
C12-D6

Section 3 - General Site and building Elements

Parking Spaces

- Universal Parking space should be 132 inches wide with a 60 inch access aisle.
- If there is no passenger loading in front of a building, an accessible loading zone space shall be provided by locating loading space(s) adjacent to universal parking spaces, thus sharing the access aisle. These accessible loading zones should be provided with appropriate signage.
- Note that when a van accessible space is a 132" (11feet) wide, then the loading zone shall be 60" (5 feet) wide or when a van accessible space is 96" (8 feet) wide, then the loading zone shall be 96" (8 feet) wide.

Section 4 - Plumbing Elements and Facilities

General

- No vestibule (i.e. doors in series) entries into restrooms.
- Gender neutral restrooms shall be accessible for the purposes of privacy and/or assisted use.
- Mirrors shall be full length or no more than 40 inches from floor to bottom of mirror.

Toilet and Bathing Rooms

- Single occupant public/employee restrooms shall be fully accessible.
- Private toilet rooms for employees shall be accessible for approach, entry and exit, and provided with a 5 foot turning radius.
- A Gender Neutral restroom shall be provided in all facility (refer to Chapter 9 of this Design Guidelines Manual)

Water Closets and Toilet Compartments

- A side approach toilet with a 5 foot turning radius located completely in the compartment shall be provided.
- Toilet paper dispensers shall be located:
    - With the front edge of the dispenser no further than 32 inches from the rear wall of the compartment.
    - Centered 26 inches above the finished floor
    - Below the side grab bar
- Toilet paper dispensers in accessible toilet compartments shall be continuous feed type dispensers; no separate sheet, controlled feed, or large roll dispensers shall be used.
- Flush valves for toilets shall be automatic. (Photo 3)
- A coat hook 44 inches above the floor must be provided in the accessible toilet compartment.

- For wheelchair accessible door, door shall open in.
- Latching mechanism for accessible toilet compartment doors shall be operable with a closed fist.

Lavatories and Sinks

- The operable portion of soap dispensers, paper towel dispensers, electric hand dryers shall be not more than 44 inches above the finished floor.
- Soap dispensers shall be operable with one hand, located within an appropriate reach range, and provided with clear floor space.
- A 29 inch knee clearance shall be provided under accessible sinks. "Extended" sinks (those with a deep front to back dimension) shall not be used to achieve the 29 in knee clearance.
- Sink faucets shall be automatic (preferred) with delayed shut-off, or lever operated. Faucet must extend over the sink so there is sufficient space for hands to get wet. (Photo 4)
- Adaptable sinks with accessible cabinetry (such as sinks found in employee kitchen areas, laboratories, dwelling units, etc.) shall be provided with a finished flooring surface in the under-cabinet space.

Photo 3: Automatic flush valve for toilet

Photo 4: Automatic Sink Faucet

Shower Compartments

- In non-residential conditions, accessible showers shall be:
  - At least 60" X 36" with 60" X 60" being ideal
  - Transfer type entry

- Provided with padded, fold down bench with integral support legs that extend the full width of the stall and located on the wall opposite of the controls/shower head
- In communal showers, all the showering areas will be accessible to include hand-held showers, grab bars and fold out shower benches.

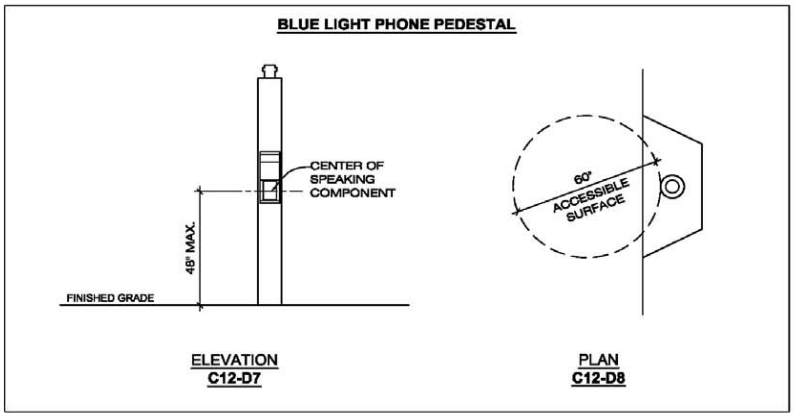
Section 5 - Communication Elements and Features

Assisted Listening Systems

- For ANSI or ADAAG required assisted listening system installations, consult with Disability Resources on the appropriate type of system for the building/space.

