3.0 DFCM REQUIREMENTS

3.2 CIVIL

DFCM DESIGN MANUAL
UNIVERSITY OF UTAH SUPPLEMENT

January 15, 2016
ADDED:

This supplement to the DFCM Manual for civil engineering is intended to acquaint architects and/or engineers working on University projects with standards and requirements of the University with regards to civil engineering related items.

ADDED:

REVISIONS SUMMARY
for the University of Utah Supplement:

<table>
<thead>
<tr>
<th>REVISION DATE</th>
<th>LOCATION</th>
<th>SUMMARY OF CHANGE</th>
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<tbody>
<tr>
<td>1 November 2014</td>
<td>3.2 / E. / (1), (2), (3)</td>
<td>Storm Water Management Plan  New requirements</td>
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<td>1 November 2014</td>
<td>3.2 / Civil / B. (5)</td>
<td>Digging Permits  Removed requirements</td>
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<tr>
<td>1 May 2014</td>
<td>3.2 / Civil / E. / (1)</td>
<td>Truck Tire Wash Down  Added detail to truck tire wash down</td>
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<td>3.2 / Civil / A. Paving / (3) / a.</td>
<td>Sidewalk Requirements on Campus  Added requirement for Dowels</td>
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<td>1 November 2013</td>
<td>3.2 / Civil / C. / (3) / a.</td>
<td>Soils Reports for U projects  Removed Sub-Paragraph “a.”</td>
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<td>21 September 2012</td>
<td>3.2 / A. / (3) / a.</td>
<td>Sidewalk Requirements  Added campus sidewalk requirements</td>
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<td>3.2 / L. / (3) / a.</td>
<td>Trace Wire, Warning Tape, Sand Cover  Trace wire elevated 8” over buried pipe, added requirements for warning</td>
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<tr>
<td>Date</td>
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<td>21 September 2012</td>
<td>3.2 L. (4)/p.</td>
<td><strong>Storm Drain Camera Inspection</strong> Added requirements for camera inspection when system test fails</td>
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<tr>
<td>21 September 2012</td>
<td>3.2 L. (5)/g.</td>
<td><strong>Sanitary Sewer Air Test &amp; Camera Inspection</strong> Added requirements for air test between manholes, and provide camera inspection if leaking</td>
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<tr>
<td>21 September 2012</td>
<td>3.2 L. (6)/h. /7</td>
<td><strong>Domestic Water Valves Below Grade</strong> Added operator extensions for valves over 5 feet deep</td>
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<tr>
<td>27 February 2012</td>
<td>- - -</td>
<td><strong>Entire Civil Section</strong> The civil section was re-written</td>
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<tr>
<td>27 February 2012</td>
<td>- - -</td>
<td><strong>3.2 Civil Detail Drawings</strong> All civil detail drawings were removed (the re-written civil section relies on AWPA for drawing details)</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>University Design Standards</strong> The former University Design Standards Chapters 1 through 12 were reformatted and re-issued as the U of U Supplement to the DFCM Design Manual.</td>
</tr>
<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>Campus Design &amp; Construction</strong> CD&amp;C has changed to <em>Construction Project Delivery</em> and is shown as <em>Construction Project Delivery</em> or <em>Facilities Management</em> in this document.</td>
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<tr>
<td>06 January 2012</td>
<td>- - -</td>
<td><strong>Plant Operations</strong> Plant Operations has changed to <em>Facility Operations</em></td>
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<tr>
<td>10 December 2009</td>
<td>3.2 C. (2)</td>
<td><strong>Soils Report</strong> Soils report shall include information required by code</td>
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<td>10 December 2009</td>
<td>3.2 G. (8)</td>
<td><strong>Site Grading</strong> Added ADA requirements to site grading</td>
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<tr>
<td>10 December 2009</td>
<td>3.2 H. (4)/b.</td>
<td><strong>Structural Fill &amp; Compaction</strong> Added code, review, and special inspector requirements</td>
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<td>10 December 2009</td>
<td>- - -</td>
<td><strong>Concrete Flat Work</strong> Expansion joints limited to ½” wide (<em>this was deleted in the 6 January 2012 Civil re-write</em>)</td>
</tr>
<tr>
<td>10 December 2009</td>
<td>3.2 L. (7)</td>
<td><strong>Natural Gas Systems</strong> Changed Mt. Fuel to Questar</td>
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### 3.0 DFCM REQUIREMENTS

#### 3.2 Civil

A. Paving

(3) **Concrete – curbs, gutters, sidewalks, exterior flatwork –**
Minimum 6” compacted base (96%) or minimum 4-3/4” crushed gravel.

**ADDED:**

a. **Sidewalk Requirements on the University of Utah Campus**

   (i) Campus sidewalks require extended width and added structural strength to handle heavy vehicular loads without damage. Due to the perimeter road system surrounding the University of Utah campus, campus sidewalks may be the only vehicular access to interior campus buildings and construction sites. All sidewalks on campus shall be designed in accordance with the requirements herein.

