	STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES **Division of Facilities Construction and Management**	**DFCM**

Solicitation for Architect / Engineer Services

Value Based Selection Method

March 27, 2006

NEW CLASSROOM BUILDING AND CENTRAL CHILLED WATER PLANT

WEBER STATE UNIVERSITY

OGDEN, UTAH

DFCM Project No. 05027810

DFCM Form 3 052505

TABLE OF CONTENTS

Current copies of the following documents are hereby made part of this Solicitation for A/E Services by reference. These documents are available on the DFCM web site at http://dfcm.utah.gov or are available upon request from DFCM.

DFCM Design Manual dated May 25, 2005

DFCM General Conditions dated May 25, 2005

GRAMA Protected Information Form

Weber State University Design Standards
http://departments.weber.edu/facilities/docs/2004_08_a_e_guide_revision.pdf

Weber State University Humanities Building & Chiller Study program document:

- AJC Architects Humanities Building Program dated October 2005
- WHW Engineering Inc. Central Chilled Water Plant & Distribution Study dated October 20005
- GSH Geotechnical Consultants Soils Investigative Report dated October 2005

NOTICE TO ARCHITECTS / ENGINEERS

The State of Utah - Division of Facilities Construction and Management (DFCM) is soliciting the services of qualified firms/individuals to perform design services for the following project:

NEW CLASSROOM BUILDING AND CENTRAL CHILLED WATER PLANT
WEBER STATE UNIVERSITY - OGDEN, UTAH
DFCM PROJECT NO. 05027810

This project will involve the demolition of Buildings #1 and #2 to make way for a new Classroom Building. The size of the new building is 87,500 gross square feet (GSF) and will consist primarily of classrooms, computer labs, teaching spaces, and administration spaces. The second element of this project involves a new central chilled water plant utilizing a combination of two (2) new chillers and reusing/relocating two (2) existing chillers adjacent to the existing cooling tower facility which is immediately northeast of Stewart Stadium. Currently, two options have been identified for the new chiller plant. The design will need to conform to IBC 2006 which is anticipated to be adopted by the State in January 2007. The Fixed Limit of Construction Cost (FLCC) for this project is $21,022,500 in today's dollars.

The selection shall be under the Value Based Selection method. The Solicitation for A/E Services documents, including the submittal requirements and the selection criteria and schedule, will be available beginning on Monday, March 27, 2006 from DFCM, 4110 State Office Building, Salt Lake City, Utah 84114 and on the DFCM web site at http://dfcm.utah.gov. For questions regarding this solicitation, please contact Bill Bowen, DFCM, at (801) 538-3271. No others are to be contacted regarding this solicitation.

A **MANDATORY** pre-submittal meeting will be held at 10:00 AM on Friday, April 7, 2006 at the DFCM, 4110 State Office Bldg., Salt Lake City, UT 84114. All design firms wishing to submit on this project must attend this meeting.

Submittal dates for the required references, management plans, statements of qualifications, and interviews will be based on the Project Schedule included in the Solicitation for A/E Services.

The Division of Facilities Construction & Management reserves the right to reject any or all submittals or to waive any formality or technicality in any submittal in the interest of the State.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
MARLA WORKMAN, CONTRACT COORDINATOR
4110 State Office Bldg., Salt Lake City, Utah 84114

PROJECT DESCRIPTION

For complete project information, refer to the WSU Classroom Building & Chiller Plant Program, which includes the following documentation:
- **AJC Architects Humanities Building Program dated October 2005**
- **WHW Engineering Inc. Central Chilled Water Plant & Distribution Study dated October 20005**
- **GSH Geotechnical Consultants Soils Investigative Report dated October 2005**

New Classroom Building
This project will involve the demolition of Buildings #1 and #2 to make way for a new Classroom Building. The size of the new building is 87,500 gross square feet (GSF) and will consist primarily of classrooms, computer labs, teaching spaces, and administration spaces. The project is currently programmed at 31,137 GSF for administration spaces and 54,562 GSF for classrooms/computer labs.

New Central Chilled Water Plant
The second element of this project involves a new central chilled water plant utilizing a combination of two (2) new chillers and reusing/relocating two (2) existing chillers adjacent to the existing cooling tower facility which is immediately northeast of Stewart Stadium. Currently, two options have been identified for the new chiller plant.

Project Schedule
The overall proposed Project Schedule is as follows but is subject to change depending on availability of project funds.

• Design	May – December 2006
• Design Complete	December 2006
• Stamped/Approved Construction Documents	January 2007
• Start of Construction	March/April 2007
• Substantial Completion	July 2008
• Occupancy	August 2008

Design Services
The design will need to conform to IBC 2006 which is anticipated to be adopted by the State in January 2007. Basic Design Services should include the following:

- Program Verification
- Architectural
- Structural
- Mechanical
- Electrical
- Civil/ Landscape
- Acoustic
- Communications
- Interiors/ Signage
- FF&E
- Vertical Transport
- Coordination of all official reviews
- Other services deemed necessary to comply with the requirements the Project Program documents

Project Funding
Currently, the project has been funded for complete Design/CA Services and CM/GC Pre-construction Services. The project budget (FLCC) is advertised in today's dollars. However, recognizing that labor and material inflation and escalation have been creating a significant impact to project budgets, the State has accounted for a 9% inflation and escalation factor over the life of the project within this budget. It will be the contractual responsibility of all parties to work toward establishing a final GMP within this window and as close to the FLCC as possible. Thus, all fees should be established by the FLCC and will not be increased without a corresponding increase in scope from the original program documents.

PROCUREMENT PROCESS

The State of Utah intends to enter into an agreement with a firm to provide professional services as described.

The selection of the firm will be made using a Value Based Selection (VBS) system. The Project Schedule lists the important events, dates, times and locations of meetings and submittals. The terms of the project schedule are hereby incorporated by reference and must be met by the selected firm.

1. Solicitation for A/E Documents

The Solicitation for A/E Services documents consist of all of the documents listed in the Table of Contents and all said documents are incorporated in this solicitation by reference. The solicitation will be available at DFCM per the attached schedule and on the DFCM web site at http://dfcm.utah.gov.

2. Contact Information

Except as authorized by the DFCM Representative or as otherwise stated in the solicitation or the pre-submittal meeting, communication during the selection process shall be directed to the specified DFCM Representative. In order to maintain the fair and equitable treatment of everyone, A/Es shall not unduly contact or offer gifts or gratuities to DFCM, any Board officer, employee or agent of the State of Utah, users or selection committee members in an effort to influence the selection process or in a manner that gives the appearance of influencing the selection process. This prohibition applies before the solicitation is issued, as the project is developed, and extends through the award of an agreement. Failure to comply with this requirement may result in a disqualification in the selection process. A/Es should be aware that selection committee members will be required to certify that they have not been contacted by any of the A/Es in an attempt to influence the selection process.

3. Requests for Information

All requests for information regarding this project shall be in writing and directed to:

Bill Bowen, Program Director
Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114
E-mail: billbowen@utah.gov
Facsimile: (801) 538-3267

4. Project Schedule.

The Project Schedule lists the important events, dates, times, and locations of meetings and submittals that must be met by the A/E.

5. Mandatory Pre-Submittal Meeting

A mandatory pre-submittal meeting will be held on the date and time and at the location listed on the Project Schedule.

A representative from each interested prime firm is required to attend. During the meeting, a presentation will be made to describe the overall scope of work and intended schedule. Interested firms may ask questions and request clarification about the project and the procurement process.

Subconsultants are invited to attend this meeting but it is not mandatory for them.

THE PRIME FIRMS ABSENCE FROM THE PRE-SUBMITTAL MEETING AND/OR FAILURE TO REGISTER PRECLUDES PARTICIPATION AS A SUBMITTING FIRM ON THIS PROJECT.

6. Submittal Due Dates and Times

All required submittals must be delivered to, and be received by, the Division of Facilities Construction and Management previous to the date and time indicated in the Project Schedule. Submittals received after the specified time will not be accepted. Please allow adequate time for delivery. If using a courier service, the submitting firm is responsible for ensuring that delivery will be made directly to the required location. It is your responsibility to allow for the time needed to park on Capitol Hill as recent construction activity has made the parking more difficult. Identification is required to enter the building.

7. Last Day to Submit Questions

All questions must be received at the office of DFCM no later than the time and dated listed in the Project Schedule. Questions must be submitted in writing to Bill Bowen at DFCM.

8. Addendum

All references to questions and requests for clarification will be in writing and issued as addenda to the Solicitation for A/E Services. Addenda will be provided to every entity that has registered for receiving documents. The addenda or notice of the Addendum will be posted on DFCM's web site.

Any addenda issued prior to the submittal deadline shall become part of the Solicitation for A/E Services and any information required shall be included in your submittal.

9. Past Performance and References

As a A/E completes each DFCM project, DFCM, the contractors and the using agency or institution will evaluate the A/E. It is the intent of DFCM that this process will be the major source for evaluating past performance.

A/Es shall submit past performance and reference information by the time indicated on the Project Schedule.

For all DFCM projects completed in the last 5 years identify the project by name, number and DFCM project manager. Each A/E wishing to compete for this project that has not completed at least three DFCM projects in the last 5 years, will be required to provide one copy of a list of references on additional similar projects for a total of 3 projects.

For non-DFCM projects provide the following information:

Point of Contact:	Person who will be able to answer any customer satisfaction questions.
Phone Number:	Phone number of the contact we will be surveying.
User Name:	Name of Company / Institution that purchased the construction work.
Project Name:	Name of the project.
Date Completed:	Date of when the work was completed.
Address:	Street, city and state where the work was performed.
Size:	Size of project in dollars.
Duration:	Duration of the project / construction in months.
Type:	Type of the project (i.e.: School, Offices, Warehouse, etc)

10. Management Plan

Firms will be required to develop and submit a plan demonstrating how they will manage their responsibilities, identifying risks, and how risks will be mitigated. An organization chart showing the roles and responsibilities of all pertinent decision-makers is a required part of the presentation.

Address project specific criteria, risks that have been identified by the Solicitation for A/E Services and additional risks that the team has identified. State how those risks will be mitigated.

As part of the Management Plan include your proposed project schedule. Indicate critical dates and other information in sufficient detail for the selection committee to determine if the time frames are reasonable.

The Management Plan should be concise yet contain sufficient information for evaluation by the selection committee.

The submitting firm shall provide seven (7) copies and one (1) electronic in .pdf format of the Management Plan by the time indicated on the Project Schedule.

11. Statements of Qualifications

The submitting firm shall provide seven (7) copies and one (1) electronic in .pdf format of the Statements of Qualifications by the time indicated on the Project Schedule.

The Statement of Qualifications is a short document that indicates the experience and qualifications of the firm, the project manager and other critical members of the team. It describes what talents their team brings to the project, how their knowledge of the subject will provide benefit to the process, how the team has been successful in the past and how that relates to this project. It should include information on similar projects that have been completed by the firm, project manager and other team members. Include the experience and special qualifications that are applicable to this project and/or are part of the project specific selection criteria.

12. Selection Committee

The Selection Committee may be composed of individuals from the Utah State Building Board, DFCM, the User Agency / Institution, representatives from the design and construction disciplines, and others deemed appropriate by the DFCM.

13. Termination or Debarment Certifications

The firm must submit a certification that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from soliciting work by any governmental department or agency. The firm must also certify that neither the firm nor its principals have been terminated during the performance of a contract or withdrew from a contract to avoid termination. If the firm cannot certify these two statements the firm shall submit a written explanation of the circumstances for review by DFCM. Firms are encouraged to submit these certifications with their Statement of Qualifications but they may be submitted up until the time the selection is completed.

14. Interviews

Interviews will be conducted with all firms who have met all of the requirements except as follows. If more than six firms are eligible for interviews, DFCM may convene the selection committee to develop a short list of firms to be invited to interviews. This evaluation will be made using the selection criteria noted below base on the information provided by the past performance/references, performance plan and statement of qualifications.

The purpose of the interview is to allow the firm to present its qualifications, past performance, management plan, schedule and general plan for accomplishing the project. It will also provide an opportunity for the selection committee to seek clarifications from the firm.

The proposed primary project management personnel, including the project manager, should be in attendance. The project manager is the firm's representative who has overall job authority, will be in attendance at all job meetings, and is authorized by the firm to negotiate and sign any and all change orders in the field, if necessary. Unless otherwise noted, the attendance of subconsultants is at the discretion of the firm.

The method of presentation is at the discretion of the firm. The interviews will be held on the date and at the place specified in the Project Schedule.

15. Selection Criteria for VBS Professional Services

The following criteria will be used in ranking each of the teams. The team that is ranked the highest will represent the best value for the state. The criteria are not listed in any priority order. The selection committee will consider all criteria in performing a comprehensive evaluation of the proposal. Weights have been assigned to each criteria in the form of points.

A. DFCM Past Performance Rating. **25 Points**. Each prime firm will be given a past performance rating. The rating will be based first on how well the firm did on past projects with DFCM. If a minimum of three DFCM past performance ratings are not available a rating will be established using any DFCM past performance ratings that are available, supplemented by references supplied by the firm at the time the Management Plans and SOQ are submitted.

B. Strength of Team. **25 Points** Based on the statements of qualifications, the interview, and management plan, the selection team shall evaluate the expertise and experience of the team and the project lead as it relates to this project in size, complexity, quality, duration, etc. Consideration will also be given to the strength brought to the team by critical consultants including how they were selected and the success the team has had in the past in similar projects.

C. Project Management Approach. **25 Points** Based on the information provided in the statements of qualifications, the management plan and information presented in the interview the selection team shall evaluate how each team has planned to approach the project. The selection team will also evaluate the degree to which risks to the success of the project have been identified and a reasonable solution has been presented.

D. Schedule. **25 Points** The A/E's schedule will be evaluated as to how well it meets the objectives of the project. Unless other objectives are stated the shorter the duration that is evaluated to be feasible while achieving an appropriate design is preferred. The A/E shall discuss during the interview the project schedule identifying major work items with start and stop dates that are realistic and critical subconsultants and if they have reviewed and agree to the schedule. The completion dates shown on the schedule will be used in the contract.

TOTAL POSSIBLE POINTS: 100 POINTS

16. Fee Negotiation

Following selection of a design firm by the Selection Committee and prior to the award of the design agreement, DFCM will negotiate the final agreement fee with the selected firm. Should the DFCM be unable to agree to a satisfactory contract with the top ranked firm at a price that DFCM determines to be fair and reasonable to the State, discussions with that firm shall be formally terminated. Negotiations will then be undertaken with the second ranked firm.

This process will be repeated until an agreement is reached or DFCM determines that it is in the best interest of the State to initiate a new selection process.

17. **Form of Agreement**

At the conclusion of negotiations, the selected A/E will be required to enter into an agreement using the attached form of the Design Agreement between DFCM and Architect/Engineer.

18. **Licensure**

The A/E shall comply with and require its subconsultants to comply with the license laws of the State of Utah.

	STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES **Division of Facilities Construction and Management**	**DFCM**

PROJECT SCHEDULE

PROJECT NAME: NEW CLASSROOM BUILDING & CENTRAL CHILLED WATER PLANT WEBER STATE UNIVERSITY – OGDEN, UTAH
DFCM PROJECT #: 05027810

Event	Day	Date	Time	Place
Advertisement Placed	Sunday	March 26, 2006		Multi-Media
Solicitation for A/E Services Available	Monday	March 27, 2006	12:00 NOON	DFCM 4110 State Office Bldg SLC, UT 84114 and DFCM web site*
Mandatory Pre-submittal Meeting	Friday	April 7, 2006	10:00 AM	DFCM 4110 State Office Bldg SLC, UT 84114
Last Day to Submit Questions	Thursday	April 13, 2006	4:00 PM	DFCM 4110 State Office Bldg SLC, UT 84114
Final Addendum Issued	Tuesday	April 18, 2006	4:00 PM	Posted on DFCM web site *
Management Plans, References, and Statements of Qualifications	Tuesday	April 25, 2006	12:00 NOON	DFCM 4110 State Office Bldg SLC, UT 84114
Short Listing by Selection Committee, if applicable.	Tuesday	May 2, 2006	4:00 PM	
Termination / Debarment Certifications Due		On or Before Date of Interview	NA	
Interviews	Monday	May 8, 2006	As req'd	TBD
Announcement	Tuesday	May 9, 2006		Fax & DFCM web site *

*** DFCM's web site address is http://dfcm.utah.gov.**

___/___/____/___/_____/__/_
Project No. xxxxxx

DESIGN AGREEMENT
BETWEEN DFCM AND ARCHITECT / ENGINEER

This AGREEMENT is made this _______ day of ____________, 20__, between the Division of Facilities Construction and Management, hereinafter referred to as "DFCM", and the "A/E", __________________________________ a ______________, duly qualified to conduct business in the State of Utah, whose address is ____, agree to all the provisions of this Agreement for the Project identified as:

____
____
____

ARTICLE I.
DOCUMENTS INCORPORATED BY REFERENCE

A. DFCM GENERAL CONDITIONS.

1. The DFCM General Conditions ("General Conditions") which is current as of the date of this Agreement and on file with the DFCM is incorporated by reference as if fully set forth in this Agreement.

2. The A/E and DFCM shall be bound by the definitions and terms described in the General Conditions.

3. Unless the context provides otherwise, all definitions and interpretations of provisions of this Agreement shall be as stated in the General Conditions. In case of conflict between the provisions of this Agreement and the General Conditions, the provisions of this Agreement shall control.

B. SOLICITATION / PROCUREMENT DOCUMENTS AND REQUIREMENTS.

The A/E shall comply with the following:

1. State Procurement requirements.

2. The DFCM solicitation documents and A/E submitted documents for this project are hereby incorporated by reference as part of this Agreement. Attachment "C" hereto indicates changes to the A/E's response, if applicable.

3. The procurement documents and Contract Documents.

C. DFCM DESIGN MANUAL.

1. The DFCM Design Manual ("Design Manual") which is current as of the date of this Agreement and on file with the DFCM is incorporated by reference as if fully set forth in this Agreement.

2. The A/E and DFCM shall be bound by the definitions and terms described in the Design Manual.

D. ATTACHMENTS TO THIS AGREEMENT

All attachments to this Agreement are incorporated by reference as if fully set forth in this Agreement. Unless the context requires otherwise, any reference in this Agreement to an "Attachment" means such an incorporated by reference attachment to this Agreement.

E. HIERARCHY OF DOCUMENTS.

In case of conflict, the following documents supersede each other in accordance with the following respective hierarchy:

1. Codes and applicable law;

2. The attachments hereto;

3. The solicitation documents issued by DFCM for the selection of the A/E;

4. Any response by A/E to the procurement documents attached to this Agreement;

5. The body of this Agreement;

6. The General Conditions; and

7. The Design Manual.

ARTICLE II.
GENERAL REQUIREMENTS

A. GENERAL OBJECTIVES. The objectives of the Work under this Agreement include, but are not limited to the following:

1. Comply with the requirements of the Predesign Program;

2. Provide designs that comply with applicable laws, codes, rules, regulations and quality requirements;

3. Comply with this Agreement including the General Conditions and Design Manual;

4. Meet the established Construction Budget in Attachment "A";

5. Maintain the Project Schedule in Attachment "A"; and

6. To work with DFCM and the Contractor to accomplish all these objectives.

B. SCHEDULE. Time is of the essence. The A/E shall commence and prosecute the work diligently so as to be in compliance with the Project Schedule in Attachment "A." However, the A/E shall not be responsible for failure to comply with the Project Schedule or any portion thereof to the extent such noncompliance is not due to the fault of the A/E or anyone for whom the A/E is liable.