Emergency "Blue Light" Phones

- Access shall be provided to the emergency "blue light" phones. There should be an accessible approach and clear ground space in front of the phone with a 60 inch turning radius.
- Pedestal mounted emergency "blue light" phone shall be installed such that the center of the speaker is no higher than 48 inches above the surface of the clear ground space.



Section 6 - Rooms and Spaces

Signage

- All permanent rooms and spaces shall be identified with visual and tactile signs mounted 60 inches above the floor on the latch side of the door.

Auditoriums, Classrooms, Tiered Classrooms, and Assembly Areas

- A minimum 10% of total seating shall be accessible.

- Wheelchair accessible seating and companion seats shall be provided in a variety of locations throughout the seating area.
- Wheelchair access shall be incorporated in the primary access route to the stage/teaching station areas.
- In fixed seating situations, seats with fold up arms shall be provided.

Office Spaces

- Each individual office space in new facilities shall have sufficient clear floor space to accommodate a 5 foot turning radius.

Academic Laboratories

- Academic (teaching) laboratories shall be accessible. The accessible work stations shall provide, or have the capacity to provide, those elements of laboratory furnishings and equipment specific to the type of teaching expected to be conducted in the laboratory in question.
- Provide at least one wheelchair accessible workstation in each lab. The workstation shall include:
    - A bench space which is 7 feet long, adjustable in height.
    - A sink with faucet controls located on the side with single action lever controls or wrist blade handles.
    - Lab gases and power outlets located on the side of the bench or within 18 inches of the front edge of the bench with single action lever controls or wrist blade handles.
    - Storage facilities (for lab equipment/materials to be utilized by students in the lab) within ADA reach ranges.
- Where academic laboratories utilize fume hoods, provide at least one accessible fume hood with:
    - An adjustable height work surface.
    - Gas/services within the hood located on the side of the hood or within 18 inches of the front edge of the hood, with single action lever controls or wrist blade handles.
- Eyewashes/safety showers shall be independently accessible and operable by a wheelchair user.
- Aisles 42-48 inches wide are required for accessible benches and fume hoods.
- Where non-laboratory teaching amenities (writing surfaces, lecture areas, etc.) are provided within academic laboratories, at least one accessible workstation which includes such amenities shall be provided.
- Specific purpose teaching facilities (balance or tissue culture rooms, etc.) shall provide a wheelchair accessible space with:
    - A 5 foot diameter radius within one room.
    - An adjustable bench space.

Research Laboratories

- Research laboratories shall have provisions for wheelchair accessibility. The accessible workstation(s) shall provide, or have the capacity to provide, those elements of laboratory furnishings and equipment specific to the type of teaching expected to be conducted in the laboratory in question.
- Individual research laboratory rooms assigned to specific employees are considered employee work areas. For employee work areas, basic access is required for approach, entry, and exit.
- Research laboratory rooms with open assignment workstations/bench space shall be provided with at least one accessible workstation with:
    - A bench space 7 feet long, adjustable in height .
    - A sink with faucet controls located on the side (not rear) with single action lever controls or wrist blade handles.
    - Lab gases and power outlets located on the side of the bench or within 18 inches of the front edge of the bench with single action lever controls or wrist blade handles.
    - Aisles 42-48 inches wide for accessible bench space/hoods.
    - Storage facilities within ADA reach ranges.
- Shared, specific purpose research laboratory rooms in open assignment research laboratories shall be provided with at least one wheelchair accessible workstation/hood with a 5 foot turning radius and an adjustable table.
- Shared fume hoods in open assignment research laboratories shall provide at least on accessible fume hood with:
    - A maximum of 32 inches high work surface with 29 inch clearance below.
    - Gas/services within the hood located on the side of the hood or within 18 inches of the front of the hood, with single action lever controls or wrist blade handles.

Section 7 - Built-in Furnishings and Equipment

General

- When unfixed furniture may be moved into the path of travel, 42-48 inches aisles for clearance/maneuvering shall be provided.

Seating at Tables, Counters and Work Surfaces

- The top of built-in work surfaces which are used for extended periods of time (computer tables, study carrels, etc.) by transient populations shall be a maximum of 32 inches above finished floor. There should be at least one height adjustable table in each area.
- The minimum clearance below built-in furniture shall be 29 inches above finished floor.

- Accessible height service/reception counters-34 inches above finished floor-shall be located at the primary queuing point or staffing location.

Section 8 - Dwelling Units

General

- Residence Halls shall provide all residents and visitors access to all publically accessible areas of the facility.