   (ii) Sidewalks on campus shall be 8’-0” wide (minimum). Central slab thickness shall be 6” thick, and grow to 8” thick at both edges. The width of the thicker edge on each side of the sidewalk shall not be less than 6”. Six inches from the sidewalk edge, the 8” thick concrete shall taper approximately 45° from 8” to the 6” central slab thickness.

   (iii) All concrete sidewalk slabs shall be doweled to adjacent slabs with rebar dowels at expansion joints or any break in the pour. Dowels are to be evenly spaced with maximum distance between dowels not to exceed 24”. Rebar dowels must be #4 or larger at least 24” long. Dowels must be embedded at least 3” deep and no closer than 6” from the edge of the slab.

   (iv) Require the Contractor to provide 6” compacted road base (untreated) under the central slab, tapering down to match the thickening concrete, to maintain a continuous 6” compacted road base under the full width of the sidewalk.

   (v) Backfill for campus sidewalks shall be specified to be laid and compacted in lifts to meet the requirements described in 3.2 CIVIL / H. STRUCTURAL EXCAVATION, BACKFILL, AND COMPACTION / (4) COMPACTION STANDARDS / a. / 2).
Compaction testing shall be specified to meet the test schedule for sidewalks described in 3.2 Civil / H. Structural Excavation, Backfill, and Compaction / (4) Compaction Standards / b. Compaction Testing / 5) Compaction Test Schedule / c).

All sidewalks shall include polypropylene multifilament fiber reinforcement. Additionally, concrete materials are to comply with 3.4 Structural / B. U of U Requirements / (3) Material Strengths and Construction Requirements / a. Concrete / 1), with minimum compressive strength no less than the table value provided for “All Other Site Cast Concrete.”

Sidewalk control joints shall be specified or drawn at 5'-0” O.C., and shall be a ¼” score, 1/4th the depth of the slab. For walking surfaces along accessible paths of travel, control joints shall be in accordance with the requirements found in 3.4 Structural / B. U of U Requirements / (3) Material Strengths and Construction Requirements / a. Concrete / 1) / h).

Sidewalk expansion joints shall be specified or drawn at 20'-0” O.C. maximum, and shall be dimensioned and tooled in accordance with 3.4 Structural / B. U of U Requirements / (3) Material Strengths and Construction Requirements / a. Concrete / 1) / h). The expansion joint shall include asphalt impregnated fiber expansion material. Direct the Contractor to use bond breaker tape with polyurethane joint sealant to a depth of 3/8”.

Require the Contractor to finish the concrete sidewalk with a tooled 1” edge above grade, and broom surface finish.

**ADDED:**

**B. Civil Design Requirements for University of Utah Projects**

1. **Design Resources**

   The A/E is to refer to all specific program requirements, soils reports, master plan, and any other applicable guidelines in designing building and site improvements.

2. **Apply APWA Standards**

   The most recently published version of the American Public Works Association (“APWA”) Standard Specifications and APWA Standard Plans, as currently adopted by the APWA Utah Chapter, are to be used for the design and construction of all University of Utah Projects. **Note:** While the APWA standards are to be closely followed, this University supplement contains additional or alternative requirements which must be included in the A/E’s design. In the event of conflict, the DFCM Design Manual and this supplement will govern.
Site Plan

a. Site plans shall be drawn at a scale of 1"=20' or larger.

b. Site grading and drainage shall be designed by a qualified civil engineer, licensed by the State of Utah for such work. The engineer's stamp and dated signature shall appear on each site drawing.

c. Provide the location and elevation of the intended construction bench mark. Assumed floor elevations are not sufficient. Location of campus monuments and their elevations can be obtained from Facilities Management / Land Surveyor through the University Project Manager.

d. Provide both existing and proposed contours with spot elevations. Contours are to extend at least 10' beyond the contract limit line. Spot elevations are to be indicated numerous and frequently.

e. Identify all existing conditions.

f. Identify existing and new utilities.

g. Site Utilities Plan

1) The site utilities plan shall be drawn at a scale of 1"=20" or larger.

2) Site utilities design shall be by a qualified professional engineer, licensed by the State of Utah for the work.

3) Existing utility locations and bury depth shall be provided.

4) Location of new utilities shall be shown with horizontal dimensional ties to landmarks for installation.

5) Profiles shall be provided for sanitary sewer and storm drainage lines (scale 1"=5' vertical and 1"=20' horizontal).

6) For roadways, provide profiles at top back of curb for each side of the roadway (plan scale 1"=20', profile scale 1"=5' vertical and 1"=20' horizontal). Provide stationing at 50.0' maximum with spot elevations at both TBC's and at centerline.

7) All domestic water mains 500 feet or more in length will require a plan review by DEQ (Department of Environmental Quality) Drinking Water Division.
(4) Storm Water Runoff

a. The hydrology associated with new construction projects must mirror predevelopment hydrology of the previously undeveloped site; or, the design must improve the hydrology of a redeveloped site and reduce the discharge of storm water.

b. Specific requirements are described below in 3.2. / L. Site Utilities / (4) Storm Drainage.

(5) Traffic Management Plan

Traffic control is a major concern on campus. Consult with Facilities Management through the University Project Manager to identify procedures to be used in a traffic management plan for the project. The approved plan should be detailed for the Contractor and included as part of the project documents.