C. STANDARD OF CARE; RESPONSIBILITY. The services of A/E and its Subconsultants, if any, shall be performed in accordance with and judged solely by the standard of care exercised by licensed members of their respective professions having substantial experience providing similar services on projects similar in type, magnitude and complexity to the Project that is the subject of this Agreement. The A/E shall be liable to the DFCM or the State of Utah for claims, liabilities, additional burdens, penalties, damages or third party claims (i.e. a Contractor claim against DFCM or the State of Utah), to the extent caused by errors or omissions that do not meet this standard of care.

D. PUBLIC INFORMATION RELEASE. A/E shall not make any public information release in connection with the Project without advance written permission of DFCM. A/E shall require of it's Subconsultants the same agreement to maintain the confidentiality of information. Notwithstanding this provision, the A/E does not need DFCM's consent to respond to any information release which is needed to defend the A/E's interest, or to the extent such public information release is protected by constitutional free speech rights.

E. CONFLICT OF INTEREST. A/E and the A/E's Subconsultants shall not have any member that has a conflict of interest that may reasonably affect the A/E or Subconsultants professional judgment in regard to the Project, unless such conflict is disclosed to the DFCM and approved by the DFCM in writing. It is the A/E's duty to enforce this provision with the Subconsultants.

1. **Use of "Sales Agents."** The A/E warrants that no person or selling agency has been employed or retained except as indicated in writing to DFCM.

F. LAWS, CODES AND REGULATIONS. A/E and its Subconsultants shall use their best efforts consistent with the Standard of Care stated herein to comply with laws, codes, rules, regulations, ordinances and quality requirements applicable to the Project as established by State statute, codes adopted by State law, administrative rule and/or deemed applicable to the Project pursuant the express terms of this Agreement including those documents incorporated by reference. A/E or DFCM may request, and will be granted, a meeting with the other to discuss any additional codes or requirements that are applicable to the Project. In the case of change(s) or conflicts in the applicable code requirements, laws, rules or regulations, during the work of the Scope of A/E's Services, when and if the A/E becomes aware of such change(s) or conflicts, the A/E shall promptly notify the DFCM in writing. If the DFCM determines that work that has already been properly performed must now be changed, such change will be considered additional work under this Agreement and the A/E shall then prepare all documents to comply with the needed change(s).

G. ESTABLISH CONSTRUCTION BUDGET. The A/E shall prepare a construction budget (including cost estimate) for each phase of work under this Agreement in accordance with the Design Manual.

H. IF BIDS/PROPOSALS EXCEED CONSTRUCTION BUDGET. If no acceptable bid or proposal is received within the Construction Budget, the DFCM in its sole discretion may elect any one or more of the following options:

1. Give written approval of an increase in the Construction Budget; and/or

2. Rebid or renegotiate the construction contract within a reasonable time; and/or

3. Revise the Project scope and/or quality as necessary to meet the Construction Budget; and/or

4. Abandon the Project and terminate this Agreement.

If the DFCM elects an option or options which does not abandon the Project, the A/E shall perform the A/E's services to implement the selected option or options at no additional cost to the DFCM.

I. STAFFING. The A/E shall maintain the human, physical and other resources reasonably necessary to timely meet its obligations under this Agreement.

J. DFCM REVIEWS, LIMITATIONS. The right of the DFCM or any entity/user to perform plan checks, plan reviews, other reviews and/or comment upon the work of the A/E, as well as any approval by the DFCM, shall not be construed as relieving the A/E from its professional and legal responsibility for services required under this Agreement. No review by the DFCM or any entity/user, approval or acceptance, or payment for any of the services required under this Agreement shall be construed to operate as a waiver by the DFCM of any right under this Agreement or of any cause of action arising out of the performance or nonperformance of this Agreement, and the A/E shall be and remain liable to the DFCM in accordance with applicable law for all damages to the DFCM caused by the A/E's acts, errors and/or omissions.

K. USE OF PROTOTYPICAL DESIGNS OR DESIGNS PROVIDED BY DFCM. A/E shall use prototypical designs or other design drawings, specifications or calculations provided by DFCM in the request for proposal. A/E shall recheck such designs and any other design data, drawings, specifications and calculations provided by DFCM. A/E shall correct any error or omission as deemed necessary thereafter, and shall be responsible therefore to the same extent as if such materials had been provided by A/E under this Agreement. A/E shall be provided with all change orders, proposed change orders, and clarifications, from previous projects that are applicable to this Project. A/E shall incorporate all pertinent material into the new plans and specifications. If A/E has provided design services to DFCM on previous projects and has designed buildings similar to the components of this Project, which are in A/E's charge, at the direction of DFCM, A/E shall modify and reuse existing design as much as possible. Where existing designs are being reused, drawings are required to conform to DFCM graphic/CAD standards unless prior written approval is given by DFCM.

L. SUBCONSULTANTS. The A/E shall be responsible and liable to the DFCM for the services of any Subconsultant of A/E. Any reference in this Agreement to Subconsultant shall refer to any subcontractor, consultant or subconsultant of the A/E at any tier. A/E shall, without additional expense to DFCM, be responsible for obtaining any business and professional licenses and for complying with any applicable Federal, State, and local laws, codes, and regulations, as necessary for the performance of the A/E's services.

M. HAZARDOUS MATERIALS. The A/E shall comply with the General Conditions and Design Manual provisions regarding hazardous materials.

N. DISCRIMINATION AND SEXUAL HARASSMENT PROHIBITED. Pursuant to the laws of the State of Utah, the A/E, or any person acting on behalf thereof, will not discriminate against any employee or applicant for employment because of race, creed, color, sex, religion, ancestry or national origin. To the extent applicable, said persons will comply with all provisions of Executive Order No. 11246 dated September 24, 1965 and rules, regulations, orders, instructions, designations and other directives promulgated pursuant thereto. The A/E, or anyone for whose act the A/E may be liable, shall not act in any manner as would violate the laws, regulations and policies of the United States or the State of Utah prohibiting sexual harassment.

ARTICLE III.
PROJECT TEAM.

A. DFCM REPRESENTATIVE. The DFCM Representative is the person assigned by the Director of DFCM to manage the Project and is the sole person authorized to act on behalf of DFCM or the State of Utah.

B. A/E AND SUBCONSULTANTS.

1. **Need DFCM Permission to Change Organizational Chart**. The A/E and Subconsultants have been selected to perform the services of this Agreement because of the skills and expertise of designated key personnel. Attachment "B" to this Agreement provides the organization chart of the A/E and Subconsultants. The identified persons and entities in the organizational chart cannot be changed without advance written approval by DFCM.

2. **A/E's Representative.** The A/E's Designated Representative identified in the organization chart is and shall be authorized to act on the A/E's behalf and bind the A/E in regard to the Project.

ARTICLE IV.
DFCM RESPONSIBILITIES AND RIGHT TO EVALUATE A/E

A. DFCM RESPONSIBILITIES. Unless otherwise expressly agreed herein, DFCM shall at its sole cost and expense shall:

1. Place advertisements for bids or proposals;

2. Conduct bid or proposal openings and interviews;

3. Timely provide and update A/E with available "public" information in DFCM's possession regarding the Project, including but not limited to, legal descriptions, topographic surveys, ALTA or other boundary surveys, utility surveys, record drawings, reports, project objectives, budgets, and other material requirements and limitations.

4. Notify A/E of any known fault, known defect, or known deficiency in the Project, including but not limited to acts, errors, omissions, or inconsistencies in A/E's services and Deliverable Instruments of Service. Notwithstanding this provision, any failure to notify the A/E, shall not relieve the A/E of any responsibility or liability for such fault, defect or deficiency.

5. The DFCM Representative shall timely render decisions so as to avoid unreasonable delays in the orderly progress of the Project.

B. PERFORMANCE EVALUATION OF A/E. The DFCM may conduct a performance evaluation of the A/E's services, including specific personnel of A/E or any Subconsultant at any time. Results of any evaluation will be made available to the A/E upon request.

ARTICLE V.
SCOPE OF A/E'S BASIC SERVICES.

A. IN GENERAL. The A/E's Basic Services consist of those described in this Agreement, the General Conditions, and Design Manual, and include normal structural, mechanical, electrical, and architectural as well as other consulting services reasonably necessary to fulfill the A/E's duties under this Agreement. Any additional scope of service requirements are provided in Attachment "A" and the Design Manual.

1. **Incidental Services.** A/E shall provide all services incidental to the A/E's identified Basic Services as established by standard professional custom and practice.

2. **Direction from DFCM Representative Only**. A/E has neither the responsibility nor the authority to accept directives or determinations from any person other than the DFCM Representative. The A/E shall not take any direction from the end User's of the Project, Contractor or any other third party's representative.

3. **Review Requests for Information**. The A/E shall review properly prepared and timely Requests for Information by the Contractor.

4. **Issue ASI's and Supplemental Drawings and Specifications.** If approved by the DFCM Representative, the A/E shall issue an ASI, and prepare, reproduce, and distribute supplemental and/or corrected drawings and/or specifications in response to Requests for Information by the Contractor.

B. SCHEMATIC DESIGN PHASE.

1. **Review Program and Statement of Scope**. The A/E shall review the program or other "statement of scope" furnished by DFCM to ascertain the requirements of the Project and shall arrive at a mutual understanding of such requirements with the DFCM Representative. The term "program" as referred to in this Agreement shall be deemed to include any "statement of scope" provided by DFCM.

2. **Preliminary Evaluation**. The A/E shall provide a preliminary evaluation of DFCM's program, schedule and construction budget requirements.

3. **Documents and Drawings.**

a. Based on the mutually agreed upon program, or scope of work, schedule and construction budget requirements, the A/E shall prepare, for written approval by DFCM, Schematic Design Documents consisting of drawings and other documents illustrating the scale and relationship of Project components.

b. The Schematic Design Documents shall comply with this Agreement and the Design Manual.

c. The Schematic Design narrative shall include the A/E's proposed design and construction budget which shall be within the DFCM budget provided to the A/E.

4. **Alternative Approaches**. The A/E shall review with DFCM, alternative approaches to design and construction of the Project. Several options shall be submitted for DFCM's evaluation.

5. **Land Use Approval Assistance**. The A/E shall cooperate with DFCM in obtaining applicable permits, and land use approvals, so as to allow for construction of the Project. However, appearances as an expert as well as the preparation of necessary drawings, visual aids and any other design work solely prepared for an appearance with zoning boards or planning commissions or other governmental meetings or hearings, shall be considered as Additional Services, if not included in Attachment "A".

C. DESIGN DEVELOPMENT PHASE.

1. **General Description of Design Development Submittal.** A/E shall prepare, for written approval by the DFCM Representative, Design Development Documents consisting of drawings and other documents to fix and describe the size and character of the Project as to architectural, structural, mechanical and electrical systems, materials and such other elements as may be appropriate. The narrative shall include the A/E's proposed design and construction budget which shall be within the DFCM budget provided to the A/E. The Design Development submittals shall comply with the following:

a. The DFCM approved Schematic Design Documents and any adjustments authorized by DFCM in the program, scope of work, schedule or construction budget; and

b. The provisions of this Agreement and the Design Manual.

2. **Authorization to Proceed Required in Writing from DFCM.** The A/E may proceed on and be paid for Design Development work only after a written authorization to proceed to the Design Development Phase is provided by the DFCM Representative.

3. Should DFCM initiate or require a material change from the approved Design Development Documents and there is no fault or responsibility of the A/E related to DFCM's initiation or requirement of the change, A/E's effort implementing said change(s) shall be compensated as an Additional Service and the schedule for delivery of A/E's services shall be equitably adjusted if/as appropriate.

D. CONSTRUCTION (CONTRACT) DOCUMENTS PHASE.

1. **General Description of Construction Documents Submittal**. A/E shall prepare, for written approval by the DFCM Representative, Construction Documents consisting of Drawings and Specifications setting forth in detail the requirements for the construction of the Project. The narrative shall include the A/E's proposed design and construction budget which shall be within the DFCM budget provided to the A/E. The A/E shall advise the DFCM of any adjustments to previous preliminary estimates of Construction cost indicated by changes in requirements or general market conditions. The Construction Documents shall comply with the following:

a. The DFCM approved Design Development Documents and any further adjustments in the scope or quality of the Project or in the construction budget authorized by DFCM;

b. The Construction Documents shall comply with and identify all applicable codes, tests and inspections; and

c. The provision of this Agreement and the Design Manual.

2. **Authorization to Proceed Required in Writing from DFCM.** The A/E may proceed on and be paid for Construction Documents work only after a written authorization to proceed to the Construction Documents Phase is provided by the DFCM Representative.

3. **Assistance with Procurement Documents.** The A/E shall assist DFCM in the preparation of the necessary procurement documents to obtain a Contractor and other entities needed to complete the Project.

4. **Assist with Filing for Governmental Approval.** When requested by DFCM, A/E shall assist DFCM in preparation and filing of documents required for the approval of governmental authorities having jurisdiction over the Project.

E. PROCUREMENT OR NEGOTIATION PHASE.

1. **In General.** The A/E, after written authorization is provided by the DFCM Representative, shall assist DFCM in obtaining bids or negotiated proposals and assist in awarding contracts for construction.

2. **Pre-Bid (including pre-proposal) Conference.** The A/E shall attend any pre-bid conference as requested by the DFCM. DFCM shall control all advertising, bid openings, publishing of bid results, awarding of the Contract.

3. **Available for Interpretations.** The A/E shall at all reasonable times be available personally, or have available, a responsible member of his or her staff to make such interpretations of the Construction Documents as are necessary to facilitate completion of the construction contract.

F. CONSTRUCTION PHASE - ADMINISTRATION OF THE CONSTRUCTION CONTRACT.

1. **Commencement and Termination.** The A/E's responsibility to provide Basic Services for the Construction Phase commences with DFCM's written authorization to proceed on to this Phase and terminates upon the completion of the guaranty period of the Contractor's work, unless extended by written agreement of the A/E and DFCM. Any final payment made prior to the end of the guaranty period does not terminate A/E's obligation to provide full performance of the A/E's services throughout the guaranty period for the fee already paid for basic services.

2. **A/E's General Assistance During Construction and One-Year Guaranty Period.** A/E shall advise and assist DFCM (1) during the Construction Phase, and (2) during period of the Contractor's guaranty obligations under the Contract Documents. During the One-Year Guaranty Period, the A/E shall make a qualified representative available to answer questions and to perform a 1-year guaranty walk through. A/E shall have authority to act on behalf of DFCM only to the extent provided in this Agreement unless otherwise modified in writing by DFCM and A/E. The A/E shall be liable for any representations made by the A/E or anyone for whose acts the A/E may be liable, not consistent with the provisions of the Contract Documents, unless DFCM has given written approval in advance.

3. **Site Visits.**

a. **In General.** Site visits shall be conducted in accordance with Attachment "A" and the Contract Documents.

b. **Compliance with Contract Documents, Reporting Defects and Deficiencies.** Site visits shall require the A/E to examine the Work of the Contractor in progress to assist the DFCM in identifying any lack of compliance with the Construction Documents, defects or deficiencies in the Work and to determine whether the Work is proceeding in a manner such that, when completed, will likely be in accordance with the Construction Documents. Except as may otherwise be provided in Attachment "A", the A/E's on-site construction-phase services are (i) not full-time, continuous, or exhaustive; (ii) do not include a duty to discover latent defects in the Work; and (iii) do not constitute a guarantee of the A/E's Work or relieve the Contractor of its responsibilities. A/E is not responsible for the Contractor's selected means, methods, or sequences of work. The A/E shall cooperate and assist the DFCM in enforcement of the Construction Documents. The A/E shall promptly report known or obvious defects to the DFCM. This provision does not relieve the Contractor of its responsibility to comply with the Construction documents.

c. **Written Report**. A/E shall promptly submit to DFCM a written report subsequent to each site visit.

d. **Limitations.** A/E shall not be required to make exhaustive or continuous on-site inspections or observations to check the quality or quantity of the Work unless specified elsewhere in this Agreement including the Attachment(s).

4. **Submittals.** Contractor submittals shall be addressed in accordance with the Contract Documents.

5. **Modifications.** A/E shall prepare Change Orders, or Construction Change Directives, with supporting documentation and data for DFCM's approval and execution in accordance with the Contract Documents, and may issue ASI's not involving an adjustment in the Contract Sum or an extension of the Contract Time which are not inconsistent with the intent of the Contract Documents. ASI's must be approved by the DFCM Representative prior to being issued. When approved by DFCM, the A/E shall prepare Statements of Justification, detailed cost and time estimates of the proposed change in the work, Requests for Proposals, Construction Change Directives, and Change Orders. A/E shall prepare, reproduce, and distribute Drawings and Specifications to completely describe Work to be added, deleted, and/or modified. The preparation of all such documentation shall not be considered additional services unless the change in the Work is determined by DFCM to be a scope change and/or an unknown condition.

6. **Record Drawings (As-Builts).** The A/E shall monitor the Contractor's efforts to regularly update the redline drawings during construction. Upon completion of the Construction Phase, A/E shall prepare Record Drawings based upon redline construction drawings and/or other information provided by Contactor. A/E has no duty to verify the accuracy or completeness of said information and, unless A/E knows that said information is on its face inaccurate and/or

incomplete, A/E is entitled to rely upon said information in preparing Record Drawings. If and to the extent A/E knows that said information is on its face inaccurate and/or incomplete, A/E shall promptly advise DFCM in reasonable detail of the inaccurate and/or incomplete information. Subject to said obligation to advise and its obligation to transcribe the Contractor's redline construction drawings and/or other information provided by Contractor in a manner consistent with the Standard of Care, A/E makes no representation regarding the accuracy or completeness of its Record Drawings.

7. **Review Process.** A/E shall comply with any review process required by DFCM. A/E shall make submissions to the reviewing entity in a timely manner so as not to delay the reviewing entity.

8. **Specific Delay Liability of A/E.** The A/E shall be liable to DFCM for damages incurred to DFCM or the State of Utah as a result of impact on the Contractor's critical path schedule to the extent due to A/E's error, act or omission.

9. **Notification of Impacts on Critical Path.** The A/E shall promptly notify DFCM in writing of facts, events or circumstances of which the A/E is or should be aware and which have or likely will adversely impact the critical path schedule.

ARTICLE VI
DELIVERABLE INSTRUMENTS OF SERVICE

A. DEFINED. "Deliverable Instruments of Service" as used in this Agreement shall mean the drawings, specifications, addendum, attachments, calculations, manuals, reports, official project meeting minutes, project observation reports and/or other information, regardless of medium, identified in and required to be delivered or submitted to the DFCM under this Agreement.

B. OWNERSHIP. It is acknowledged and agreed that all documents developed pursuant to this Agreement are Instruments of Service. Deliverable Instruments of Service are the sole property of DFCM. DFCM shall have unlimited rights, for the benefit of DFCM, in all said deliverable instruments of service, including, but not limited to use, re-use, modification, and transferability for reference only related to the site.

C. PROMOTIONAL ISSUES. The A/E shall have the right to include photographic or artistic representations of the design of the Project among the A/E's promotional and professional materials, provided that the A/E appropriately gives recognition to the State of Utah regarding the Project. The A/E shall be given reasonable access to the completed Project to make such representations. However, the A/E's materials shall not include the DFCM confidential or proprietary information. The DFCM shall provide professional credit for the A/E in the DFCM's promotional materials that relate to the A/E's work for the Project. Except to the extent related to the A/E's defense of any statements made by others in regard to the A/E's performance, and notwithstanding any other provision of this Agreement, the A/E shall not make any public information release in connection with services performed under this Agreement without the advance written approval of the Director of the Division of Facilities Construction and Management.