Entrances

- All accessible building entrances to residence halls shall be provided with the infrastructure to permit unlocking the doors with a proximity card and permit opening with an automatic door operator.

Paths of Travel

- Stairs and elevators shall be located on a common route within the building.
- Interior doors along the path of travel to accessible rooms and those to building-wide amenities/services (i.e. kitchen, laundry, study/common rooms, etc.) shall be prodied with automatic door operators.
- The location of accessible rooms [1] in residence halls shall be:
    - On a convenient path of travel from the main entrance and elevator.
    - Close to building-wide amenities/services.

Doors

- Accessible rooms on all floors of a residence hall shall be provided with the infrastructure for automatic door operators.
- If “peep holes” are provided to residence rooms, provide an additional “peep hole” at 48 inches above the finished floor in the doors of accessible rooms.
- Infrastructure of door knock signalers (i.e. strobes) shall be provided for the entry doors to accessible rooms and the doors to bathrooms attached to accessible rooms.

Bathrooms

- Shower compartments in residential condition accessible bathrooms shall be:
    - Roll in showers
    - Specifically a 60” X 60” dimension
    - Provided with a padded, fold down bench with integral support legs installed on the wall adjacent to the controls/shower head.
- Accessible lavatories in residential condition accessible bathrooms shall be provided with counter top space (to accommodate personal care items).

[1] In new construction, all rooms shall be accessible

CODES AND STANDARDS

It is the intent and purpose that all construction projects conform to the requirement standards for persons with disabilities as set forth in the 2010 ADA Standards, as adopted by the Department of Justice (DOJ) in September 2010 and their related standards as they apply. Compliance shall conform to the requirements of the latest editions of all state regulations and the various codes which have been adopted by the University at the time of bid.

9. GENDER NEUTRAL RESTROOM REQUIREMENTS

The University is committed to designating and maintaining a minimum of one gender neutral accessible restroom (GNA) in as many of its buildings as reasonably feasible. Therefore the following criteria should be followed:

WHERE REQUIRED

- **New Buildings** - A minimum of one gender neutral (GNA) restroom should be provided in each new building.
- **Building Expansions** - Major building expansions should include a GNA restroom unless it is determined that the existing facility has a restroom that can be designated or converted *as part of the project scope*.
- **Renovations** - Renovation projects are defined as those projects involving the alteration of a portion of an existing building. Renovations range from simple aesthetic improvements to complex physical reconfigurations and systems replacement. Due to the potential range of existing conditions – and the ability of a renovation project to address such conditions – it is incumbent that each renovation project undergoes an evaluation early in the design process to outline the scope of compliance which can be achieved.

In general, addition of GNA restrooms should be considered for all projects including minor renovations. For projects where major bathroom renovations are part of the scope, addition of one GNA restroom, should be included. For major renovation projects affecting entire floors or buildings GNA restrooms should be provided if reasonably feasible.

- **Residential Facilities** - Because of the variety of facilities that Residence Life deals with, the Design Professional shall discuss with the User specific project requirements and criteria.

DESIGN CRITERIA

- A GNA restroom consists of a single room with its own door.
- Accessible GN restroom(s) shall not be used as a substitute for providing accessibility to multi-stall rest rooms.
- In new construction, each GNA restroom shall include one diaper changing table in addition to standard restroom fixtures/equipment.
- Refer to other sections of this DSS as applicable for plumbing and bathroom accessory criteria.
- The plumbing fixtures in GNA restrooms shall count towards the total fixture counts required by code.
- All GNA restrooms will be designated as RESTROOM with the universal male symbol, universal female symbol and universal handicap accessible symbol (if applicable).

10. CUSTODIAL PLANNING AND DESIGN

Custodial Services are inherent to the operations of buildings and proper service areas must be considered with all other areas during the programming and planning stages of each building.
Universally accepted standards have yet to be set for custodial closets and storerooms. Certain criteria however, for size, shape, location, and special appurtenances, have been developed which are compatible with present cleaning procedures and today's cleaning equipment.
Comprehensive custodian operations encompass three major areas:

- Custodial Closets
- Custodian Storage Areas
- Recycling and Solid Waste Disposal Systems

CUSTODIAN CLOSETS
The custodial closets should be planned to function primarily as the workrooms of men and women responsible for cleaning the interior surfaces of the building.
CO-LOCATION OF UTILITES NOT ALLOWED: Telephone switching gear, elevator controls, electric panels water heaters, pipe chases or other service functions are not compatible with custodian operations, and should not be located inside custodian closets. Openings to pipe chases or mechanical equipment areas should also not be located inside custodian closets.