(8) Testing

a. Provide a comprehensive testing and inspection schedule, and include details for every test and inspection required on the project (i.e., soils, subgrade, base course, asphalt, concrete, etc.).

b. Include details for the type of each test, its location, and frequency.

c. A separate contract for a testing firm will be arranged by the University Project Manager.

1) Testing services will be requested by the Contractor with payments to the testing firm by the University.

2) Specify that the University will pay for the first test, and any additional test due to test failure shall be paid for by the Contractor.

d. Note: Compaction testing standards are provided below (see H. / 4. Compaction Standards / c. Compaction Testing).

C. Soils Reports for University Projects

(1) All new building, parking or roadway projects shall include soils investigations performed by a professional soils engineering firm qualified and licensed for such work.

a. The A/E shall provide the soils engineering firm with the following items:

1) A preliminary site plan showing new improvement locations with finish floor and finish grade elevations.
2) A general description of the type of structure or facility to be constructed.

3) Pavement locations and instructions for any needed pavement sections.

4) Specific areas where potential infiltration would suggest permeability testing, with specific testing locations and associated depths.

(2) The soils engineering firm shall provide a report of its investigative findings, and shall include all information required by State adopted codes.

a. The report shall contain an evaluation of on-site soils and their suitability for use in construction of the building or other improvements.

1) All on-site material shall be recycled to the greatest extent possible to limit import/export and meet the University’s sustainability goals.

2) The report shall prioritize the use of onsite soils and any soil amendments to reduce import/export.

3) The report shall include recommendations for the modification of non-acceptable soils for reuse on site.

4) The report shall indicate appropriate locations where on-site soils can be used (i.e., trench backfill, etc.).

b. The report shall indicate soil suitability for storm water infiltration and include infiltration rates and recommended methods, if requested, based on permeability testing.

c. The report should contain recommendations for at least one foundation system and describe precautions to be taken for special problems such as expansive soils, collapsible soils, etc.

d. Special attention is to be given to the possibility of expansive soil conditions.

e. In roadway or parking lot areas, the report shall contain recommendations for roadway and parking lot cross sections including asphalt or concrete thickness and thickness of accompanying road base.

1) Pay particular attention to areas where the asphalt or concrete paved surface will be subject to heavy loads. The pavement section may require special design to ensure long use with minimal maintenance. Consult with Facilities Management through the University Project Manager to determine where heavy use design will apply.
f. As an alternate for University consideration, the report shall include at least one pavement section that incorporates rubberized asphalt (at a minimum as a top layer), or pervious (gap graded) asphalt or concrete. The A/E will consult with Facilities Management through the University Project Manager about the possibility of including at least one section as an alternate bid item in the bidding documents. Options might include pervious concrete, 4” asphalt over 8” road base, pervious concrete over 18” gravel, etc.

g. The report shall have a specific section addressing site specific sustainability recommendations to support the University’s sustainability goals and climate change concerns.

(3) The A/E shall modify project plans and specifications appropriately to incorporate the soils engineering firm's recommendations.

D. Surveying on University Projects

(1) Licensed Professional Surveyor

All surveying on campus projects shall be performed by a professional surveying firm qualified for such work and licensed by the State of Utah.

(2) Code Compliance

Surveyors working on campus shall comply with all pertinent surveying codes, regulations, methods and procedures.

(3) Coordinate System

All surveying will be accomplished, and all subsequent drawings will be produced using the following coordinate system (no exceptions):

a. Horizontal: NAD 1983 UTM Zone 12N Feet

b. Vertical: NAVD 1988 Feet

(4) Accuracy

Horizontal accuracy shall be 1:15,000 minimum.

(5) Control Reference Marks

a. The surveyor shall furnish and install reference marks set in concrete or mortar in sufficient number and durability to assure the perpetuation or easy replacement of any survey point, monument or line. Any monuments to be disturbed during construction shall be referenced in
such a manner as to facilitate re-monumentation by the project surveyor at completion of the project.

1) Identify the land surveyor who supervised the setting of reference marks with the land surveyor's license number on all survey monuments set and on the title page of all survey field notes.

2) Require the protection of all bench marks and existing survey work from damage or displacement. Specify requirements for maintaining or replacing survey monuments.

(6) Field Notes and Drawings

a. Submit a good (readable) copy of all survey field notes, raw data, basis of bearing, and drawings in digital format to Facilities Management, particularly Facilities Business Services/Geographic Information Systems, through the University Project Manager as follows:

1) Before Construction

Include any point, monument or line which will be destroyed or disturbed during construction.

2) After Construction

Include all survey field notes, raw data, basis of bearing, and drawings.

(7) Surveyors Working on Campus

a. The University will not provide design surveying. The University will provide horizontal and vertical control information to surveying firms providing design and construction surveying.

b. Requests for information should be made to Facilities Management/Professional Land Surveyor through the University Project Manager.

c. Surveyors intending to do work on campus must contact the University Land Surveyor prior to beginning work. Contact information is provided at the Facilities Management / Facilities Business Services / Land Surveying web site.

d. Submittals shall be AutoCAD Civil 3D (latest version, verified to be compatible with University requirements), and shall be submitted to the University Land Surveyor in digital format.

e. Required Surveyor’s Materials on University Surveys:

1) Survey grade GPS equipment or Total Station.
2) Biodegradable flagging with a life span of 6 months to 2 years.