D. LICENSE. A/E hereby grants DFCM a nonexclusive license for governmental purposes to any copyrighted portion of Deliverable Instruments of Service. Such license shall include, but not be limited to, the right to use and reuse such copyrighted materials to construct the buildings, facilities, or other matters covered by such copyrighted materials for additional use and to license such copyrighted materials for reuse. DFCM's rights and licenses in and to said Deliverable Instruments of Service are conditioned upon A/E receiving all sums related to DFCM approved deliverables due under this Agreement.

E. INDEMNIFICATION RELATED TO CERTAIN DFCM'S ACTION WITH DELIVERABLES. DFCM's use on other projects, DFCM's re-use, or DFCM's modification of the Deliverable Instruments of Service shall be at DFCM's sole risk and without recourse against A/E, its Subconsultants at any tier, and their principals, agents and employees. DFCM shall hold harmless, indemnify and defend A/E, its Subconsultants at any tier and their respective principals, agents and employees from and against any and all actions, claims, loss, or damages of any nature whatsoever to the extent related to and resulting from any said use, re-use, or modification of all or any portion of the Deliverable Instruments of Service by or on behalf of DFCM, or under any license issued by, through, or on behalf of DFCM, irrespective of any actual or alleged fault on the part of the indemnitee(s). Under no circumstances shall A/E be indemnified for the use of the Deliverable Instruments of Service for the Project that is the subject of this Agreement. For purposes of this paragraph, DFCM includes the State of Utah or any department, division or agency of the State of Utah.

F. ACCESS TO DELIVERABLES. A/E, for a period of three (3) years after completion of the Project, agrees to furnish and to provide access to all the aforesaid Deliverable Instruments of Service upon the request of DFCM. DFCM shall pay all costs for labor, reproduction and/or shipping of requested documents. DFCM agrees to make no demand on A/E for responsibility for DFCM use of such material for any other DFCM work which is not the subject of an Agreement between DFCM and the A/E for such use.

G. STAMP. If the A/E is not the same A/E commissioned for the project within the Deliverable Instruments of Services, DFCM shall reasonably remove all indications of authorship, including the title blocks, names, initials, signatures, and professional stamps of A/E, its Subconsultants at any tier, and their agents and employees.

ARTICLE VII.
COMPENSATION, PAYMENTS
TO THE A/E, AND DAMAGES

A. FEES IN ATTACHMENT "A." Payment shall be in accordance with the schedule of lump sum payments for each phase listed under this Agreement as shown in the Schedule of A/E's and Subconsultant Fees (Attachment "A"). Progress payments with respect to such lump sum amounts shall be based upon percentage of such services completed.

B. PAYMENT IN FULL. The fee for any particular phase or activity described in Attachment "A" shall be the full payment owing by DFCM for such phase or activity.

C. WITHHOLDING OF PAYMENT; LIABILTY OF EXCESS OWING. Should the A/E fail to perform any of its obligations hereunder, be in default of this Agreement, or otherwise fail to complete the services of this Agreement within the time established by the Project Schedule (Attachment "A"), the A/E shall be liable to the DFCM for the actual damages incurred and such amount, may be deducted from any amount due or that may become due the A/E. To the extent that the damages exceed any amount that would otherwise be due the A/E, the A/E shall be liable for such excess to the DFCM. The DFCM may seek enforcement of such obligation by legal action, and if such is necessary, shall recover the related costs and attorney fees. Notwithstanding the above, the DFCM agrees that the A/E is not responsible for damages arising directly or indirectly from any delays for causes beyond the A/E's control.

D. OTHER PREREQUISITES TO RECEIVE PAYMENT: In addition to any other requirements under this Agreement, the following is required before any payment shall be made and/or deemed owed by the DFCM:

1. **Invoices.** The A/E shall submit invoices for progress payments not more than once a month. Invoices shall include the DFCM project and contract number, and be signed by the A/E. Each invoice shall include a detailed description by line item showing the contract prices, percentage of the services completed for the period, payments received to date, payment requested for the period, the overall percentage of completion, any lien waivers or releases previously requested by DFCM.

2. **Adjustments of Progress Payments.** The DFCM may, at its discretion, adjust any progress payments so that it corresponds to the percentage of completion as estimated by the DFCM. Notice shall be given to the A/E prior to making any such adjustments.

E. ACCEPTANCE OF FINAL PAYMENT. The acceptance by the A/E of final payment without a written protest filed with DFCM within three (3) days of receipt of final payment, shall release the DFCM from all claims and all liability to the A/E for fees and costs of the performance of the services pursuant to this Agreement.

F. INTEREST ON LATE PAYMENTS. Except as otherwise provided by law, if any payment is late based upon the provisions of this Agreement, the A/E shall be paid interest in an amount equal to the published Wall Street Journal prime rate plus 2%. The published Wall Street Journal Prime Rate shall be determined using such rate that is published closest to the 1st of the month for each month of the late period. The amount of payment of interest shall be apportioned using such rate(s) for the late period.

ARTICLE VIII.
REQUIREMENTS FOR ADDITIONAL SERVICES.

A. ADDITIONAL SERVICES; IN GENERAL.

1. **Not Allowed when Correcting an Error, Omission or is Already Part of this Agreement.** Notwithstanding any provision of this Agreement, the A/E shall not be entitled to any additional compensation or the considering of any work as an additional service when such work is being performed in order to resolve an error or omission of the A/E or is otherwise required to meet the terms of this Agreement.

2. **Written Modification in Advance of Work Required.** The A/E shall perform additional services when authorized by a written modification to this Agreement in advance of the performance of the subject work. Failure of the A/E to obtain a written approval from the DFCM of the cost and authorization to proceed shall result in the A/E's forfeiture of the right to seek additional compensation for the contended additional service. A/E shall have no obligation, and shall not, begin or provide any additional services unless and until such written modification has been provided by the DFCM.

ARTICLE IX.
INSURANCE AND INDEMNIFICATION

A. INSURANCE. To protect against liability, loss and/or expense arising in connection with the performance of services described under this Agreement, the A/E shall obtain and maintain in force during the entire period of this Agreement without interruption, at its own expense, the following stated insurance from insurance companies authorized to do business in the State of Utah, in a form and content satisfactory to the DFCM, and rated "A-" or better with a financial size category of (a) Class X or larger where the applicable Construction Budget is $1,000,000 or greater; or (b) Class VII or larger where the applicable Construction Budget is under $1,000,000. All said ratings and financial size categories shall be as published by A.M. Best Company at the time this Agreement is executed. The A/E shall require all Subconsultants to have and maintain similarly required policies. All of the following listed insurance coverages shall be provided by the A/E:

1. **A/E's Professional Liability Insurance.** The A/E shall maintain a policy on a claims made basis, annual aggregate policy limit based on the following chart, unless modified in Attachment "A" to this Agreement.

Construction Budget	Minimum Liability Coverage
$50,000,000 and above	$2,000,000 per claim, $4,000,000 aggregate
$25,000,000 and above, but under $50,000,000	$2,000,000 per claim, $2,000,000 aggregate

$1,500,000 and above but under $25,000,000	$1,000,000 per claim, $1,000,000 aggregate
Under $1,500,000	$ 500,000 per claim, $ 500,000 aggregate

The DFCM reserves the right to require additional coverage from that stated in the chart herein above, at the DFCM's expense for the additional coverage portion only. DFCM also reserves the right to require project specific insurance, and if such right has been exercised it shall be indicated as an exhibit to this Agreement. Unless project specific insurance is required by the DFCM, the coverage may be written under a practice policy with limits applicable to all projects undertaken by the firm but must be maintained in force for the discovery of claims for a period of three (3) years after the date final payment is made to the A/E under this Agreement. All policies provided by the A/E must contain a "retroactive" or "prior-acts" date which precedes the earlier of, the date of the A/E's Agreement or the commencement of the A/E's services. The A/E's policy must also include contractual liability coverage applicable to the indemnity provision of this Agreement for those portions of the indemnity provisions that are insured under the A/E's policy and in accordance with this Agreement, including the attachments hereto.

2. **Commercial General Liability Insurance.** A/E shall provide, at its own expense, Commercial General Liability Insurance, on an "occurrence basis", including insurance for premises and operations, independent Subconsultants, projects/ completed operations, and contractual liability coverage including specifically designating the indemnity provisions of this Agreement as an insured contract on the Certificate of Insurance. Such Commercial General Liability Insurance must provide coverage for explosion, collapse and underground hazards. Insurance required by this paragraph shall provide for limits that are not less than the following:

$2,000,000	General Aggregate
$2,000,000	Products-Completed Operations Aggregate
$1,000,000	Personal and Advertising Injury
$1,000,000	Each Occurrence
$ 50,000	Fire Damage (any one fire)
$ 5,000	Medical Expense (any one person)

3. **Workers' Compensation Insurance and Employers' Liability Insurance.** Worker's Compensation Insurance shall cover full liability under the Worker's Compensation Laws of the jurisdiction in which the Project is located at the statutory limits required by said jurisdiction's laws. Employer's Liability Insurance shall provide the following limits of liability: $100,000 for each accident; $500,000 for Disease-Policy Limit; and $100,000 for Disease-Each Employee.

4. **Automobile.** Automobile liability insurance for claims arising from the ownership, maintenance, or use of a motor vehicle. The insurance shall cover all owned, non-owned, and hired automobiles used in connection with the work, with the following minimum limits of liability: $1,000,000 – Combined Single Limit Bodily Injury and Property Damage Per Occurrence.

5. **Valuable Papers and Records Coverage and Electronic Data Processing (Data and Media) Coverage.** The A/E and all Subconsultants of the A/E shall provide coverage for the physical loss of or destruction to their work product including drawings, specifications and electronic data and media.

6. **Aircraft Use.** A/E using its own aircraft, or employing aircraft in connection with the work performed under this Agreement shall maintain Aircraft Liability Insurance with a combined single limit of not less than $1,000,000 per occurrence. Said certificate shall state that the policy required by this paragraph has been endorsed to name the State of Utah and DFCM as Additional Insureds.

7. **Certificates.** Before this Agreement is executed, the A/E shall submit certificates in form and substance satisfactory to the DFCM as evidence of the insurance requirements of this Article. Such certificates shall contain provisions that no cancellation, or non-renewal shall become effective except upon thirty (30) days prior written notice by US Mail to DFCM as evidenced by return receipt, certified mail sent to DFCM. The A/E shall notify the DFCM within thirty (30) days of any claim(s) against the A/E which singly or in the aggregate exceed 20% of the applicable required insured limits and the A/E shall, if requested by DFCM, use its best efforts to reinstate the policy within the original limits and at a reasonable cost. The State of Utah and DFCM shall be named as an insured party, as primary coverage and not contributing, on all the insurance policies required by this Article except the professional liability and workers' compensation policies. The DFCM reserves the right to request the A/E to provide a loss report from its insurance carrier.

8. **Maintain Throughout Agreement Term.** The A/E agrees to maintain all insurance required under this Agreement during the required term. If the A/E fails to furnish and maintain said required insurance, the DFCM may purchase such insurance on behalf of the A/E, and the A/E shall pay the cost thereof to the DFCM upon demand and shall furnish to the DFCM any information needed to obtain such insurance.

9. **Waivers of Subrogation.** All policies required, except Practice Professional Liability Insurance and Workers Compensation Insurance, shall be endorsed to include waivers of subrogation in favor of the State of Utah and DFCM.

10. **Excess Coverages.** Any type of insurance or any increase of limits of liability not described in this Agreement which the A/E requires for its own protection or on account of any statute, rule or regulation, shall be its own responsibility and at its own expense.

11. **Not Relieve A/E of Liability.** The carrying of any insurance required by this Agreement shall in no way be interpreted as relieving the A/E of any other responsibility or liability under this Agreement or any applicable law, statute, rule, regulation or order.

12. **A/E Compliance with Policies.** A/E shall not violate or knowingly permit to be violated any of the provisions of the policies on insurance required under this Agreement.

B. INDEMNIFICATION

1. **"Indemnitees"** as that term is used in this Article IX-B means the State of Utah, its institutions, agencies, departments, divisions, authorities, and instrumentalities, boards, commissions, elected or appointed officers, employees, agents, and authorized volunteers.

2. **"A/E"** as that term is used in this Article IX-B, means the A/E, its Subconsultants at any tier, or any of their agents, employees including those employed directly or indirectly, or other persons or entities for whose acts the A/E or its Subconsultants at any tier may be liable.

3. **Indemnification Requirements.**

a. **A/E's Indemnification of Indemnities.** To the fullest extent permitted by law, A/E shall indemnify and hold harmless the Indemnities from and against every kind and character of claims, damages, losses and expenses, including but not limited to reasonable attorneys' fees, to the extent caused by any negligent or wrongful act, error or omission of the A/E.

b. **Defense by A/E.** A/E shall defend all actions brought upon such matters to be indemnified hereunder and pay all costs and expenses incidental thereto, but the State of Utah shall have the right, at its option and its own expense, to participate in the defense of any such action without relieving the A/E of any obligation hereunder. A/E shall be reimbursed by DFCM their reasonable costs and expenses incurred under this provision to the extent such costs and expenses relate to the fault of DFCM and not the A/E.

c. **Not Affect Other Indemnification Rights or Obligations**. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person under this Agreement.

d. **Not Affected by Workmen's Compensation or Certain Benefit Acts.** In claims against any person or entity indemnified under this paragraph by the A/E, the indemnification obligation under this paragraph shall not be limited by a limitation on the amount or type of damages, compensation or benefits payable by or for the A/E under workers' or workmen's compensation acts, disability benefits acts or other employee benefit acts.

e. **Affect of Written Directives by DFCM.** Notwithstanding any of the above, to the extent A/E is complying with a written directive from DFCM, that is not based on the A/E's recommendation, the A/E shall not be held liable under the indemnification provisions of this Agreement if the A/E has promptly disagreed with the written directive by delivering such objection to DFCM in writing.

f. **Specific Waiver for Damages Covered by Builder's Risk.** DFCM and A/E waive all rights against each other for damages, but only to the extent covered by the State of Utah's Builder's Risk Policy concerning damage to the Work during construction, except such rights as they may have to the proceeds of such insurance as set forth in the General Conditions.

DFCM and A/E each shall require similar waivers from their Subconsultants and agents at any tier.

ARTICLE X.
LIMITATIONS OF ACTIONS

A. STATUTE OF LIMITATION AND STATUTE OF REPOSE. An action by or against the A/E, the A/E's Subconsultant, agent, independent Subconsultant, or anyone for whom the A/E may be liable, shall comply with and be bound by the applicable and lawful statute of limitation and statute of repose provisions. Notwithstanding this, any action by or against the A/E, the A/E's Subconsultant, agent, independent Subconsultant, or anyone for whom the A/E may be liable, that is based in contract or warranty shall be commenced within six (6) years of the date of substantial completion of the improvement or abandonment of construction except that such period of limitation shall be modified as follows:

1. **Fraudulent Concealment.** In the event that the A/E, the A/E's Subconsultant, agent, independent Subconsultant, or anyone for whom the A/E may be liable has fraudulently concealed the act, error, omission or breach of duty, or the injury, damage or other loss caused by the act, error, omission or breach of duty, the six year period shall not begin to run until such time as the DFCM discovers or, through the exercise of reasonable diligence, should have discovered its claim.

2. **Willful and Intentional.** In the event that the A/E, the A/E's Subconsultant, agent, independent Subconsultant, or anyone for whom the A/E may be liable commits a willful or intentional act, error, omission, or breach of duty, the six year period shall not begin to run until such time as the DFCM discovers or, through the exercise of reasonable diligence, should have discovered its claim.

3. **Unintentional and Nonfraudulent Latent Acts, Errors, Omissions or Breaches of Duty.** In the event of an unintentional and nonfraudulent latent act, error, omission or breach of duty, the DFCM shall have the time period allowed by Utah law and the Utah Code, unless a longer period is provided for in an attachment to this Agreement.

4. **"Different Period of Limitation" from Utah Code.** These provisions are understood and agreed to by the A/E as establishing a "different period of limitations" as that terms is used in UCA 78-12-21.5(3)(a) or any other similar statute of the Utah Code. These provisions are not intended to shorten any time period allowed by Utah law and code for non-contract actions, including but not limited to, those based in tort.

ARTICLE XI.
PRELIMINARY RESOLUTION EFFORTS, CLAIMS AND DISPUTES

A. GENERAL CONDITIONS REQUIREMENTS APPLY. The provisions of Articles 7.7 through and including 7.14 of the General Conditions shall allow to Preliminary Resolution

Efforts, Claims and Disputes under this Agreement. References in said Articles 7.7 through and including 7.14 to the term "Contractor" and "Subcontractor" shall refer to A/E and Subconsultant under this Agreement, respectively. Unless inconsistent with the provisions of this Agreement, definitions in the General Conditions shall apply to this Agreement.

B. TIME FOR FILING. Notwithstanding paragraph A above, the PRE must be filed in writing with the DFCM Representative within twenty-one (21) days of any of the following:

1. Issuance of a denial by DFCM of an A/E request for additional monies or other relief under this Agreement;

2. In the case of a Subconsultant, after the expiration of the time period for the A/E / Subconsultant PRE process under Paragraph 7.7.5 of the General Conditions; or

3. When the A/E knows or should have known about any other issue where the A/E seeks additional monies, time or other relief from the State of Utah or DFCM.

C. NOT LIMIT DFCM RIGHTS. As stated in Rule R23-26-1(6), this does not limit the right of DFCM to have any of its issues, disputes or claims considered. DFCM reserves all rights to pursue its issues, disputes or claims in law or equity including, but not limited to, any or all of the following: damages, delay damages and impacts, losses, liability, patent or latent defects, or failure to perform under this Agreement. If the Director appoints an expert or a panel to consider any such issue(s), dispute(s) or claims(s) of DFCM, the A/E shall cooperate with such expert or panel process.

ARTICLE XII.
TERMINATION OR SUSPENSION

A. TERMINATION FOR CAUSE. The DFCM or A/E may terminate this Agreement for cause should the other party fail to substantially perform the material covenants herein contained at the time and in the manner herein provided, including the failure to design the project within the Construction Budget. In such event, the party seeking termination shall give the other party fourteen (14) calendar days written notice of intent to terminate for cause. If the other party cures said default, or is diligently pursuing a cure, within said fourteen (14) day period, there shall be no termination for cause.

1. **DFCM May Proceed; Liabilities.** In the event of such termination for cause by the DFCM, the DFCM may proceed with the work in any manner deemed proper by the DFCM. The cost to the DFCM or damage to the DFCM as a result of the failure to perform shall be deducted from any sum due the A/E under this Agreement, and the balance, if any, shall be paid to the A/E upon demand. If the cost or damage to the DFCM exceeds the sums due the A/E, such costs or damages shall be paid to the DFCM by the A/E.

2. **Paid Sums Owing Through Date of Termination.** In the event of such termination for cause by the A/E, the A/E shall be paid all sums owing A/E through the date of

termination. Under no circumstances, shall A/E be paid for any other sums related to the termination for cause, including but not limited to, lost profits or consequential damages.