Northern Arizona University has developed the following criteria for custodian closets:

- Size should be a minimum of 92 square feet, with an eight foot minimum width.
- Recessed light fixtures (to allow for clearance of long broom and mop handles) providing 75 foot candles of light.
- Adequate ventilation.
- Pegs for storage of rotary brushes.
- Hangers for wet mops over the sink.
- Hangers and wall space for dust mops and brooms.
- Hard surface walls impervious to water. Floors of sealed concrete or epoxy flooring.
- Shelves in closet to accommodate supplies in case lots, and to allow for storage of liquids in original 5 or 6 gallon containers. Additional shelving (minimum 11 inches deep) shall be mounted at five feet high to accommodate light containers and provide clearance for machines storage.
- A 36 inches wide door that swings out, not into the room.
- Reinforced hot and cold water outlets shall be provided with institutional grade hardware and shall be mounted not less than 24 inches above a floor type basin. Basin curb should be 8 inches minimum above the floor.
- A minimum of 5feet x 2 feet open area to allow for the vacuum unit storage.

- A grounded 20 Amp. Duplex outlet in open wall space, not behind shelves, for recharging battery operated equipment. A minimum of three GFI duplex electrical outlets shall be provided.
- Floor drains for the closet, all floors sloped to drain at a minimum ¼ inch per foot to the drain.

Location of custodian closets is very important. They should be centrally located with multiple closets as needed so that no area in a building is more than 150 feet in walking distance from a "wet" closet. Each closet should not serve in excess of 15,000 square feet.

Buildings should have custodian closets on every floor. Good locations for secondary custodian closets are:

- Close to elevators
- Close to main pedestrian areas
- Between two restrooms

It is considered poor planning to locate a custodian closet:

- At the dead end of a corridor. A situation such as this results in many unnecessary steps for the custodian.
- On a stair landing. A stair-landing closet would cause the custodian to always carry utensils and equipment up and down stairs.
- Inside another room (unless that closet serves only that room).
- Under stairs. Low ceilings and narrow dimensions are hard to ventilate.
- In narrow spaces. The custodian must move his equipment into the hall to utilize a narrow room. Square shaped closets are most efficient.

VERTICAL TRANSPORTATION

- There should be an elevator in every multi-storied building.
- The elevator should land on every floor including the basement.
- The elevator should be available to custodian and maintenance personnel.

LARGE STORAGE ROOMS

- Every large building should have a storeroom for custodian equipment, bulk supplies and custodian lockers. Buildings larger than 150,000 sq.ft. should contain two such rooms. Storage areas should be designed specifically for custodian storage, not for dual usage. Planning should be done in consultation with those who will be responsible for maintaining the building.
- Locking cabinets should be provided for supplies.
- Dock or elevator facilities must be provided.
- Doors should be no less than 36 inches wide and open out. Storage areas should contain a minimum of 144 square feet. 12 feet x 12 feet are good dimensions.

RECYCLING AND SOLID WASTE DISPOSAL

Northern Arizona University Maintenance is responsible for disposal of the solid waste collected by custodial staff. Custodians throw all of the material into a co-mingled dumpster for physical removal by truck and separation by hand for reclamation and disposal. As a matter of practice, recycling is collected separately from wet waste by the custodians, but the disposal is by the same method. No special waste management rooms or areas are required for gathering or sorting materials.

The design of areas adjacent to the source of recyclable waste generation shall include additional space for collection of recyclable materials as follows:

- Copy Rooms: Paper from copy rooms: 24 inches deep x 22 inches wide minimum
- Common Areas: Newspaper collection bins: 24 inches deep x 22 inches wide minimum
- Vending Areas: Aluminum collection bins: 22 inches deep x 12 inches wide minimum
- Restrooms, break rooms, lounges, and vending areas: Wet waste collection bins: 24 inches deep x 22 inches wide minimum

SUMMARY

Proper custodian closets carefully planned and sized storage rooms or custodial supplies, and consideration of solid waste and recyclables collection and disposal requirements are prime ingredients in any efficient housekeeping program.

11. LEARNING SPACES PLANNING AND DESIGNING

REFER TO "Northern Arizona University Guidelines for Planning and Designing Learning Spaces", Report to the Provost, From the Provost's Academic Computing Advisory Committee, dated June 2008.

The full report is posted on the Capital Assets and Services website at the following link: (Post link here when posted)

12. LABORATORY PLANNING AND DESIGN

Pending Issuance

13. KEYLESS ACESS AND SECURITY

Pending Issuance