3) Florescent spray paint, water based, which has a life span of 2 months.

4) Data form and format easily translated into the University’s database.

E. Storm Water Management Plan

(1) General Requirements

a. An approved Storm Water Pollution Prevention Plan (SWPPP) for projects 1 acre or larger will be required prior to obtaining a digging permit.

b. Direct the Contractor to submit the SWPPP to the University Construction Project Delivery Project Manager and the Environmental Health and Safety Department for review.

(2) Maintenance and Escalation of Best Management Practices

The density of developed area and close proximity of impervious surfaces requires proactive storm water protection at the University of Utah. Impermeable surfaces adjacent to construction sites are to be kept free of sediment and construction site debris. The University requires all contractors to ensure that these potential pollutants be controlled to the “Maximum Extent Practicable” (MEP) as defined by the Federal Clean Water Act (CWA) part 402(p)(3)(B)(iii). In situations where the installation of a Best Management Practice (BMP) has proven ineffective (two or more corrective actions issued) the University of Utah will require alternate BMPs.

(3) Long Term Storm Water Controls

The design team must complete the University's Utah Pollution Discharge Elimination System submittal form for Long Term Storm Water control compliance. Describe why the specific long-term storm water controls were selected, the pollutant removal expected from the selected controls and the technical basis that supports the performance claims for the selected controls. For a copy of this form, please see the forms section on the University's Documents and Standards web page.

(4) Job-Site Cleanup Responsibilities

a. Specifications shall identify daily, weekly, and job completion cleanup responsibilities for the removal of garbage, rubbish and unused materials.

1) Require the Contractor to coordinate daily cleanup operations in areas of the jobsite which may be affected by surrounding University activity. Construction activities shall be coordinated
with the University Project Manager to reduce congestion and limit interruption of University traffic, operations, graduation ceremonies, etc.

2) Facilities Management approval, through the University Project Manager, must be included in the final project cleanup process.

F. Erosion Control

(1) Erosion Sensitive Areas

Avoid disturbing areas of high erosion susceptibility, sensitive vegetation areas, and areas with steep slopes.

(2) Steep Slope Control Measures

Provide special erosion control measures on slopes greater than the angle of repose necessary for natural erosion control. Coordinate erosion control measures with the soils engineer.

(3) Erosion Control Plan

a. Create an erosion control and sedimentation plan for all construction activities associated with the entire project site. The plan must incorporate practices for stock piling of top soil for reuse, seeding, grading, mulching, filter socks, stabilized site entrances, protection of drain inlets, preservation of existing vegetation, and any other ‘best management practices’ (“BMP”) needed to control site erosion and sedimentation from storm water runoff.

b. The plan must include a drawing and a complete description of the BMPs that will be implemented to prevent erosion at the site and control sedimentation in storm water runoff. A menu of sample erosion and sediment control BMPs can be found at the EPA’s National Pollutant Discharge Elimination System / National Menu of Storm Water Best Management Practices web site: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

G. Site Grading

(1) Existing Site Utilities

Require the Contractor to locate and protect all existing utilities. Require the Contractor to contact Facilities Management through the University Project Manager to assist in locating campus utilities at the site, and Blue Stakes for other utilities (see the Facilities Management / Construction Processes web site for contact information).
(2) Existing Objects to Remain

Specify that all bench marks, structures, fences, roads, sidewalks, utilities, trees, shrubs, lawns, paving and curbs which are to remain are to be protected. Above or below grade utilities which are to remain are to be located and safeguarded by the Contractor. The Contractor must repair any damage his work causes.

(3) Existing Objects to be removed

a. Require the removal of existing objects, not designated to remain, down to the subgrade. Direct the Contractor to remove designated objects and material from the construction site and University property in a neat, orderly and legal manner.

b. Re-usable top soil should be stripped and stored as directed by the University Project Manager for later use.

c. Materials, objects, excavation export, garbage, residue, etc., which contain hazardous or regulated waste must be properly transported and disposed in accordance with the laws of the State of Utah.

d. On-site burning is not permitted.

(4) Unforeseen Conditions

Upon discovery of unknown utilities or concealed conditions, instruct the Contractor to discontinue work which would affect the utility or concealed condition, and immediately notify both the A/E and the University Project Manager.

(5) Rock Removal

a. Explosives are not to be used without approval from Facilities Management. Any perceived need to use explosives will require extensive review in advance, and must not be organized without written approval from the University Project Manager. If approved, allow ample time for University notices and preparation.

b. Rock/cobbles up to 30-inches in diameter are considered ordinary earthwork. When unexpected rock removal is required, direct the Contractor to notify both the A/E and the University Project Manager.

(6) Re-Use of On-Site Materials

Site grading shall balance on-site material, and import/export shall be minimized to the greatest extent possible. Every effort shall be made to reuse all existing on-site materials, whether native or demolished.