B. TERMINATION FOR CONVENIENCE. The DFCM reserves the right to terminate this Agreement for convenience or any reason upon fourteen (14) calendar days written notice to A/E. The DFCM may also suspend the services of the A/E for a period not to exceed 180 days and pay the A/E all sums owing through the date of suspension. For any period beyond 180 days, the A/E may consider it a termination for convenience. Should said termination occur during or upon completion of the Schematic Design Phase, A/E shall be entitled to receive and shall be paid all fees stated herein through the Schematic Design Phase, together with reimbursable expenses incurred to date, less the amount of said fees and expenses paid by DFCM and received by A/E through said date. Should said termination occur during the Design Development Phase or any subsequent phase, A/E shall be entitled to receive and shall be paid the greater of: (i) all fees earned and reimbursable expenses incurred through the effective date of said termination, less said fees and expenses paid by DFCM and received by A/E through said date; (ii) the actual, reasonable cost to A/E and its Subconsultants (regardless of tier) of the authorized services provided, plus a profit thereon of 10%, plus reasonable reimbursable expenses incurred under this Agreement through the effective date of said termination, less said fees and expenses paid by DFCM and received by A/E through said date; or such other amount as agreed to by A/E and DFCM.

C. DEATH OR INCAPACITY. If the A/E transacts business as a sole proprietorship, the A/E's death or incapacity shall automatically terminate this Agreement as of the date of such event. Under these circumstances, neither the A/E nor the A/E's estate shall have any further right to perform hereunder and the DFCM shall pay the A/E or the estate shall be paid through the date of termination.

D. DELIVERABLES PROVIDED TO DFCM. Promptly after termination and payment of any sums owing the A/E, the A/E shall deliver all of the Deliverable Instruments of Services, including those in progress, to the DFCM as hereinbefore described.

E. RIGHT TO COMPLETE. Subject to the above termination provisions of this Agreement, DFCM shall have the right to complete the work or any portion thereof by itself or others, and to modify and/or use the A/E's work in part or in its entirety as hereinabove described.

ARTICLE XIII
GENERAL LEGAL REQUIREMENTS

A. SEVERABLE AGREEMENT. This Agreement is severable. Authorization to perform one of the design phases or activities under this Agreement shall not be considered as creating any obligation of DFCM to authorize any further phase(s) or activity(ies).

B. INDEPENDENT CONTRACTOR. A/E is an independent contractor and not an employee of DFCM or the State of Utah. A/E shall have no authorization, express or implied, to bind the State of Utah or DFCM to any agreement, settlement, liability or understanding whatsoever, nor to perform any acts as agent for the State of Utah or DFCM, except as specifically set forth in this Agreement.

C. THIRD PARTIES. Nothing contained in this Agreement shall create a contractual relationship or a cause of action in favor of a third party against the State of Utah and DFCM and/or A/E or its-Subconsultants at any tier.

D. AGREEMENT BINDING AND ASSIGNMENT LIMITATIONS. This Agreement shall be binding upon DFCM, A/E, and their respective partners, employees, agents, joint ventures, successors and assigns. Neither the performance of this Agreement, a right or claim, nor any part thereof including any monies to be paid, may be assigned by the A/E or DFCM without the prior written consent and approval of the other party. The DFCM may assign this Agreement to an institutional lender providing financing for the Project. In such event, the lender shall assume the DFCM's rights and obligations under this Agreement. The A/E shall execute all consents reasonably required to facilitate such assignment.

E. ENTIRE AGREEMENT AND AMENDMENT LIMITATION. This Agreement represents the entire and integrated agreement between the DFCM and the A/E and supersedes all prior negotiations, representations or agreements, either written or oral. This agreement may be amended only by written instrument signed by both DFCM and A/E.

F. NOTICES. Any notice required by this Agreement shall be served upon the recipient's designated representative by hand delivery at the last known business address, or by mail with "delivery confirmation" to the last known address. Notwithstanding any other provision of this Agreement, written notice shall also be deemed to have been duly served by verified use of a FAX system by using the known and operative calling number. Service by use of the FAX system is encouraged when timely notice will benefit the DFCM, A/E, or Subconsultant. Notice shall be considered complete and verified upon the sending and confirmation of delivery using the FAX system, if on the same day notice is also sent by registered or certified mail, return receipt requested, to the last business address known to the party giving notice, confirming the FAX delivery.

G. WAIVERS. No waiver by the DFCM or A/E of any default shall constitute a waiver of the same default at a later time or of a different default.

H. APPLICABLE LAW AND VENUE. This Agreement shall be construed in accordance with the laws of the State of Utah. Venue for any legal proceeding regarding this Agreement shall in the Salt Lake County, State of Utah.

I. AUTHORITY TO EXECUTE. The A/E and DFCM each represent that the execution of this Agreement and the performance thereunder is within their respective duly authorized powers.

IN WITNESS WHEREOF, the parties hereto have entered into this Agreement on the day and year first written above.

A/E: ______________________________

____
Signature Date

Title: ______________________________

____
Please type/print name clearly

State of ____________)
)
County of ____________)

On this ______ day of _____, 20____, personally appeared before me, ________________________, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the ________________ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

____
Notary Public

(SEAL)

My Commission Expires ____________

APPROVED AS TO AVAILABILITY OF FUNDS:

____
Financial Manager, Date
Div. of Facilities Construction
and Management

DFCM: DIVISION OF FACILITIES CONSTRUCTION & MANAGEMENT

____
______________ Date
Manager – Capital __________

APPROVED AS TO FORM:
May 25, 2005
By: ALAN S. BACHMAN
Asst. Attorney General

APPROVED FOR EXPENDITURE:

____
Division of Finance Date

(Name of Project)
DFCM Project No. ________

Attachment "A"

1. **BASIC SERVICES:** Basic Services Fee: $________. Construction Budget (FLCC): $__________ (See attached A/E's proposal dated __________ for schedule of A/E's and A/E's subconsultant's fees and further breakdown). **The following services are provided in the basic fees:** architectural, mechanical, electrical, structural, civil, landscape and acoustic design as required for the project. Services shall also include Value Engineering Session participation; meeting minute production and distribution; cost estimating; fire/water flow analysis; plan reviews with the Building Official, the Fire Marshall and the Health Department; Construction Procurement Phase services; travel as outlined in Item A below; document reproduction as outlined in Item B below; and Construction Period services as outlined in Item C below.

   A. Travel reimbursement requirements: As outlined in A/E's attached proposal.
   B. Document reproduction requirements (needs for review sets, bidding, construction, etc.):
      Note: Printing for use by design team in presentations and for coordination is included in basic services fee. As outlined in A/E's attached proposal.
   C. Construction Period site visits: As outlined in A/E's attached proposal.
   D. Record drawings: Amount of fee allocated to completion of Record drawings $_________________

   The Basic Services Fee is divided into the following percentages for the different phases of Work: schematic design - 15%; design development - 20%; construction documents - 40%; bidding - 5%; and construction closeout/warranty period - 20%.

   Exceptions to this list of basic services are: ____

2. **ADDITIONAL SERVICES / REQUIREMENTS:** The following additional services/requirements (i.e. hazardous material requirements, special inspection services, insurance requirements) will be provided as described and at the listed fee: ______________________ $__________________

3. **TOTAL FEE FOR AGREEMENT** (Total of Items 1 and 2) $__________________

4. **MILESTONES / SCHEDULE:** Required project milestones and A/E's project schedule.
   (See attached schedule of A/E's work plan):
   Design complete ready for bidding: ___________________
   Construction complete and ready for occupancy permit: ___________________

Attachment "B"

The A/E's Organization Chart is hereby identified and attached.

Attachment "C"

Any additional explanation of the A/E's response to the DFCM's submittal documents are hereby identified and attached.

Program Document

HUMANITIES BUILDING
Weber State University
Ogden, Utah
DFCM Project # 05027810

Weber State University
Review Signatures

We have reviewed the Program and warrant that it adequately represents our request for a facility to fulfill our mission and programmatic needs. All appropriate parties in the agency have reviewed it for completeness and accuracy.

Ann Millner — Date
President

Norm Tarbox — Date
Vice President for Administrative Services

Division of Facilities Construction and Management, State of Utah
Review Signatures

We have reviewed the Program, jointly prepared with the agency, for completeness and accuracy. These signatures do not necessarily represent an endorsement for the need of this requested space at this time.

Bill Bowen
Program Director, DFCM

Date

PARTICIPANTS

The following is a list of individuals and groups represented during the Programming Process.

Weber State University Facilities Management

Kevin P. Hansen, Facilities Management
Jim Harris, Construction Project Manager

State of Utah, Division of Facilities Construction Management

Blake Court, Program Director

Steering Committee

Mike Vaughan, Provost
Norm Tarbox, Vice President for Administrative Affairs
Carl Porter, Executive Director of Academic Support Services and Programs
June Phillips, Dean, Humanities
Al Talbot, Chair, Telecomm and Business Education
Randy Scott, Communication
Gary Dohrer, English and Literature
Gary Godfrey, Foreign Languages and Literatures
Warren Hill, Dean, Applied Technology

Program Architects and Consultants

Architecture	
Jill A. Jones, AIA	ajc architects
Merhdad Samie, AIA	ajc architects
Aid Korkut	ajc architects
Civil	
Kirk Bagley	Bowen Collins and Associates
Structural	
Chris Barker	Dunn Associates Incorporated
Mechanical	
Steve Wadsworth	WHW Engineering Incorporated
Win Packer	WHW Engineering Incorporated
Electrical	
Akbar Matinkhah	ECE Mechanical Electrical Consultants

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

1.1 College of Arts and Humanities Mission

The College of Arts and Humanities, the largest and the most diverse college in terms of faculty and programs, draws upon those strengths to foster a Liberal Arts education among the increasingly diverse student body of Weber State University. College programs provide students with rich learning opportunities in the arts, communication, languages, literatures, and writing, pivotal disciplines for life-long learning in the changing global environment.

Students pursuing liberal studies gain an understanding of humanities cultural and aesthetic heritage, develop abilities in critical thinking, and become informed world citizens. The Arts and Humanities faculty strives for excellence and relevance in curriculum so that students might aspire to the professions of the present and be equally capable of embracing the new specialties of the future.

Much of the curricula in the college incorporates an interdisciplinary focus or applied research to assist students in forging connections between theory and practice, professional and personal lives, work and leisure. Achieving these goals depends upon faculty members who continually pursue new knowledge in their disciplines through research and scholarship while serving the larger community with their commitment and expertise.

The College of Arts and Humanities is comprised of five excellent academic departments:

- English and Literature
  - English as a Second Language
- Communication
- Foreign Languages and Literatures
- Performing Arts
- Visual Arts

1.2 Vision Statements and Principles for the New Humanities Building

The following Vision Statements and Principles for the new Humanities Building were identified by the Steering Committee:

The new building will accommodate consolidation and cluster of faculty offices (for the identified departments) in one building.

The new building will have modern, high tech teaching space.

The new building will have student space for group/individual/study/community spaces.

The new building will be interdisciplinary, and provide spaces for faculty/students to interact.

The new building will be programmed and designed for flexible space and will be adaptable to new technology.

1.3 Summary of Existing Facilities and Program

The essential mission of this project is to replace existing Building 1 and Building 2 with a new, multi-level, state-of-the-art research/learning facility. The following users currently occupy these buildings:

Current Building 1 Occupants
- Foreign Languages and Literatures
- Geography
- Air Force ROTC

Current Building 2 Occupants
- Foreign Languages and Literatures
- Telecommunication and Business Education (TBE)
- Printing/Newspaper

The new Humanities Building will have the following occupants:

Department	Current Location
English and Literature	Social Science, Annex 2, Annex 8
Communication	Building 3, Union, and Library
Foreign Languages and Literatures	Buildings 1 and 2
Telecommunications and Business Education (TBE)	Building 2

Geography will be relocated to the vacated space of English in the Social Science Building.
Air Force ROTC will be relocated to an Annex Building.
Printing will be relocated to the Stores and Receiving Building.

Department	Current Location	Square Feet Presently Used
English and Literature	Social Science	10,944 Net Square Feet
	Annex 2	1,378 Net Square Feet
English as a Second Language (ESL)	Social Science	1,244 Net Square Feet
	Annex 8	2,512 Net Square Feet
	Sub Total	*16,078 Net Square Feet*

Communication	Building 3	8,976 Net Square Feet
	Union	1,561 Net Square Feet
Multi Media Services	Library	5,167 Net Square Feet
	Sub Total	*15,704 Net Square Feet*
Foreign Languages and Literatures	Building 1	6,319 Net Square Feet
	Building 2	1,333 Net Square Feet
	Sub Total	*7,652 Net Square Feet*
Telecommunications and Business Education (TBE)	Building 2	5,437 Net Square Feet
	Sub Total	*5,437 Net Square Feet*
Total Existing Square Feet Presently Used		**44,871 Net Square Feet**

1.4 Project Justification-New Humanities Building

Existing Building 1 and Building 2 are two of the original buildings at Weber State University. These buildings were constructed in 1954, and have had minimal upgrades over the years. The buildings have antiquated mechanical and electrical systems, are not completely ADA accessible, contain asbestos, and are seismically unsafe for their current occupancy classification of A-3. In summary, the buildings have out-performed their life expectancy, and the cost to renovate/remodel would not be practical.

The existing Building 1 is approximately 15,533 gross square feet, and Building 2 approximately 16,894 gross square feet, for a total of 32,427 gross square feet on 1 level. The new Humanities Building will have the opportunity of multiple levels, providing a larger building in the same amount of space, yielding a greater use of prime real estate located in the center of campus.

The Humanities Departments of English, Communication and Foreign Languages and Literatures are currently located in 8 different buildings on campus. Part of the Vision and Mission for Humanities is to provide space that is interdisciplinary, where faculty, staff and students from different departments can interact. The new Humanities Building will provide an opportunity for 4 departments to be located in one building, allowing for this interaction and interdisciplinary approach to learning. Clustering humanities departments of the college also is more effective to administer, to facilitate cooperation and staff assignments, to share facilities such as conference rooms, large meeting rooms, etc. Currently, three humanities disciplines are located in four separate buildings (Social Sciences, Buildings 1, 2, 3). A new building is a propitious opportunity to bring together these three related disciplines that report to one dean/college.

There is also the opportunity for shared spaces in the new building that are now currently duplicated across campus. The 4 departments located in the new Humanities Building will share the following spaces:

- Faculty Work Rooms
- Faculty Break Rooms/Lounge
- Conference Rooms
- Adjunct Offices
- Student Lounges

This approach to space sharing has resulted in a reduction of required square footage per each department.

All departments in Arts & Humanities underwent external program review in Fall of 2005. Visual and Performing Arts were recognized for the quality of their facilities. However, the humanities departments all had listed among weaknesses the lack of adequate physical plant for student classrooms and the lack of specialized technical learning centers.

The humanities departments have no dedicated space for special events, invited guest speakers, large or combined class presentations. They must always search elsewhere for availability which results in inconvenient times and locations and less than ideal audiences. Having a dedicated space in a Humanities Building will promote and enhance curricular and co-curricular events.

1.5 Project Description- New Humanities Building

1.5.1 Total Facility Summary

The new Humanities Building will be a new facility consisting of 85,700 gross square feet (GSF). It will consist primarily of classroom/computer lab/teaching spaces and administration spaces. The project is currently programmed at:

Total Administration Spaces	20,239 NSF	31,137 GSF
Classrooms/Computer Labs	35,465 NSF	54,562 GSF
Total	**55,704 NSF**	**85,698 GSF**

An efficiency ratio of 65% has been utilized for this Program Document.

SPACE SUMMARY

Administration Spaces

English and Literature	6,998 NSF	10,766 GSF
Foreign Languages and Literatures	2,652 NSF	4,080 GSF
Communication	3,042 NSF	4,680 GSF
Telecommunications and Business Education	2,043 NSF	3,143 GSF
Administration Support Spaces (Shared)	5,504 NSF	8,468 GSF
Total Administration Spaces	**20,239 NSF**	**31,137 GSF**

Administration Space is made up of the following:

Administration Space	
Offices (Enclosed)	93 Total
Offices (Open Work Stations)	15 Total
Shared Adjunct Offices (Open Work Stations)	24 Total
Storage Rooms	4 Total
Tutoring Rooms	3 Total
Conference Rooms	2 Total
Small Adjunct Meeting Rooms	3 Total
Shared Faculty Work Rooms	3 Total
Shared Faculty Break Rooms	2 Total
Shared Student Lounge	1 Total

Classroom/Computer Lab Space is made up of the following:

Classroom/Computer Lab Space	
200 Person Auditorium	1 Total
40 Person Classroom	4 Total
35 Person Classroom	4 Total
30 Person Classroom	10 Total
25 Person Seminar	9 Total
40 Person Specialty Lab	3 Total
30 Person Specialty Lab	1 Total
Debate Special Use Lab	1 Total
34 Person Writing Center	1 Total
32 Person General Computer Lab	1 Total
24 Person General Tutoring	1 Total

Additional Specialty Areas
Electronic Media Production
TBE Audio Visual Recording Room

1.5.2 Project Cost Summary for New Humanities Building

Site Summary for Construction based on October 2005 Construction Costs

Site Costs		$ 960,600
Sub Total		*$ 960,000*
General Conditions	7.0%	$ 67,252
Bonding	1.0%	$ 9,606
Overhead and Profit	5.0%	$ 48,030
Sub Total		*$ 1,085,478*
Design Contingency	10%	$ 96,060
Total Site (Construction) October 2005		**$ 1,181,538**

Building Summary for Construction based on October 2005 Construction Costs

Architectural		$ 5,046,115	
Structural		$ 3,401,938	
Mechanical		$ 2,555,375	
Electrical		$ 1,569,875	
Sub Total		*$12,573,303*	
General Conditions	7.0%	$ 880,131	
Bonding	1.0%	$ 125,733	
Overhead and Profit	5.0%	$ 628,665	
Sub Total		*$14,207,832*	
Design Contingency	10%	$ 1,257,330	
Total Building (Construction)		**$15,465,162**	
Total Building and Site		**$16,646,700**	**$194/SF**

Inflation has not been included and will be calculated by DFCM for Total Project Costs

1.5.3 Project Schedule

The overall proposed Project Schedule is as follows:

Design	March 2006 –December 2006
Start of Construction	March 2007
Construction Substantial Completion	July 2008
Occupancy	August 2008

1.5.4 Project Procurement

DFCM will select, through their Value Based Selection Process, a CM/GC (Construction Manager/General Contractor) to provide construction for the new Humanities Building. Ideally, this selection will take place during the early design phases of the project.

1.6 New Chiller

As part of the Programming effort for the new Humanities Building, the programming team was asked to also provide programming services for a new Chiller Building and Plant for Weber State University. A complete Chiller Feasibility Report is included in the Appendix (Section 7) of this Program Document. A complete program for the new Chiller Building is included in Section 6 New Chiller.

Included in Section 7 Appendix of this document is the **Weber State University Central Chilled Water Plant and Distribution System Study.** This study focuses on the existing and proposed chilled water systems for Weber State University. The study identifies existing chilled water distribution conditions, new and existing cooling requirements, and provides recommendations for the construction of a new central chilled water plant. The study will provides recommendations for new upgrades to the existing chilled water distribution systems. Capacities of existing and future buildings were taken from the Weber State University master plan. These capacities and totals can be found in Section 7 Appendix, **Weber State University Central Chilled Water Plant and Distribution System Study,** Sections 2 and 3.

Weber State University originally began as Weber State Academy in 1889. It was made a State Junior College in 1933. Weber State College was updated to University status in 1991. Weber State University has since experienced a steady growth of students and educational facilities. The University is comprised of thirty six (36) main on-campus buildings, and ten (10) auxiliary buildings. Among these buildings, twenty one (21) on-campus buildings are connected to the campus Central Chilled Water Plant. The study focuses on the cooling requirements of the existing buildings, future planned campus buildings, and projected load increases. All discovered and known information has been summarized and the findings incorporated into the design of a new Central Chilled Water Plant.

The following are the main concerns and recommendations for improving the Existing Chilled Water Distribution System and the construction of a new Future Central Chilled Water Plant. (All sections referenced are sections within the document located in Section 7 Appendix):

1. The capacities of the existing three chillers and piping are adequate to handle the existing connected demand. See Section 3.4. However, the existing campus pumping system has reached its' operating limits. Pumps must operate at full capacity to meet current campus needs, without adequate back-up. If a primary pump is lost, the campus capacity is reduced by 50% of one chiller. This could be as much as 625 tons. If a secondary pump is lost, the entire campus cooling capacity will be reduced by 50%.

2. The capacities of the existing three chillers, cooling tower and piping are adequate for the combined existing load and the projected summer 2006 load as long as all three chillers are operating. See Section 3.4. Pumping system will be inadequate as it is currently operating. A higher chilled water Delta T needs to be used to compensate for the lack of pump capacity at future peak demands.

3. The capacities of the existing three chillers, pumps, cooling tower and piping are <u>not</u> adequate for the combined existing connected load, projected summer 2006 load and the future projected load. See Sections 3.3 and 3.4.

4. The new projected central chiller plant should be designed so that a back-up chiller or combination of chillers will always provide the capacity to cover the connected load.

5. Two of the existing chillers are manufactured by The Trane Co, the third chiller by Carrier Corp. The Trane chillers are in good condition and should be relocated to the new proposed central chiller plant. The Carrier chiller is beyond ASHRAE'S recommended service life and should be removed from service.

6. The different chiller combinations that are evaluated for the new central chiller plant in Section 5.2 are as follows:

Combination A:
1) Chiller #1 – New 1500 Ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1500 Ton with optional VFD
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination B:
1) Chiller #1 – New 2000 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1250 ton
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination C:
1) Chiller #1 – New 1500 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1250 ton with optional VFD
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination D:
1) Chiller #1 – New 2000 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1500 ton
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination E:
1) Chiller #1 – New 2000 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1700 ton
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination F:
1) Chiller #1 – New 1700 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1700 ton with optional VFD
4) Chiller #4 – Existing 650 Ton Trane Unit

7. Modify the campus chilled water loop as recommended in Section 4. This includes the following:
   a. Incorporate a primary chilled water circulation loop for each chiller.
   b. Provide a secondary loop with new pumps and variable frequency drives. Incorporate the campus loop pipe section modifications as part of the secondary loop.
   c. Provide a separate "decoupled" chilled water loop for the skybox and its' associated loads. Provide a plate and frame heat exchanger and associated pumps and specialties in the old chiller plant room to serve this loop.

8. Provide a new plate and frame exchanger to provide free cooling by utilizing condenser water from the cooling tower without activating the chillers.

9. Provide all new chilled and condenser water pumps with stand by pumps for the chilled water and condenser water systems.

10. Provide an automated control system to match a sequence of control approved by WSU. An example of a sequence is as follows:
    a. The first stage of cooling when the outdoor temperature is below 60 degrees F, shall be provided by the "Free Cooling" ie. plate and frame exchanger and the cooling tower. This stage of cooling shall be provided until the return water temperature can no longer be maintained. At this point, the "Free Cooling" shall be terminated and the lead chiller shall start.

    b. The lead chiller shall start and maintain operation until the return water temperature continues to rise at which time a return water temperature controller (adjustable) will start the other chillers depending on the combination recommended or approved by WSU.

11. The existing five cell cooling tower is not large enough to handle the combination of the existing connected load, the projected summer 2006 load, and the future projected load.

12. Provide a refrigerant detection, evacuation and personnel safety system. See Section 6.4.

13. Design engineers shall use WSU and DFCM standards to Architects and Engineers defining design criteria, equipment approval, etc. for the new central chiller plant.

14. The new chilled water distribution system and condenser water system within the new central chiller plant should be balanced by an independent testing and balancing agency after the new systems are installed.

15. Based on Sections 3 and 5, we recommend for the new central chilled water plant one of the following chiller combinations with the associated equipment listed below:

    Combination A
    1) Chiller #1 – New 1500 ton with VFD
    2) Chiller #2 – Existing 1250 Ton
    3) Chiller #3 – New 1500 ton with optional VFD

4) Chiller #4 – Existing 650 Ton

Combination F

1) Chiller #1 – New 1700 ton with VFD
2) Chiller #2 – Existing 1250 Ton
3) Chiller #3 – New 1700 ton with optional VFD
4) Chiller #4 – Existing 650 Ton

a. Central Air Eliminator – Remove all existing building air eliminators.
b. Central expansion tanks – Remove all existing building expansion tanks.
c. Four inline mounted, constant volume chilled water primary loop circulating pumps for the chillers.
d. Three main campus base mounted secondary distribution pumps with variable frequency drives.
e. Three main condenser water pumps with variable frequency drives.
f. Plate and frame exchanger for free cooling with and automatic change over to mechanical cooling.
g. Cell addition to the existing cooler tower.
h. Automation System.
i. Re-using the existing 24 inch condenser water piping as the new chilled water piping distribution system. See Existing Campus Distribution Map Section 4.2 C.

The recommendations included in this report are based off of WSU master plan information dated September 2005. Because many assumptions have been made concerning future buildings, i.e. future loads, locations, etc. Because of change in the future, as individual building designs are refined, this report shall only be used as a guide and not a finished design for future buildings. WHW Engineering, Inc. assumes no design liability for future modifications to the existing campus plan. Equipment sizing, pipe sizing, loop modifications, field verification of existing conditions, and all other associated recommendations are the responsibility of the future design teams to verify, calculate, and design at the time of the associated future projects.

Costs for Chiller Project (October 2005) **$5,639,844.00**

See Section 6 New Chiller for complete narrative on the New Chiller Building

2.0 SITE ANALYSIS

2.6 PROPOSED SITE CONSIDERATIONS

2.7 SELECTED SITE PLANNING OPTION 4

2.0 SITE ANALYSIS

2.1 SITE LOCATION

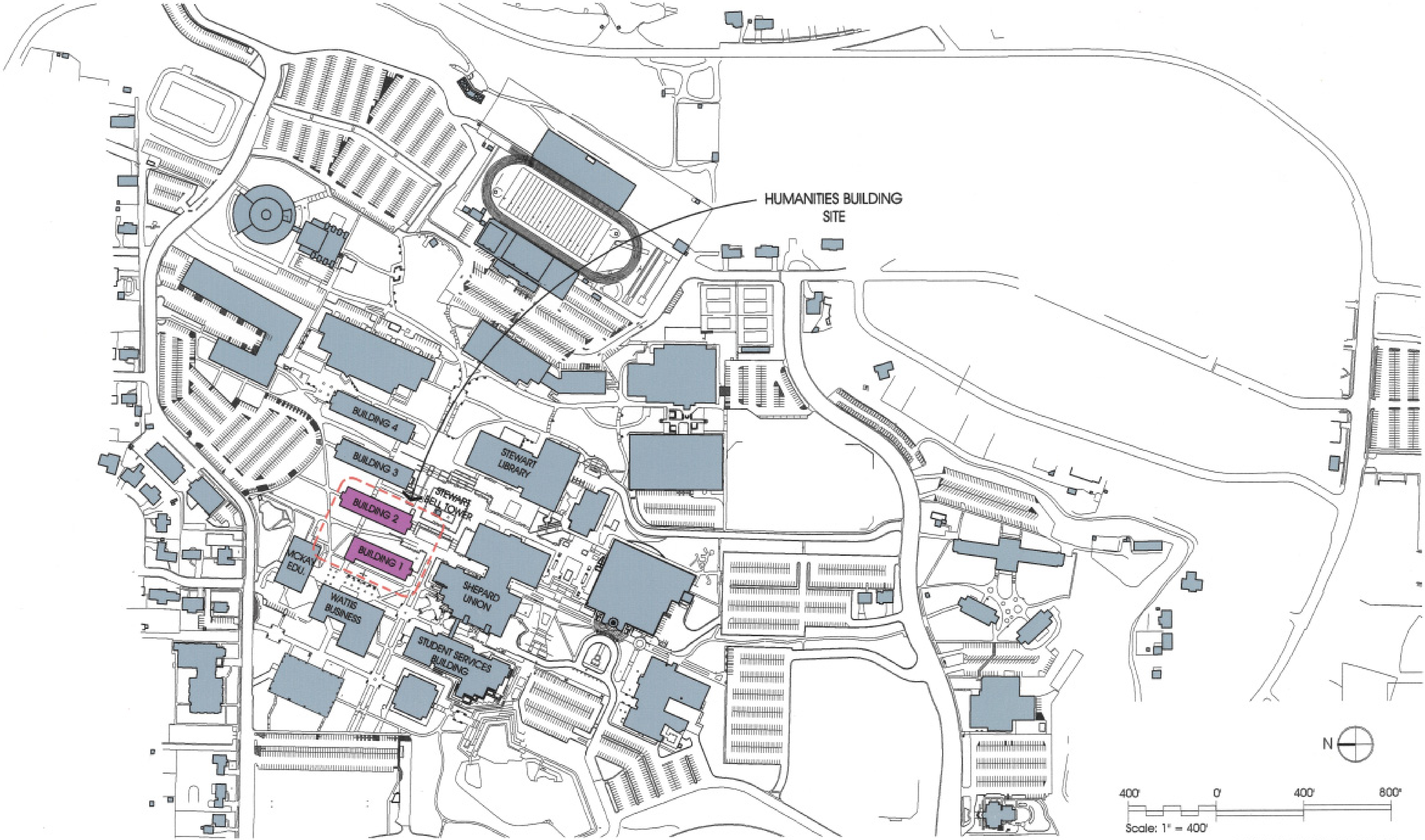
2.1.1 MAIN CAMPUS LOCATION

Weber State University is a four-year institution of higher education located in Ogden, Utah. Its focus is providing undergraduate and selected masters programs of the highest educational quality. WSU offers over 200 separate degrees and programs—the largest and most comprehensive undergraduate program in the State of Utah. The University has a student body of 19,000 drawn predominantly from the Wasatch Front, but also includes students from 50 states and 34 foreign countries. Weber State University takes pride in its student-centered environment for learning and believes that quality undergraduate education is founded upon close associations between faculty and students.

The proposed location for the new Humanities Building is the current location of Buildings 1 and 2. Buildings 1 and 2 are located in the center of campus, just north of the Central Quad Area and Stewart Bell Tower.

To the east of Buildings 1 and 2:	Buildings 3 and 4 Stewart Library Building
To the south of Buildings 1 and 2:	Stewart Bell Tower Shepard Union Building
To the west of Buildings 1 and 2:	Student Service Center Building Wattis Business Building McKay Education Building
To the north of Buildings 1 and 2:	Parking and Open Space

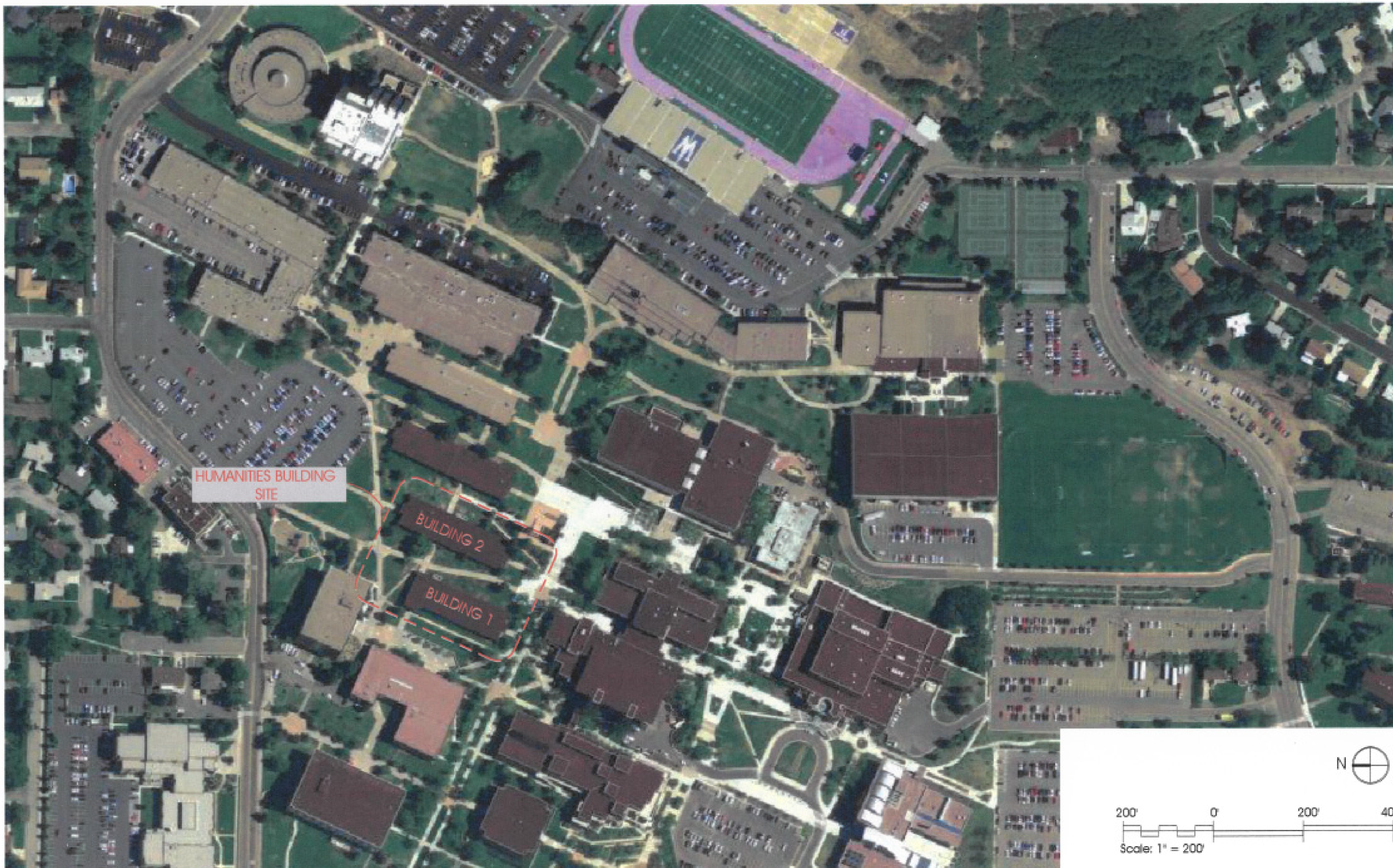
See the **Overall Campus Map** and **Aerial Photo.**



ajc architects

OVERALL CAMPUS MAP
Humanities Building

Program Document



ajc architects

AERIAL PHOTO
Humanities Building

Program Document

2.1.2 CENTRAL QUAD MASTER PLAN

The Central Quad Plaza serves as the heart of the Weber State University Campus and is the location of the most significant campus landmark, the Stewart Bell Tower. The Stewart Bell Tower is located directly adjacent to the Shepard Union and the Stewart Library, two main centers of student activity. The new Humanities Building will be located just northwest of the Stewart Bell Tower; creating an opportunity to become an additional center for student activity.

In late December 2003/ early January 2004, Weber State University developed a Master Plan document for improvements to the Central Quad Plaza. This Master Plan studied three different solutions/concepts for improvements to the Central Quad, of which a fourth hybrid solution was developed.

In developing the site design for the new Humanities Building, it is critical for the design architect to incorporate and support the main design concepts that were developed in the Central Quad Master Plan Document. These concepts are specifically for the Central Quad, but have design implications for the new Humanities Building which will create the northwest "edge" of the improved Central Quad.

Central Quad Main Design Concepts

- Central Quad Plaza to provide a more direct path at the northeast corner, as this is the main circulation path between classes.
- Shade and cooling to be provided—with additional trees located at the new water feature.
- ADA access through the entire Central Quad area must be provided.
- Central Quad Plaza area should be simple to maintain.
- The Central Quad Master Plan proposes a study for the space between the new building on the north (new Humanities Building). A corridor of no greater than 80' is proposed in the Master Plan document.
- The water feature should be successful and interesting with and without water. (It will be drained in the winter months.)
- The raised area around the Stewart Bell Tower should discourage class change traffic, but encourage student interaction for rest, study and informal gathering.
- Emergency vehicular access through the site needs to be incorporated.

The lower plaza area was planned to respond to the Union and serve as an active zone, connecting the new Union entrance, and the future entrance to the new Humanities Building that is replacing Buildings 1 and 2. This zone of activity will include a designated area for seating at its east side where a new water feature will also be constructed. Entries to the new Humanities Building from the Central Quad Plaza will feed the active zones and relate to Plaza features and axis. If possible, the circulation zone between the new Humanities Building and the replacement building for #3 and #4 should be no greater than 80' in width with a building height of 20' – 24' directly adjacent to the corridor. The building height to circulation path width has been identified as an important relationship in the Central Quad Master Plan Document, as it will frame the Stewart Bell Tower, creating a powerful "gateway" from the parking lot from the north.

2.2 EXISTING SITE CIRCULATION

2.2.1 EXISTING VEHICULAR ACCESS

Vehicular access to the new Humanities Building would be from Harrison Boulevard to Dixon Drive to Edvalson Drive to Parking Lot A-2 located to the north of the site, (north of existing Buildings 1 and 2). There is also parking available at nearby Lots A-4 and A-5 (located to the east) and Lot A-1 (located to the west of the proposed site. The primary vehicle access to the site will be from the north, Lot A-2. This Lot A-2 is located directly adjacent to the new Humanities Building site.

The new Humanities Building location is not eliminating any existing parking on campus. It is a replacement of the Buildings 1 and 2, and has no impact on the current number of existing parking stalls. Therefore, additional parking for the new Humanities has not been provided.

Accessible stalls currently existing in Lot A-2 will be maintained as accessible stalls once Buildings 1 and 2 are replaced with the new Humanities Building.

It has been determined that a traffic study is not required during the Programming phase of this project.