(7) Grading for Storm Water Runoff
Grading shall direct storm water runoff to pervious surfaces and landscaped areas prior to capture in a formal drainage system/structure. The intent is to slow the time of concentration, reduce runoff, improve water quality, and provide supplemental landscape irrigation. See G. / (9) / e. Landscaping Areas below.

(8) Accessible Paths of Travel

Where finish surfaces are to accommodate wheel chair accessible paths of travel, ADA slopes and requirements must be met.

(9) Basic Grading Requirements

a. Finish Floor Elevations

Establish finish floor elevations 6" above the finish grade adjacent to the building.

b. Grade Away from Building

Provide 2% minimum positive grade away from the building for at least 12’.

c. Asphalt Surfaces

1) In general, 2% minimum grade is desired, 1% grade is the absolute minimum.

2) For parking lots, do not exceed 6% maximum grade.

3) For roadways, do not exceed 10% maximum grade except as approved by Facilities Management through the University Project Manager.

4) Asphalt surfaces are not to be used as gutters, or used as channel paths for water unless specifically approved by Facilities Management through the University Project Manager.

5) As an alternate for University consideration, the A/E’s design shall include at least one asphalt pavement section that incorporates rubberized asphalt (at a minimum as a top layer), or pervious (gap graded) asphalt, or pervious concrete. The A/E will consult with Facilities Management through the University Project Manager about the possibility of including at least one section as an alternate bid item in the bidding documents.

d. Concrete Surfaces

1) In general, 1% minimum grade is desired, 0.5% grade is the absolute minimum.

2) For parking lots, do not exceed 6% maximum grade.
3) For roadways, do not exceed 10% maximum grade except as approved by Facilities Management through the University Project Manager.

4) As an alternate for University consideration, the A/E’s design shall include at least one concrete pavement section that incorporates pervious concrete. The A/E will consult with Facilities Management through the University Project Manager about the possibility of including at least one section as an alternate bid item in the bidding documents. Options might include concrete pavers, etc.

e. Landscaping Areas

1) In general, 2% minimum grade is desired, 1.0% grade is the absolute minimum.

2) Do not exceed 3’ horizontal to 1’ vertical maximum slope except as approved by Facilities Management through the University Project Manager.

3) The A/E’s design shall minimize paved and impervious surfaces, and maximize the use of landscape except for functional requirements.

4) The site grading design shall closely coordinate with the site storm water systems. The A/E shall look for and employ site opportunities to maximize water quality and minimize the quantity of storm water leaving project site.

5) The site grading and landscape design shall reduce the amount of directly connected impervious surfaces, and shall create micro detention and bio retention (bioswale) areas intended to improve water quality and slow the time of concentration.

6) As part of the A/E’s design, the 10 year 2 hour storm shall be retained on site (see L. / (4) Storm Drainage below).

H. Structural Excavation, Backfill, and Compaction

(1) Special Attention Required

a. Structural excavation and backfill is a topic of major concern to the University, and should be given special attention in the preparation of bidding documents.

b. To the greatest degree possible, on-site materials are to be evaluated for suitability as structural backfill. The University desires to use on-site
materials to the greatest degree possible as long as there is no loss of quality or stability.

c. The A/E should carefully define minimum acceptable standards for structural backfill, and quantify on-site sources of acceptable material.

d. Minimize the potential for change order cost issues by including material unit prices on the bid form. These unit cost items should be clearly described in the measurement and payment section of the specifications. Coordinate unit pricing and alternate pricing schemes with Facilities Management through the University Project Manager during design.

(2) Alternate Storage Site

Specify that any excavated soil identified for use as backfill is to be stored at the project site. Where this is not feasible, an alternate temporary storage site should be arranged with Facilities Management through the University Project Manager. Such storage must be discussed and arranged with Facilities Management early in the design process.

(3) Soil Not Usable as Backfill

Direct the Contractor to remove and legally disposed of any excavated soil not identified for use as backfill. There will be no permanent dumping on University property unless so directed by the University Project Manager.

(4) Compaction Standards

a. Specify that backfill shall be properly laid and compacted in lifts to the following standards. Where specific compaction recommendations are included in the soils report for the project, the soils report recommendations shall be followed in lieu of the following standards.

1) In lawn and landscaped areas: 85% of maximum dry density, 12-inch layers.

2) In sidewalks, roads, parking areas or under buildings: 95% maximum dry density, 8-inch layers.

b. Compaction testing shall be required. Coordinate the need for anticipated testing with the University Project Manager who will arrange a contract for the services of an independent testing firm.

1) The A/E shall include testing requirements for the Contractor and the testing firm in the project specifications. Duties of the University’s testing firm should also be made a part of the specifications.

2) Specifications shall indicate the testing frequency and type.
3) Include in the specifications, “Failure of Facilities Management or the A/E to detect defective work or material does not prevent later rejection of the work, nor obligate the A/E for final acceptance when such defective work or material is discovered.”

4) Include in the specifications a list of informational items required for submittal.

5) A test schedule shall be included in the specifications.
   a) Curb and gutter with grade less than 0.5%: One random test per lift per 200 lineal feet.
   b) Curb and gutter with grade greater than 0.5%: One random test per lift per 400 lineal feet.
   c) Sidewalk: One random test per lift per 400 lineal feet.
   d) Trenches: One random test per lift per 200 lineal feet.
   e) Roadways: One random test per lift per 1000 square yards.
   f) Landscape Areas: No specific requirements.