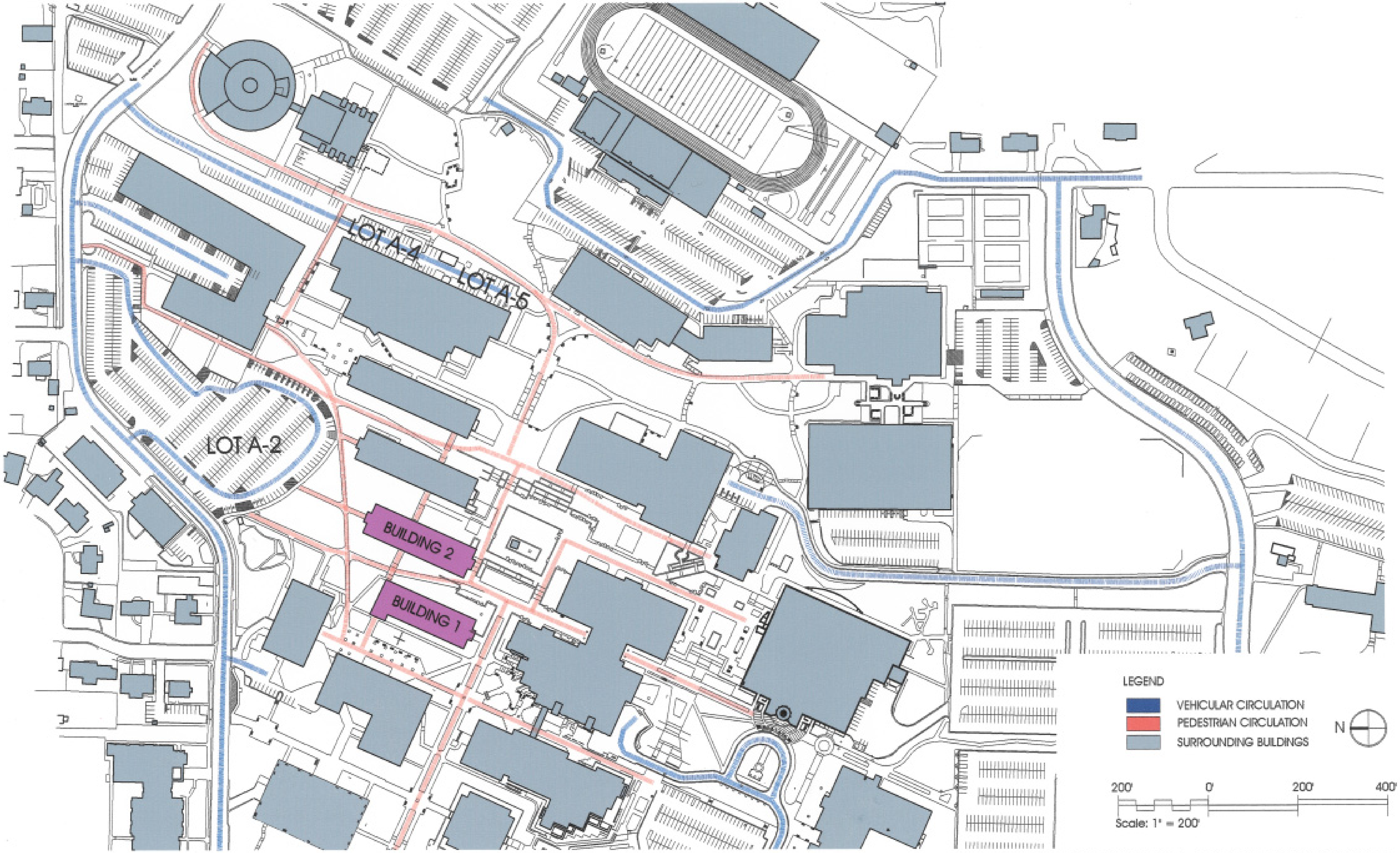
2.2.2 EXISTING PEDESTRIAN ACCESS

The pattern for pedestrian circulation around the existing Buildings 1 and 2 is quite complex, with pedestrians having the options of entering both buildings from all four directions. The main campus circulation pattern takes place around the Central Quad area. This relationship of main campus circulation to the new Humanities Building will be critical in the site location for the new Building.

2.2.3 EXISITING SERVICE AND EMERGENCY ACCESS

Service vehicles and emergency access currently utilize Lot A-2 to access Buildings 1 and 2. It is anticipated that this relationship of emergency access and service access will be maintained with the new Humanities Building location.

See the **Existing Circulation-Pedestrian and Vehicular** drawing.



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EXISTING CIRCULATION - PEDESTRIAN AND VEHICULAR
Humanities Building

Program Document

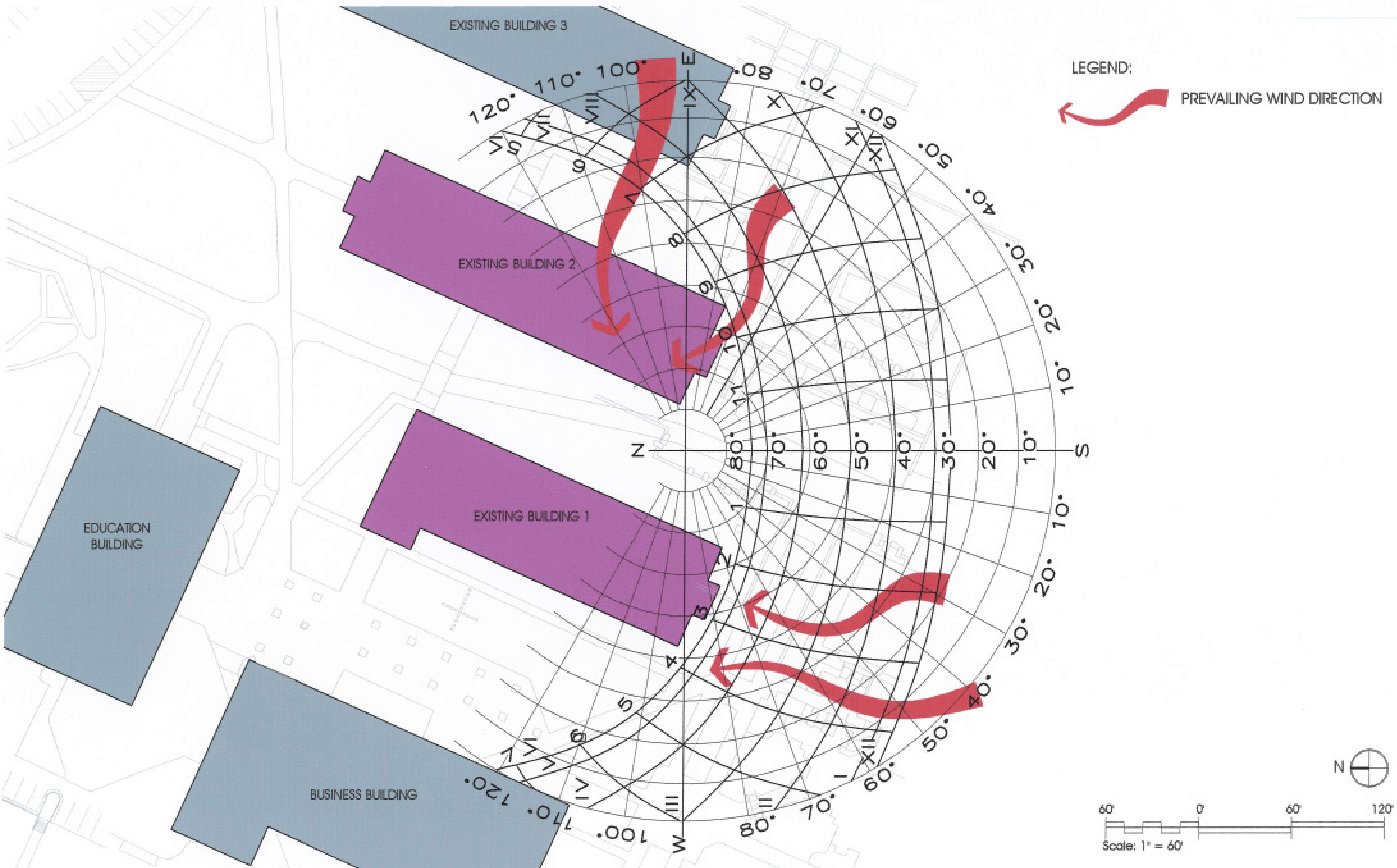
2.3 EXISTING SITE CONDITIONS

2.3.1 CLIMATES, VIEWS AND KEY OPEN SPACES

Climate

The climate of this site (Ogden) ranges from winter low temperatures of 5-25 degrees F to summer lows of 70 degrees F to highs of over 100 degrees F. However, typical relative humidity is low, ranging from 15-30%. In general, the prevailing winds will come from the south (both southwest and southeast), and winter storms approach from the west. There are several months during the year where the micro-climate on the site is not conducive to outdoor activity. Located on the east "bench" of the northern Wasatch Front, the site will typically see substantially more snow than the Ogden area. There are also unique canyon winds from the east that create very cold conditions during the winter. For these reasons, protected exterior spaces will be critical in working with the climate of the site.

See the **Solar Exposure and Prevailing Winds** map



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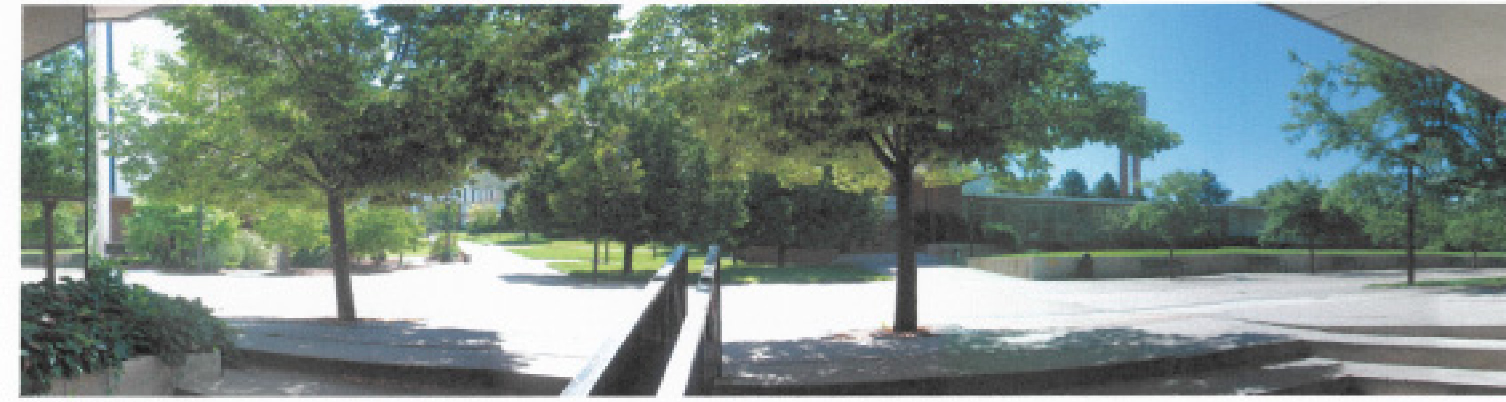
SOLAR EXPOSURE AND PREVAILING WINDS MAP
Humanities Building

Views of the Site

The proposed site for the new Humanities Building is currently occupied by existing Buildings 1 and 2. Both of these buildings, built in 1954, are 1 story masonry buildings.

See the following **Views Into the Site** photos for views into the site and of the existing Buildings 1 and 2.



VIEW #1

VIEW #2

VIEW #3

N

300' 0' 150' 300'

Scale: 1" = 150'

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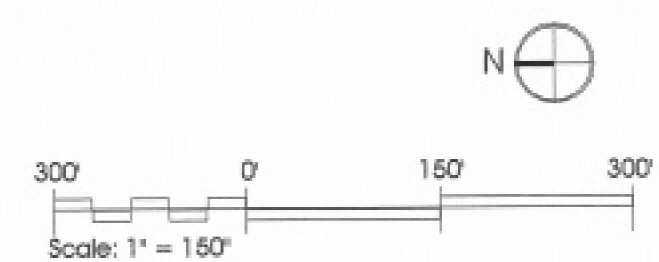
VIEWS INTO THE SITE
Humanities Building

VIEW #4

VIEW #5

VIEW #6



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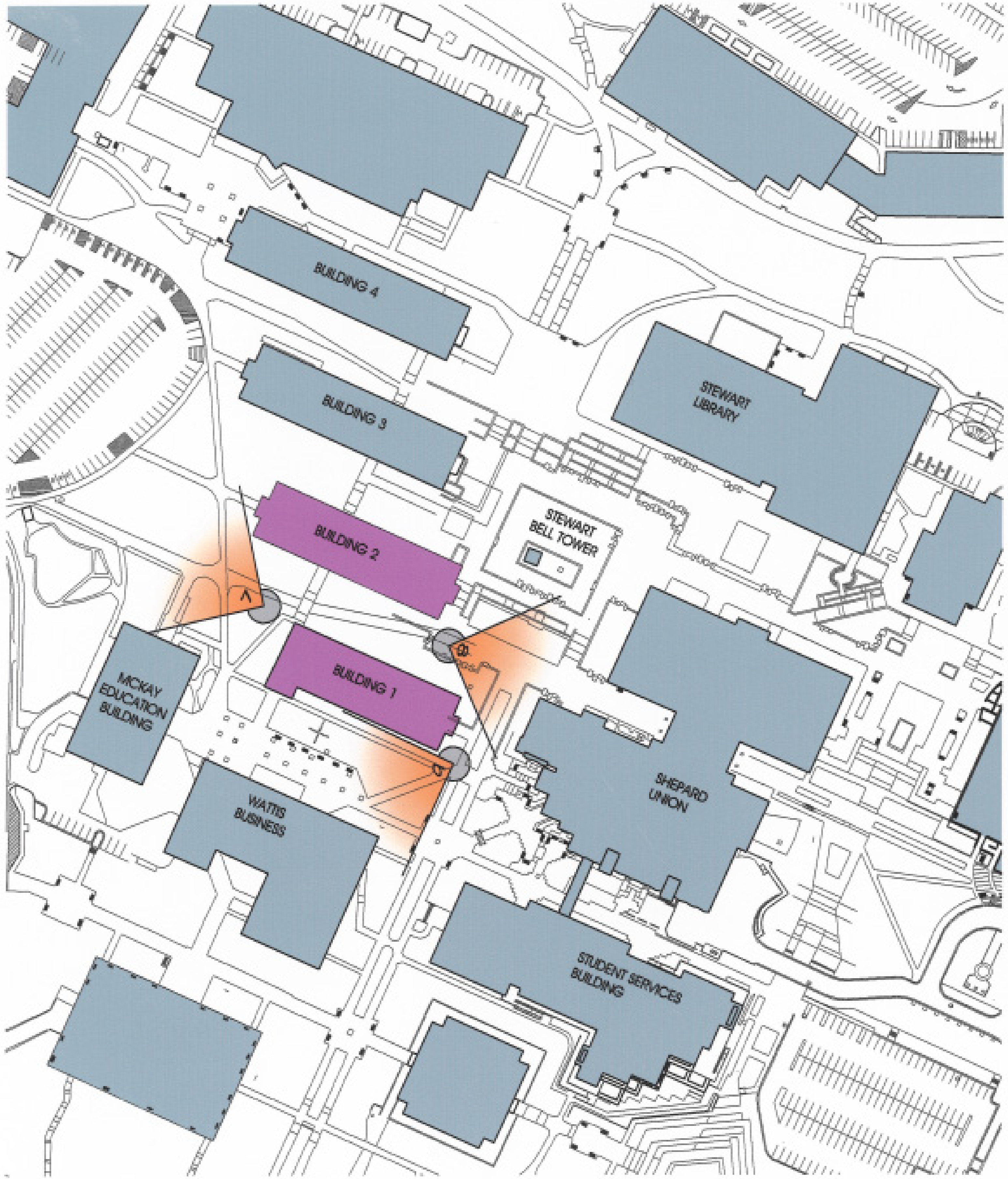
VIEWS INTO THE SITE
Humanities Building

Program Document

Views From the Site

The proposed building site for the new Humanities Building offers spectacular views of the Ogden Valley to the west and the northern Wasatch Front to the north, east and south. Views from the site to the north and east foothills are spectacular and panoramic. The location of the new Humanities Building will not have a significant impact on the view corridors of any existing buildings at the present time. Nor should it impact the replacement building for Building 3 and 4, since that building will be located further up the sloped site.

See the following **Views From the Site** photos for views from the site to adjacent areas.



VIEW #7

VIEW #8

VIEW #9

N

300' 0' 150' 300'
Scale: 1" = 150'

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VIEWS FROM THE SITE
Humanities Building

Program Document

VIEW #10

VIEW #11

VIEW #12

N

300' 0' 150' 300'

Scale: 1" = 150'

VIEWS FROM THE SITE
Humanities Building

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Program Document

Key Open Spaces/Outdoor Gathering Areas
Site Options developed for the new Humanities Building have identified a key open space corridor between the new building and the future replacement building for Buildings 3 and 4. Maintaining this view corridor from the north parking Lot A-2 to the Central Quad Area will help frame the Bell Tower, and enhance the north –south pedestrian corridor.

Even with Utah's snowy winter climates, outdoor gathering spaces can be quite pleasant in the spring-summer-fall months if designed appropriately. Small areas of hardscape combined with landscaped areas with overhead protection from the summer sun, should be provided for outdoor gathering areas.

2.3.2 GEOTECHNICAL INVESTIGATION REPORT

A geotechnical report has not been provided during Programming and will need to be completed prior to the Design Phase.

Once the final building size, configuration, structural system, number of levels above and below grade, and column loads have been defined in more detail, the project geotechnical consultant shall provide guidance on the following design criteria as well as any other criteria deemed by the geotechnical consultant to be important.

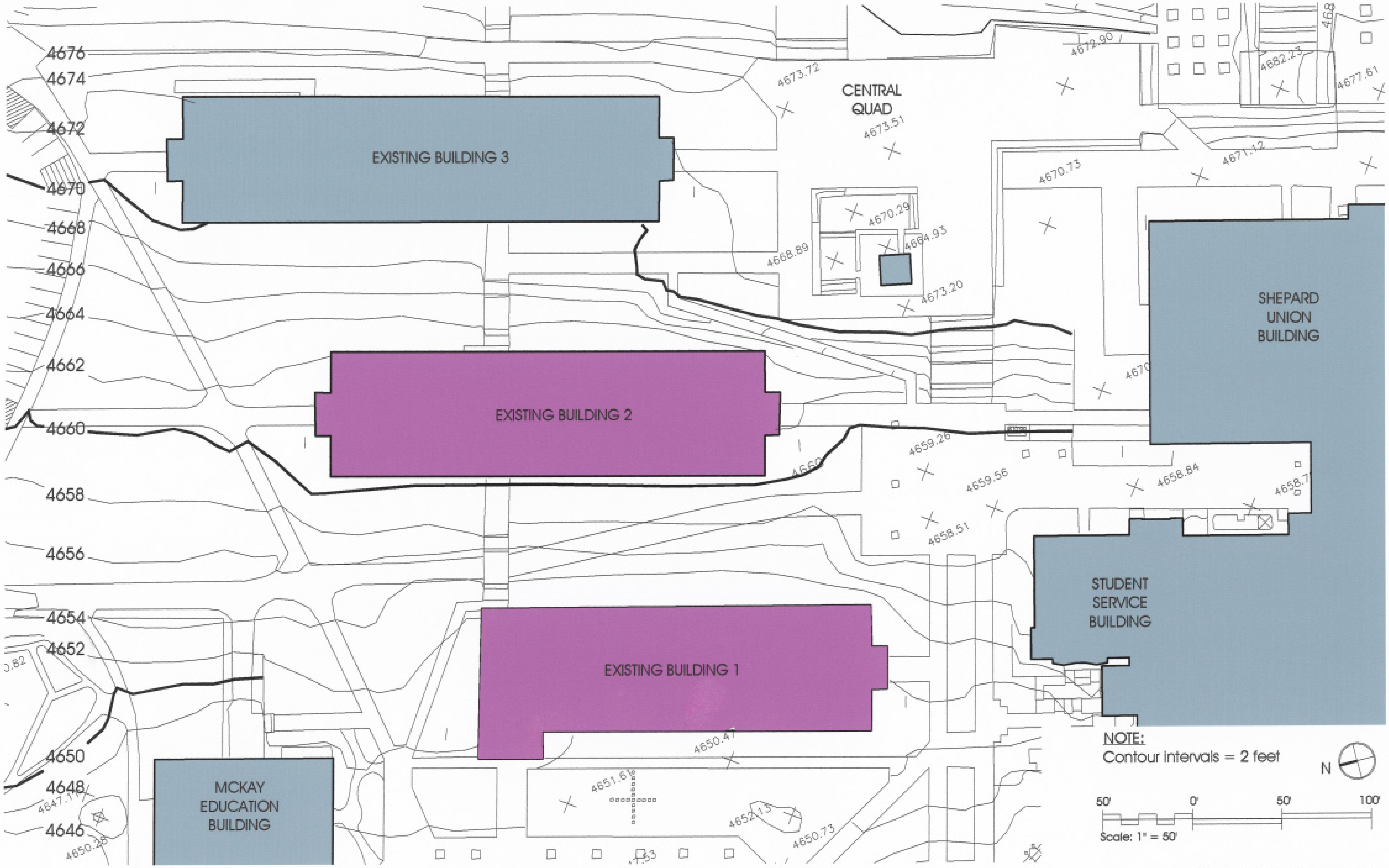
- Soil bearing capacity
- Structural fill requirements
- Potential differential settlements
- Potential for expansion or collapse of soils due to moisture changes
- Liquefaction potential
- Groundwater characteristics and restrictions
- Seismic considerations, coefficients, fault traces, etc.
- Lateral bearing pressures – active and passive
- Alternate foundation systems
- Pavement sections

2.3.3 TOPOGRAPHIC SURVEY

Prior to the start of design, a topographic survey of this site will be contracted by the State of Utah, Division of Facilities Construction and Management. It is anticipated that this survey will document all existing conditions of the site including surface and subsurface improvements. This survey will be made available for use during the design and construction phases of the project.

Weber State University has provided existing topography for use in the Program document. In general, the site slopes from east (high side) to west (low side), with approximately 18'-20' of fall across the site.

See the following **Existing Topography Plan.**



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EXISTING TOPOGRAPHY PLAN
Humanities Building

2.3.4 ENVIRONMENTAL IMPACT ISSUES

Buildings 1 and 2 may have asbestos and asbestos containing materials. During the design phase of the project, the method of abatement and disposal of these materials will need to be determined as part of the demolition plan for Buildings 1 and 2.

There are no additional anticipated environmental impact issues anticipated with the design and construction of the new Humanities Building.

2.3.5 DISTANCE TO THE NEAREST KNOWN SEISMIC FAULT

It appears that the fault runs along Skyline Drive along the east side of the campus. Buildings 1 and 2 are located approximately 1/4 mile from this fault.

2.4 UTIITIES

2.4.1 EXISTING/PROPOSED NEW SITE UTILITIES AND CAPACITIES

Specific utility sizes and capacities are available from Weber State Facilities Management. It is the responsibility of the Design Team to fully investigate all existing utilities and confirm all specific information provided in the Programming Document.

Site

The location of the proposed Humanities Building is located east of the existing Education Building and west of Building 3. The site slopes down from southeast to northwest and is currently developed with two existing buildings, Building 1 and Building 2. The existing buildings run north/south between the Education Building and Building 3. Site work for the Humanities Building will require demolition of Buildings 1 and 2. The remainder of the existing building surrounding the site will be retained and protected during construction. The site will also require demolition of existing sidewalk, maintaining an existing utility tunnel, and relocating existing utilities prior to construction of the Humanities Building.

Utilities Located in the Tunnel

Beneath Buildings 1, 2, 3, and 4 is a utility tunnel approximately 12-feet in width. Between Buildings 2 and 3 an additional smaller tunnel approximately 5-feet in width connects to the 12-foot wide tunnel and runs southeast. These tunnels generally enclose utility lines from the central plant such as steam, condensate and chilled water; along with power, data, communications, cable, control, natural gas and domestic water line for the site. The larger tunnel that runs beneath Building 1 and 2 and the utilities located inside the tunnel will be required to be retained and protected with the construction of the new Humanities Building.

Gas

A 4-inch, 4 psi natural gas line is located in the tunnel and will be required to be retained and protected along with the tunnel. The gas line appears to serve Building 1, 2, 3, and 4 as well as a 4-inch gas line that runs in the 6-foot tunnel between Building 2 and 3. Any new gas service for the Humanities Building could be serviced from this gas line.

Sanitary Sewer

An existing sanitary sewer line runs parallel to the existing utility tunnel on the south side of the tunnel and services Buildings 1, 2, 3 and 4. Both the tunnel and the sewer line are located beneath Building 1, 2, 3 and 4. The sewer slopes from east to west until it reaches the west side of Building 1 and then slopes to the northwest. This sewer line will need to be relocated while maintaining service to Buildings 3 and 4 and provide new service to the Humanities Building. To accomplish this, a new sewer line is proposed to run parallel to the existing sidewalk located on the north side of Buildings 1, 2, 3, and 4. This route would require the sewer to cross beneath the 4-foot wide tunnel on the west side of the new Humanities Building and would provide options for servicing the new Humanities Building and any future redevelopment of the ground currently occupied by Buildings 1 and 2. In order to maintain sewer service for Buildings 3 and 4, the sewer would extend from the new sewer line parallel with the sidewalk and run south between the new Humanities Building and Building 3. The line would be required to route beneath the existing 12-foot tunnel and connect to the existing sewer line on the south side of the tunnel. Sewer piping shall be cast iron. No-hub piping is not allowed underground. Provide cleanouts as required by code.

Water

The domestic cold water is fed from building #4 through the utility tunnel. The existing cold water main is 3" from building #4 to building #3, and reduces to 2" from building #3 to building #2. Design team shall evaluate line size and determine if the domestic water line size needs to be increased based on number and type of fixtures. Culinary water and fire water services for the new Humanities Building could possibly be serviced by connecting to the existing 10-inch culinary water main located adjacent to the south side of the proposed building location.

Underground water service piping shall be type K wrapped copper and enter the building into a pressure reducing station and main building shut-off valve. All interior above grade water piping shall be type L copper. All culinary hot and cold water piping shall be insulated.

Water PRV station shall reduce upstream water pressure to 60 PSIG (adj.) down stream pressure. Provide water meters for culinary hot and cold water at this building. Flow meters shall measure instantaneous flows (in gpm), as well as cumulative flows (in gallons). Flow meter shall have a manual reading at the building, as well the ability to communicate readings via the central control system.

Fire riser shall be tied into existing fire line at building exterior.

Storm Drainage

The proposed building site is surrounded by an existing storm drain; 8-inch concrete lines are located adjacent to the proposed building both on the east and west side; a 12-inch concrete line is located on the north side and a 15-inch line is located on the south side. The proposed roof drain services should be able to connect to these existing lines. Primary and secondary roof drain system shall be provided. Roof drains shall be tied into campus storm drain system.

Steam and Condensate Piping

Steam and condensate piping from the central plant are routed through the tunnel beneath buildings 1 and 2. The high pressure steam branches off to feed the Union Building at the junction just east of Building #2. The Union building kitchen equipment requires steam service year round. Steam piping replacement systems shall be designed to minimize shut down time for the Union building.

All the tunnel piping beneath the Humanities Building shall be replaced and re-connected at the junction east of the Humanities Building. This includes: high pressure steam piping, low pressure condensate piping from Buildings #1 and #2, pumped condensate piping from the Union building, and the domestic cold water piping main. This design shall include high pressure steam traps, expansion joints, anchors, and all other required specialties. There are existing domestic hot water lines, compressed air lines, gas lines, etc. being fed from the east. All of these lines shall be removed and capped at the east tunnel.

Medium Voltage Power Distribution System

Existing five (5) way medium voltage switch is to be replaced with a new six (6) way medium voltage SF6 switch. The new switch should be installed on grade outside of the building. Existing switch is tied to building #4, building #2, union building #1, student services building and a spare switch. Spare switch can be utilized temporarily to provide power to new on grade switch to reduce length of power outages. This will allow existing feeder cables to be extended to new switch one at a time. New switch must be located close to where existing is to reduce or eliminate number of splices.

The medium voltage switch, which provides power to new Humanities building, must have fuse protection.

Existing three (3) 167 kva single-phase medium voltage transformers are to be replaced with a new pad-mounted transformer (approximately 1,000 kva). New pad-mounted transformer is to be located next to the Medium Voltage Switch. Currently the existing medium voltage transformers provide power to building #1, #2 & #3. During construction of the new Humanities building, temporary power should be provided to building #3.

The new medium voltage switch should provide power to a new oil-filled, air-cooled, pad-mounted transformer. Primary voltage for new transformer should be 12,470 volt Delta; secondary voltage should be 480/277 volts 3-phase WYE connection.

Telecommunication Distribution

The MDF room in the new Humanities building should have connections to the campus distribution network. A total of four (4) 4" conduits should run from this building to existing utility tunnel. MDF room should be located in close proximity to the existing utility tunnel.

Telecommunication work should comply with the Weber State University telecommunications design standards and all work should be coordinated with Weber State University telecommunications.

2.4.2 UTILITY TUNNEL OPTIONS

There were four options considered in regards to the conflict of the existing utility tunnel location and the new building footprint. These options are:

Option 1: Locate and design the new Humanities Building to keep and maintain the existing utility tunnel and associated utilities at their current location.

Advantages: Minimal utility costs since tunnel will be maintained.

Disadvantages: May cause "limitations" to design/layout of building/may not have maximum opportunities for daylight.

May not utilize this construction project as an opportunity to "upgrade" the existing utilities located in the tunnel.

Option 2: Relocate the existing utility tunnel to the north, "missing" the footprint of the new Humanities Building and allowing for the replacement of existing Building 3 and 4 in the future.

Advantages: New Humanities Building footprint will "comfortably" fit the site, allowing quality circulation and access spaces.

New Humanities Building footprint will "comfortably" fit the site, allowing ample open space and providing view corridor from north parking to Stewart Bell Tower.

New Humanities Building footprint will "comfortably" fit the site, allowing ample space for the replacement building for Building 3 and Building 4.

Relocating the tunnel and its associated utilities will force the infrastructure of existing utilities to be upgraded as needed.

Relocated portion of new utility tunnel will not be located under any buildings.

May be easier to maintain existing utility service while new tunnel and new utilities are being constructed.

Disadvantages: Substantially increases overall construction cost of project.

Option 3: Maintain the existing utility tunnel in its current location, but lowering the tunnel and its existing utilities to accommodate the main level of the new building.

Advantages: Less site area is impacted.

Disadvantages: Difficult constructability: Existing utility services will need to be maintained during construction. If they are being lowered but still in the same site location, this may prove to be more expensive than totally relocating them to the north. Substantially increases overall construction cost of project.

Utility tunnel will be located under the new Humanities Building.

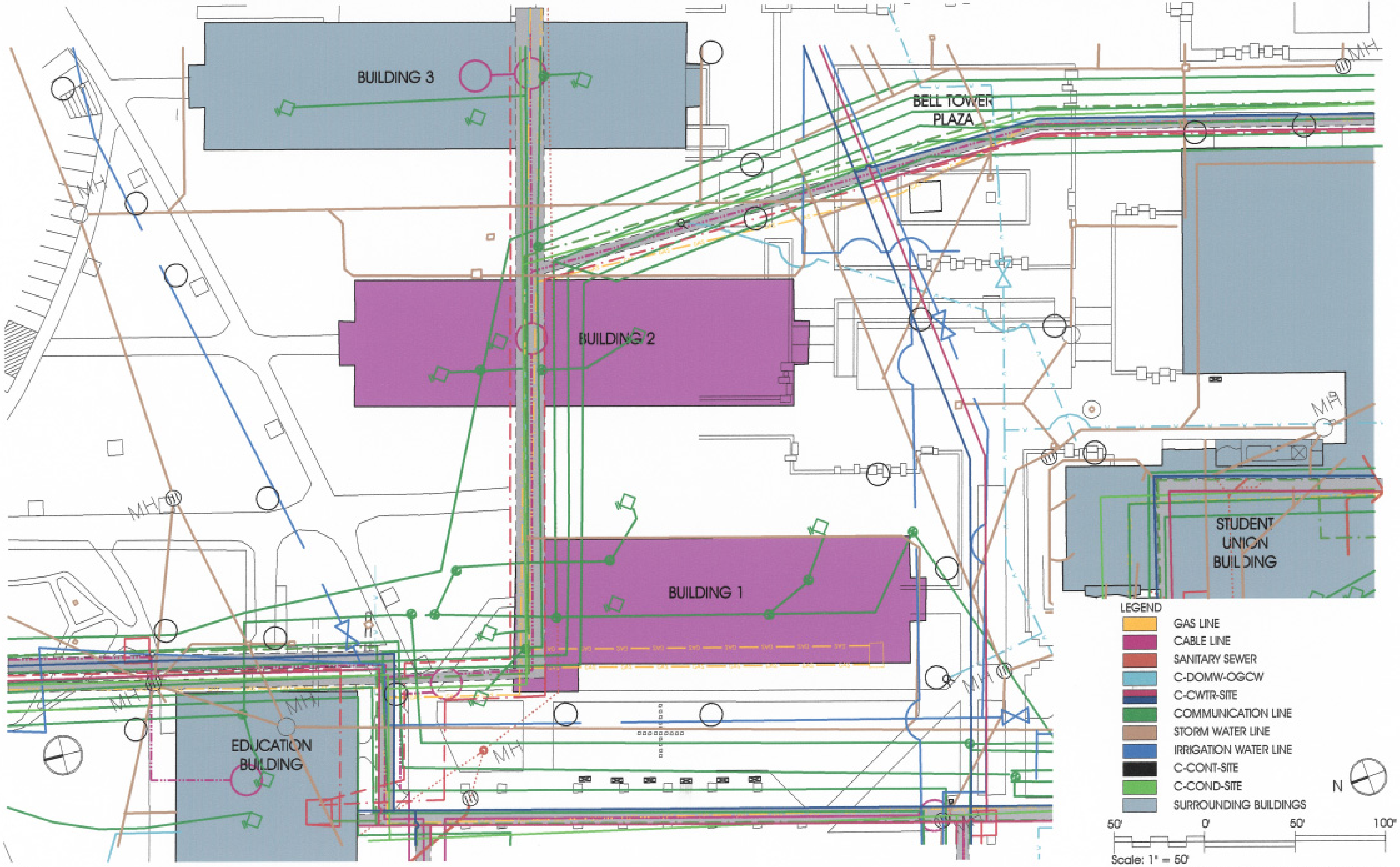
Option 4: Service the new Humanities Building from an existing utility tunnel elsewhere on campus. This Option requires additional capacity studies by Weber State University to determine how this could take place.

The Opinion of Probable Cost, located in Section 5, is based on Option 1: Maintaining the existing utility tunnel and associated utilities.

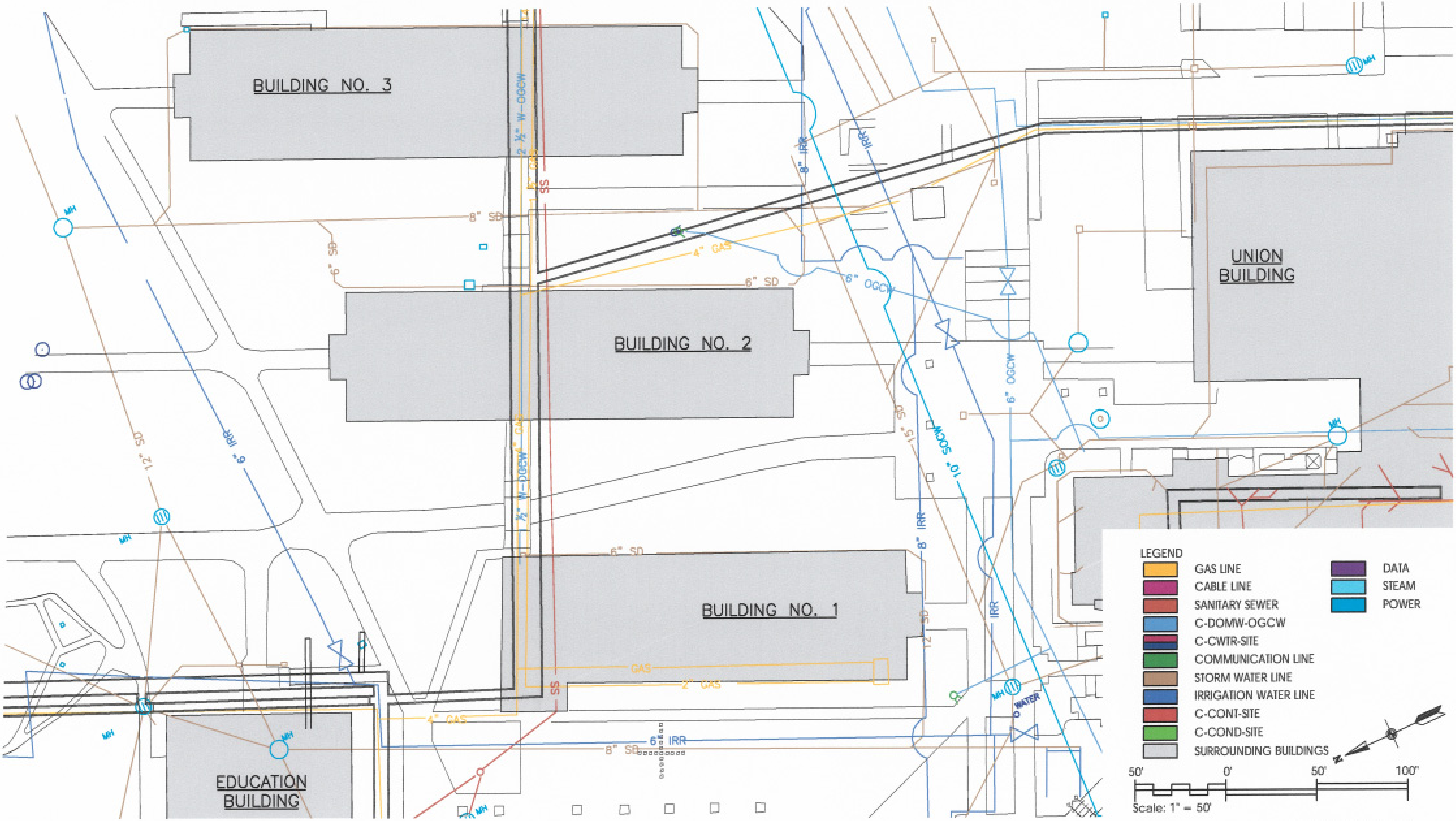
2.4.3 UTILITIES PLANS

See the following Utility Plans:

- Overall Existing Utility Plan
- Existing Utilities Public Utilities
- Existing Utilities Heating and Cooling
- Existing Utilities Power Cable Control
- Existing Utilities Communication and Data
- Proposed Public Utilities