6) Cooperate with the testing firm hired for compaction testing. Note: The first test will be provided by the University, but any retesting due to test failure will be at the Contractor's expense.

I. Soil Stabilization

(1) Slope Standards
   a. Soil stabilization is a particular concern on University projects and will require special attention. Review all areas of concern with Facilities Management through the University Project Manager during design and well before the project is released for bidding.
   b. Slopes steeper than 3:1 are only to be used when no other option is available and only with prior approval from Facilities Management through the University Project Manager.
   c. When slopes steeper than 3:1 are unavoidable, require seeded slopes or blanket type slope protection.

(2) Soils Engineering

The A/E shall include soil type and classification in the design. Soil that is susceptible to slippage shall be properly engineered to prevent movement. Materials that are loose, wet, soft, or frozen will require special attention.
J. Dewatering and Drainage Control

(1) The A/E shall consider possible needs for dewatering and drainage control. When needed, include mitigation measures in the design to prevent erosion (i.e., seeding, landscaping, etc.).

(2) Any dewatering system design shall be submitted to the University Project Manager for review and approval by Facilities Management. Dispose site water to an existing underground gravity flow system that is approved by Facilities Management.

(3) Dewatering systems should be of the gravity underground type, but may be pumped or flow overland if prior approved by Facilities Management through the University Project Manager.

(4) Require that all dewatering systems be maintained and operated by the Contractor during the entire construction of the project. The system is not to be shut down or interrupted without Facilities Management approval.

(5) Sub-Drainage Systems

a. Approved sub-drainage systems are traditional building perimeter foundation and under floor drainage networks with gravity outfall systems.

b. Containment sub-drainage systems shall not be used (i.e., sumps, pits, detention, or other containment systems) without prior approval of Facilities Management through the University Project Manager.

K. Underground Utility Conflicts

(1) Crossing Limits

a. Where piping systems (i.e., sewer, water, irrigation, drainage, chilled water, etc.) must unavoidably cross structures (i.e., footings, walls, concrete ducts, tunnels, etc.) that are more than 4 feet wide and 5 or more feet deep; and, where direct access to the piping is limited and will not comply with OSHA trench standards, design the crossing with either a casing pipe that extends a minimum of five (5) feet beyond the structure, or require a 20 foot (minimum) section of ductile iron pipe.

b. See 3.8 HVAC for special requirements at buried HTW crossings.

(2) New Above Grade Structures

a. Any new above grade structure which will be located over any existing utility will require one of the following design options:

1) Relocate all utilities.
2) Design a tunnel, chase way, pipe sleeve, or other suitable access for any utility being crossed by, or in the “near vicinity” of footings, retaining walls, staircases, or other concrete structures 8” thick or greater. “Near vicinity” means a lateral distance 1 ½ times the depth of the utility, from each side of the pipe or conduit. This will allow for excavations to comply with OSHA trench standards and eliminate the need for costly concrete demolition and replacement during utility failures. The chosen access must extend a minimum of 2’ past each side of the concrete structure.

3) Use an alternative design approved by the Design Standards Committee.

L. Site Utilities for Campus Projects

(1) Available Utility Information

a. Facilities Management will provide any available utility information for the project upon request.

b. The project A/E shall evaluate the utility information available against the project needs.

1) If exact elevations and locations are needed but not available from Facilities Management; and, if this information is deemed necessary for the design of the project, the A/E shall request an excavation to expose the utility. The University will excavate and expose each requested utility (except the high temperature water system) and perform necessary surveys to obtain the information requested. Requests for this special information are to be made to Facilities Management through the University Project Manager. Requested information will be provided only upon request. If no request is received, the University will assume that the A/E has adequate information for the design.

(2) Utility Layout, Capacity, Connection Points

a. Coordinate with Facilities Management through the University Project Manager concerning utility connection points, capacities, crossings, etc.

1) Computer models of campus utility systems shall be used to evaluate the impact of new systems on existing pipe sizes and capacities.

2) The proposed system layout shall be optimized by model analysis.

3) Submit the proposed system layout with a complete report, including calculations, to the University Project Manager for
Facilities Management review. The A/E is responsible for the accuracy of the submittal and subsequent design. University approval of the submittal shall not be considered a verification of the data, nor verification of the workability of the proposed design.

(3) Trace Wire, Warning Tape, Sand Cover Over Pipe

a. **All underground conduit and pipe 4” diameter and larger shall be installed with an 18 gage continuous copper wire 8” over the pipe to serve as trace wire.**

   1) **Plastic Pipe**

      Whenever plastic pipe is used, direct the Contractor to install 2 feet of sand over the pipe and include a yellow warning tape with the trace wire at 8” over the pipe.

   2) **Buried Natural Gas Pipe**

      For buried natural gas piping, in addition to the trace wire described above, natural gas lines shall be installed with 2 feet of sand covering the pipe, and yellow warning tape 8” over the sand layer routed along the entire length of the pipe.

b. Direct the Contractor to test and verify continuity of trace wire at the terminal end points prior to backfill. Also direct the Contractor to verify continuity again after backfill using the installed termination end points.

c. The A/E shall show the location for each trace wire termination end point on the drawings.

   1) Each trace wire is to be terminated in the interior of an irrigation valve box or manhole. If no suitable box or manhole exists at the termination point, instruct the Contractor to install an irrigation valve box for the trace wire.

   2) Where underground pipe penetrates the building, the trace wire shall be terminated and secured in a box or manhole at the building exterior over the pipe penetration.

   3) Instruct the Contractor to complete each termination with a screwed connection to the side of the box or manhole, conveniently located for easy access. Excess wire may be coiled in place beyond the screwed attachment.

   4) As-built drawings shall show the actual location of each trace wire termination box or manhole, and note the pipe or conduit it serves.
(4) Storm Drainage

a. Engineer Qualifications

Storm drainage design shall be performed by a qualified civil engineer, licensed to perform such work by the State of Utah.

b. BMP and Pollutant Calculations

The design shall incorporate both water quality and water quantity best management practices (BMP) and pollutant concentration calculations.

c. Submit Design Calculations and Drawings

Storm drainage calculations and drawings are to be submitted to the University Project Manager for review and approval. The submittal shall include the engineer's stamp and dated signature.

d. Storm Runoff Design Criteria

1) Provide on-site detention of storm water runoff to detain the 100 year, 24 hour storm, with 0.20 CFS/Acre run-off rate. Show calculations for detention volume requirement.

2) Provide on-site retainage for a 10 year 2 hour storm.

a) If a 10 year 2 hour storm cannot be retained on the project site, design a modification to the University’s storm water system which will accommodate an equivalent retention of the 10 year 2 hour storm. The modification could include bio retention (bioswale), pervious pavement, etc.

e. Piping Connections

Coordinate all connections to the University storm drainage system with Facilities Management through the University Project Manager.

f. Concrete Pipe

Gravity flow storm drainage systems shall be reinforced concrete or non-reinforced concrete pipe as specified by the A/E and approved by Facilities Management through the University Project Manager. Non-reinforced concrete pipe shall only be used where load requirements permit.

g. Minimum Pipe Size

Minimum pipe size for storm drainage lines shall be 12" diameter.
h. Minimum Slope

Minimum slope for storm drainage lines shall be 0.5%.

i. Manhole or Cleanout Spacing

Maximum distance between manholes or cleanouts shall not be greater than 300 feet.

j. Changes in Direction and Lateral Tie-In's

Manholes, catch basins or cleanouts shall be provided at every change in direction and every lateral tie-in point.

k. Minimum Pipe Cover

Minimum allowable cover over the top of pipe shall be 3'-0" to grade. Facilities Management through the University Project Manager shall be consulted if minimum cover is not achievable. Special design considerations will be required when minimum cover is not maintained.

l. Limit Impervious Surfaces

Every effort shall be made to minimize and disconnect impervious surfaces, slow the time of concentration, and improve water quality through the use of micro detention, bio retention (bioswale), etc. Convey runoff in surface conveyances to the greatest extent possible.

m. Roof Runoff Capture

The A/E’s design shall include an evaluation of an option to capture the roof runoff for beneficial reuse (either for outdoor landscaping or indoor toilet flushing) to reduce potable water use, slow the time of concentration, and reduce the size of storm drainage facilities.

n. No Direct Roof Drain Connections

No roof drains may be directly connected. All roof drains must drain to a pervious area or be captured for reuse.

o. Runoff First to Pervious Surfaces or Landscape

The A/E’s design shall direct the runoff onto pervious surfaces or landscaped areas prior to capture in a formal drainage system/structure to slow the time of concentration and increase water quality, and provide supplemental irrigation for landscaped areas.

p. Camera Inspection

If the new storm drainage piping system fails during testing, require a camera inspection to identify the location and extent of failure. Failed or
(5) Sanitary Sewer Piping

a. Salt Lake City Codes Apply

The University sanitary sewer system drains into Salt Lake City’s sanitary sewer system; therefore, codes applicable to that system must be followed. Consultation with Facilities Management through the University Project Manager is necessary before considering any change to the University’s sewer system.

b. Minimum Pipe Size

The minimum lateral size outside a building shall be 6" diameter. The minimum main size shall be 8" diameter.

c. Minimum Design Slope

The minimum design slope for a 6" lateral is 1.0%. The minimum design slope for an 8" main is 0.5%. The design for larger piping shall include 2.0 feet per second minimum velocity.

d. Manhole Spacing

The maximum distance between manholes shall not exceed 300 feet. Manholes shall be provided at every change of direction.

e. Minimum Pipe Cover

The minimum allowable cover over the top of pipe shall be 3'-0" to grade. Facilities Management through the University Project Manager shall be consulted if the minimum cover cannot be maintained.

f. Grease Interceptors

1) University buildings which will include food service facilities shall have a grease interceptor installed in the immediate location of that building.

2) Drawings shall clearly show the location and design of the grease interceptor. Prior to design, the proposed location of the grease interceptor shall be reviewed with Facilities Management through the University Project Manager.

g. Additional Testing Requirements

In addition to standard testing requirements, direct the Contractor to verify continuity of the piping with an air test between manholes. If the air test fails, require the Contractor to provide a camera inspection to damaged portions of the new piping system shall be excavated and repaired. Require repeat test(s) until the system is proved.
identify the leak. Failed or damaged portions of the new sewer line shall be excavated and repaired. Require the Contractor to provide air testing until the piping is proved air tight.

(6) Domestic Water

a. Source

The source of the University’s domestic water distribution system is Salt Lake City’s water supply system.

b. University Water Distribution System

The building water supply for each project shall be taken from the University water distribution system. Connections to the water system are to be coordinated with Facilities Management through the University Project Manager.

c. Fire Suppression Systems

Hydraulically calculated fire suppression systems shall include a water system computer analysis to provide water pressure information.

d. Minimum Pipe Size

Water lines that are part of the campus water distribution system or branches shall not be smaller than 8” in diameter. All lines supplying fire hydrants shall not be smaller than 6” in diameter.

e. Three Valves at Tees and Crosses

All tees, crosses and connections to water mains will have valves installed on all branches of the fittings.

f. Minimum Pipe Cover

Minimum allowable cover over the top of pipe shall be 3'-0" to grade.

g. System Design Pressure

1) All components of the water system shall be designed for a 200 psi working pressure.

2) Thrust blocks shall be designed to withstand the forces exerted by 200 psi working pressure utilizing 2,000 pounds per square foot soil bearing pressure, unless the soil conditions dictate less in the best judgment of the A/E.

3) Where soils engineering has been performed at the project site, the soil bearing pressure provided in the soils report shall be used.
h. Valves for Domestic Water

1) Approved Valve Types

Valves approved for use are gate, butterfly, ball, air and vacuum, pressure and check type. Review all proposed valves with Facilities Management through the University Project Manager for additional requirements.

2) Gate Valves

Gate valves shall be resilient wedge in accordance with AWWA C509-80. Valves 12" and smaller shall be bubble tight at 200 psi water working pressure. Include valve box and 2" nuts for buried locations.

3) Butterfly Valves

Butterfly valves shall be AWWA Specification C 504, Minimum Class 150B. Valve bodies shall be cast iron if exposed or in meter vaults. Provide with flanged end connections (125 pound ASA Standard) when buried; otherwise mechanical end connections. Valve disc shall be AWWA C504, Section 3.4. Valve shaft shall be AWWA C504, 18-8 type 304 Stainless Steel. Valve bearings shall be sleeve type, corrosion resistant, and self-lubricating. Testing shall be in accordance with AWWA C504, Section 13. Manual operators shall be AWWA C504.

4) Ball Valves

Ball valves shall be consolidated brass coupling, Conbraco Industries "Apollo" valves are approved, or prior approved equal.

5) Air and Vacuum Valves

Air and vacuum valves shall be DeZurik/APCO, Crispin-Multiplex, G-A Industries, or prior approved equal, and shall be capable of operating up to 300 psi. Drawings should show: (1) Weld-O-Let (for steel pipe only); (2) threaded pipe outlet; (3) corporation cock; (4) gate valve; (5) nipple; and, (6) vacuum and air release valve.

6) Pressure and Check Valves

Pressure valves and check valves should be hydraulically operated globe valves, single seat construction, with replaceable stainless steel seat ring and a reversible inner valve disc. The valves shall have fully supported diaphragm operators.
7) Operator Extensions

Any valve located more than 5 feet below grade shall be installed with a valve operator extension to allow operation from the surface with a 5 foot key.

i. Testing for the Domestic Water System

1) All water mains require testing at 200 psi for two hours in accordance with AWWA Standard C600-93. Each test shall be witnessed by the A/E’s professional engineer and the Facilities Management water distribution specialist.

2) All new water lines shall be chlorinated to 50 ppm or higher and remain in the piping system for a 24 hour period. After 24 hours of holding time, the heavily chlorinated water shall be flushed into a sanitary sewer (do not empty into a storm drain). The Salt Lake City Sewer Department must be contacted prior to discharge. Salt Lake City must be notified that highly chlorinated water is coming to them. Upon refilling the new domestic water system with clean potable water, two bacteriological samples, 24 hours apart, shall be analyzed. After the second sample comes back satisfactory, the system can be connected to the University’s water system. All work shall be inspected by the Facility Operations Plumbing Shop before being concealed or buried, and prior to start-up.

(7) Natural Gas Systems

a. Natural gas systems on campus are University owned. Extensions or connections shall be coordinated with Questar when applicable and Facilities Management through the University Project Manager.

b. During design, notify Questar of any intended construction activity on their main lines, and continue coordination with Questar as the design progresses toward construction.

c. Review all available documentation regarding each natural gas location affecting the project site with the University Project Manager.

d. Identify all actual locations of gas utilities, and clearly mark each system with associated appurtenances on bidding / construction documents.

e. See 3.2 Civil / L. Site Utilities for Campus Projects / (3) Trace Wire for trace wire, warning tape and sand coverage requirements.

End of 3.2 Civil