OVERALL EXISTING UTILITIES PLAN
Humanities Building



EXISTING UTILITIES
PUBLIC UTILITIES
Humanities Building

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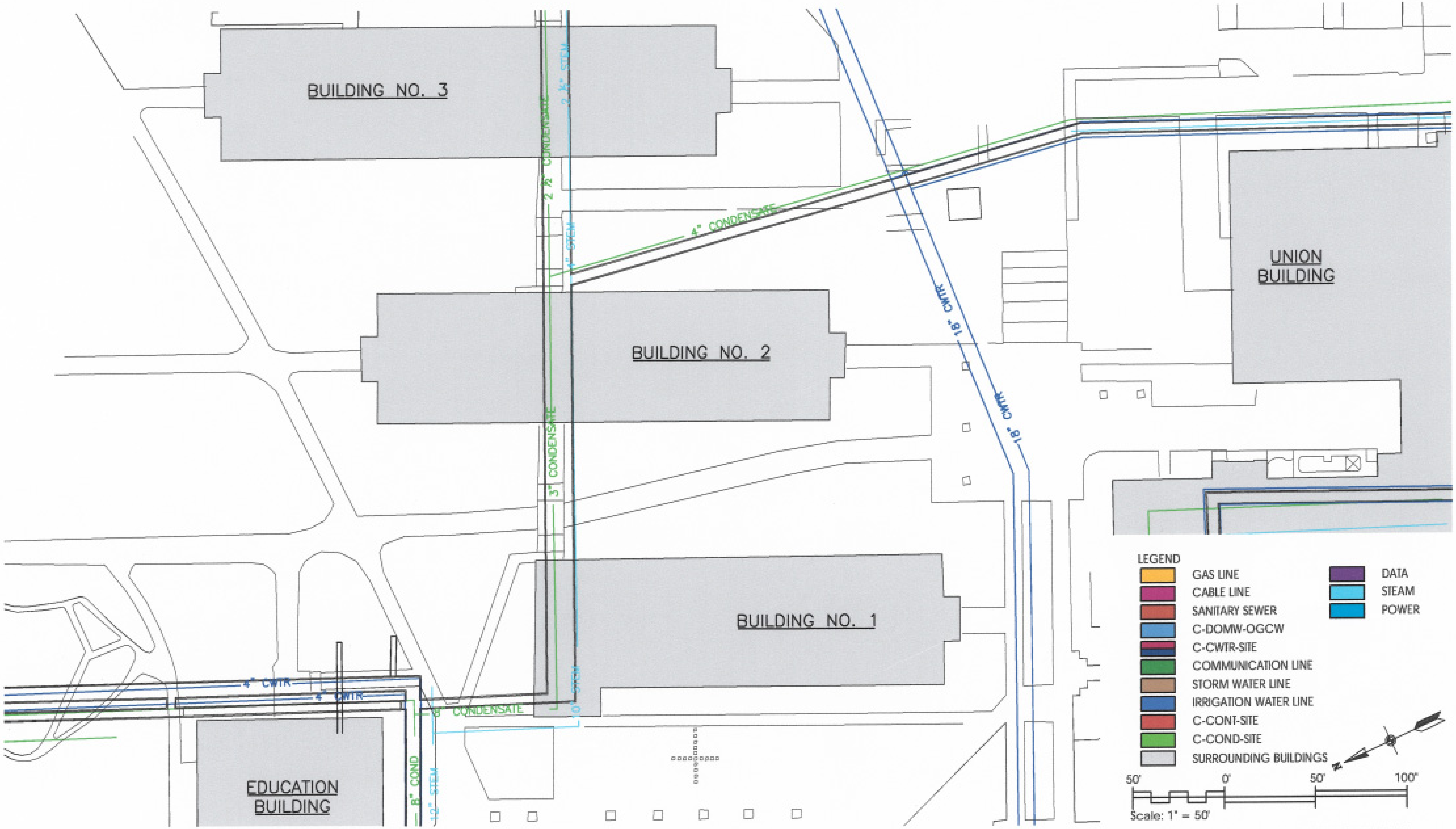

EXISTING UTILITIES
HEATING & COOLING
Humanities Building

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Program Document

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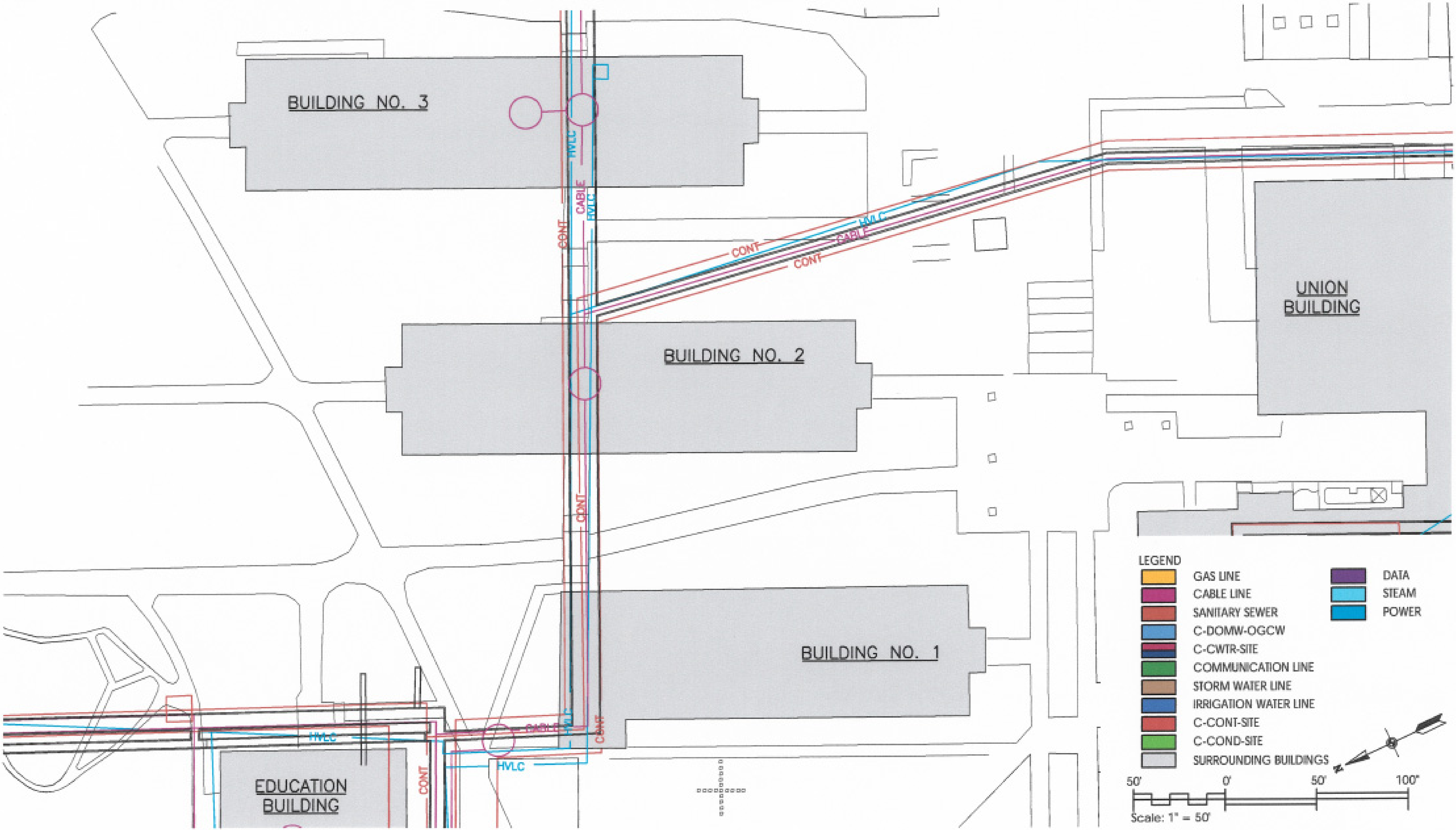

EXISTING UTILITIES
POWER CABLE CONTROL
Humanities Building

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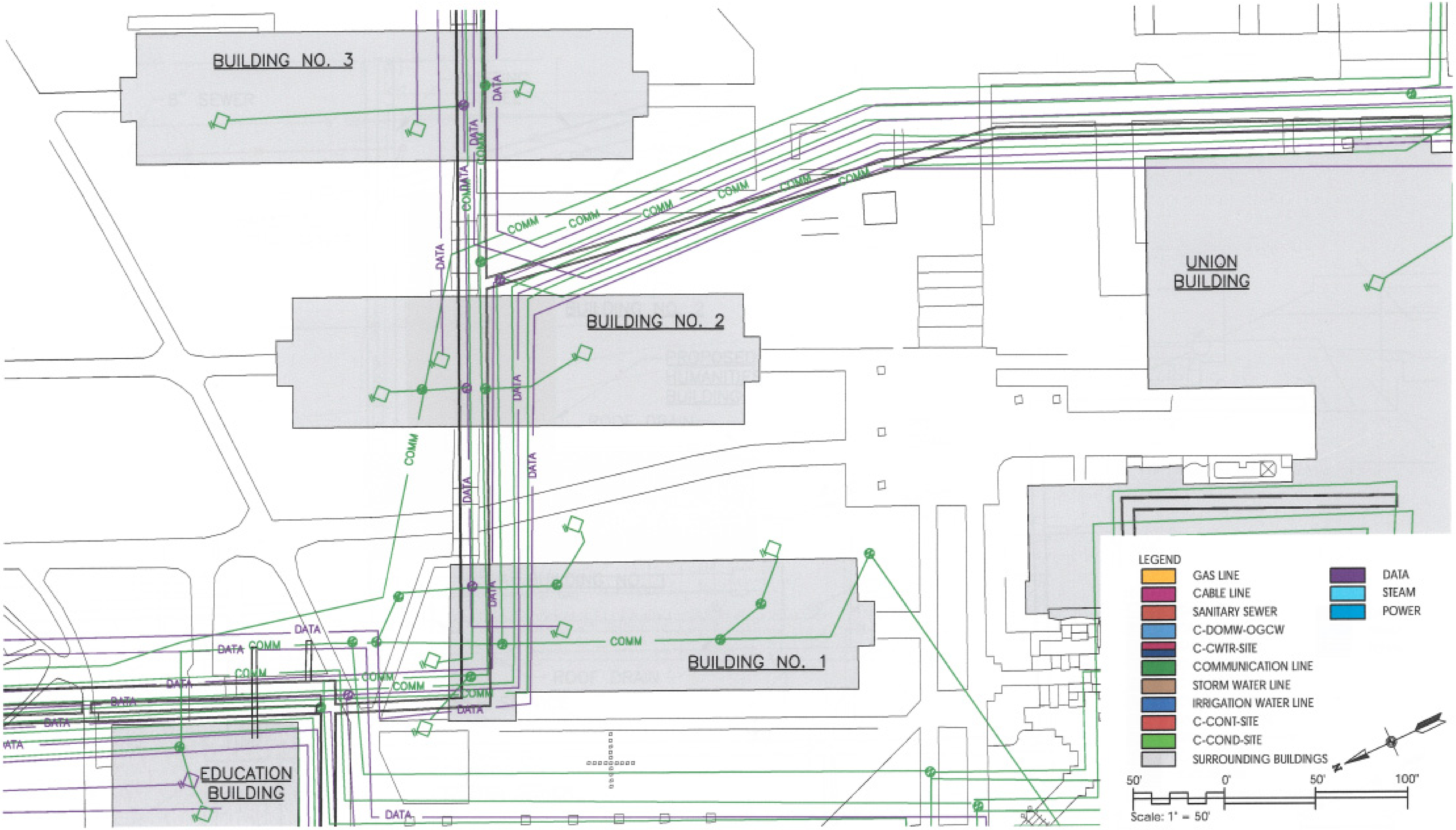
Program Document



EXISTING UTILITIES
COMMUNICATION & DATA
Humanities Building

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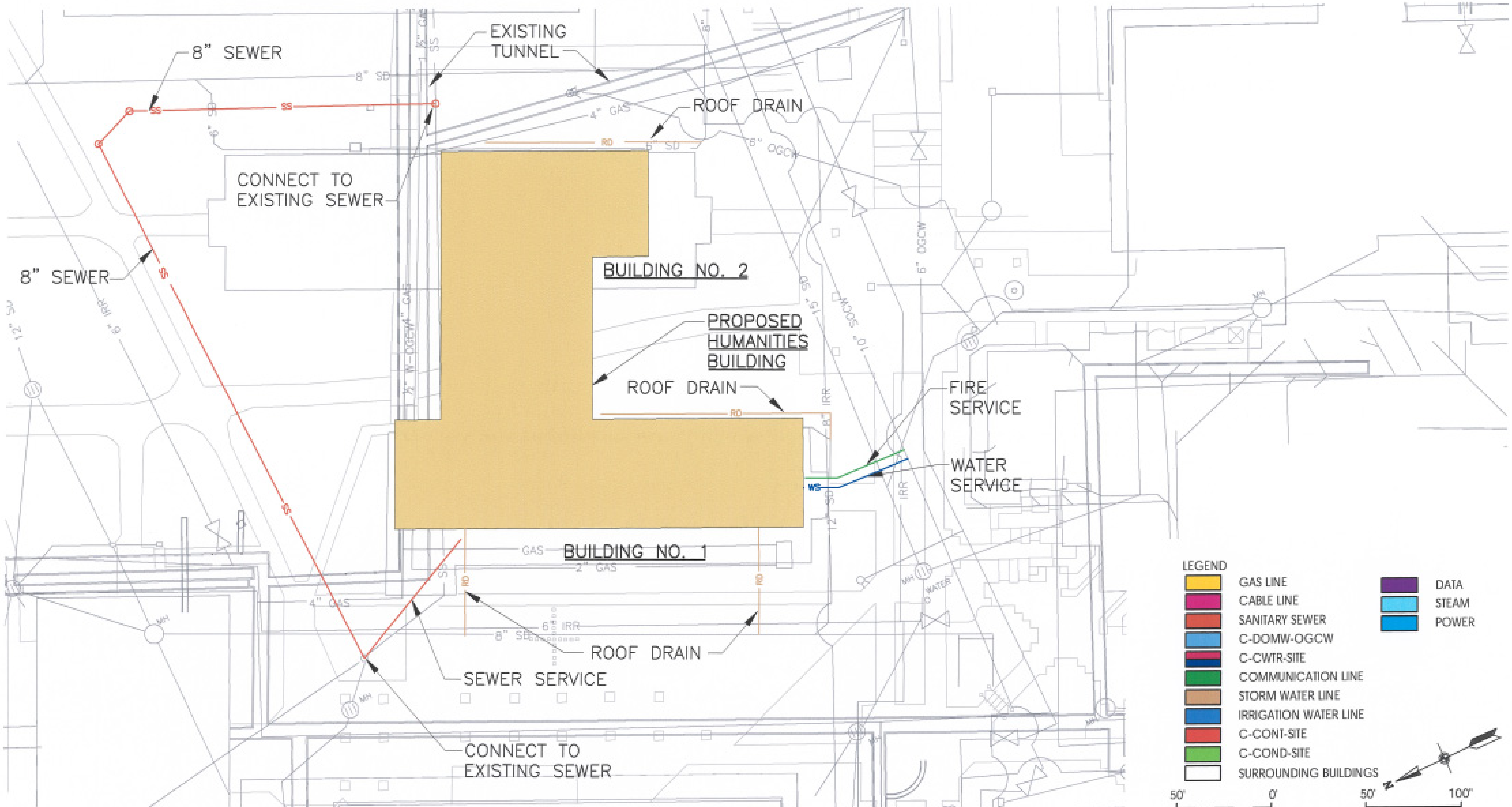

PROPOSED PUBLIC UTILITIES
Humanities Building

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Program Document

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2.5 SITE PLANNING PRINCIPLES

Shade and Shadow

Minimize building shadowing of habitable outdoor spaces in winter, spring and fall-- maximize shade in summer. Utilize mature deciduous tree canopies as much as possible to achieve this end. Allow areas of un-shaded seating areas to extend the useful seasons into the late fall and early spring.

Views

Preserve/enhance existing view opportunities to west, north and east. Prioritize views from very public outdoor and public indoor spaces over those from private spaces. Create "viewing platforms" as well as peripheral views out of the campus open spaces. Link campus spaces together with selective views from one to the other. Plantings should encourage view corridors or direct views away from undesirable views, such as the service/dock area.

Outdoor Spaces

Create linked outdoor spaces or "outdoor rooms," with both spatial closure and views outward. Create a variety of campus space-types: quiet--active, green--paved, open--closed, shaded--sunny, etc. Limit hardscape areas to those which will attract large gatherings; in principle most outdoor spaces should not be hardscape. The building site offers an opportunity to create additional outdoor activity areas and to enhance the existing outdoor activity area of the Central Quad. Provide fixed and movable site furniture at strategic quiet and busy locations to accommodate both quiet lounging and interactions. Also provide connections, links, and other methods of integration to the Central Quad utilizing open spaces and pathways. Planning should consider the future pedestrian link to replacement building of Buildings 3 and 4.

Building Spirit

Create a building that is the virtual core of the College Humanities and Telecommunications Business Education physically, functionally and symbolically. The new Humanities Building must have an open, shared character to express the interdisciplinary nature of its programs. The landscape adjacent to the building should extend this character into adjacent circulation paths and campus spaces.

Building Identity

Create an external identity associated with the whole of the College of Humanities. Create internal building identities associated with particular departments and programs. Identify existing identity context and develop a strategy for the new Humanities Building to truly be perceived as the center of campus.

Future Buildings

Locate the new Humanities Building to integrate with the existing Central Quad Area while not limiting the future replacement building for Buildings 3 and 4. Establish finish floor elevations that will allow accessible connections to the Central Quad and upper floor connections to the replacement building for Buildings 3 and 4.

Building Access
Express the public shared nature of this building by connecting internal circulation to external circulation through multiple entries at multiple grade elevations, with extensive views in and out, etc. Provide strong functional connections between interior program spaces (particularly social spaces, meeting rooms, student lounges, etc.), and exterior spaces.

Loading and Service
It is recommended to locate the loading and service area on the north side, in close proximity to parking Lot A-2 and be fully screened. For this type of building, this area should be minimal, but still needs to be accommodated.

Emergency and Non-Routine Service Access
In accordance with Weber State University's management and maintenance practices, design paths and walkways to accommodate emergency vehicles and occasional non-routine service access. Utilize Weber State University's Design Standards to prevent private vehicles from using these paths.

Accessibility
Wherever possible, all site paths shall meet ADA criteria for slope and landings. If this is unfeasible in a particular location, provide elevator access within the new Humanities Building that will allow wheelchair users to transition the non-compliant grade condition. All usable outdoor campus spaces shall be fully accessible.

Bicycle Access
Provide for bicycle usage along the north-south pedestrian corridor, and secure bicycle storage adjacent to the new Humanities Building entrances. Bicycle racks, rather than bike lockers, should be located conveniently near building entrances.

2.6 PROPOSED SITE CONSIDERATIONS

The guidelines and objectives put forth in the Weber State University Central Quad Master Plan were carefully considered in the planning proposals for the new Humanities Building. Generally, the Central Quad Master

Plan provides a thoughtful and insightful framework for future development, one that reflects an intimate experience for the central campus area and its potential for future improvements.

The site planning guidelines of the new Humanities Building site are as follows:

1. To replace existing Building 1 and 2 with a larger, multiple story building for more efficient use of the land.
   - Maximize use of land available by "sizing" the new Humanities Building based on programmatic need, budget, and maximum use of the land.

2. To not prohibit the replacement of Building 3 and 4 in the future, including potential views from the multi-level replacement building, limiting the new Humanities Building height to 3 levels.
   - Major view opportunities should be considered, enhanced or preserved. Building location, massing and height should contribute to this.
   - Enhance views west towards the city and north-south towards the Wasatch Range.
   - Provide view east towards the foothills.
   - Strategically locate the roof top penthouse as to not block views to the west for the future replacement building for Building 3 and 4.

3. To work with the contours of the site allowing spaces not requiring daylight to be "buried" in the main level east side, allowing the building to be three levels on the west side and two levels on the east side.
   - Take advantage of the 20' fall across the site from east to west to allow a 3 story building with a portion of the main level/east side "buried" into the hillside.
   - Identify program spaces that do not require daylight or views (such as large Auditorium and computer labs) and locate these spaces "into-the-hill."

4. To support major central campus circulation paths from the north parking to the Central Quad Area.
   - Numerous entrances to the building shall be provided, with access to the main entrance accessible from both the north and the south.
   - Establish the location of the building with future growth in mind, to allow a physical connection to new buildings to the east by either a pedestrian bridge or underground connection.
   - Complete pedestrian connection to all surrounding buildings; integrate the new Humanities Building with circulation paths that connect it to all adjacent buildings.
   - Separate the main entrance from all service/loading zone areas.

5. To enhance the Central Quad Area as a student gathering zone.
   - Provide a new physical connection from the existing Central Quad Area to the new Humanities Building through the use of landscaping and an enhanced pedestrian walk way.
   - Provide enhancements to the new south side entrance of the Humanities Building to make it a more usable space, including seating areas and possible shade areas for summer time use.
   - Provide exterior site enhancements to the north, east and west side entrances of the new Humanities Building.

Four Site Plan Options were considered for the Programming Phase of this project. Option 4 was selected as the preferred Option and is included in this section. Option 4 presents 1 zoning solution for the Administration

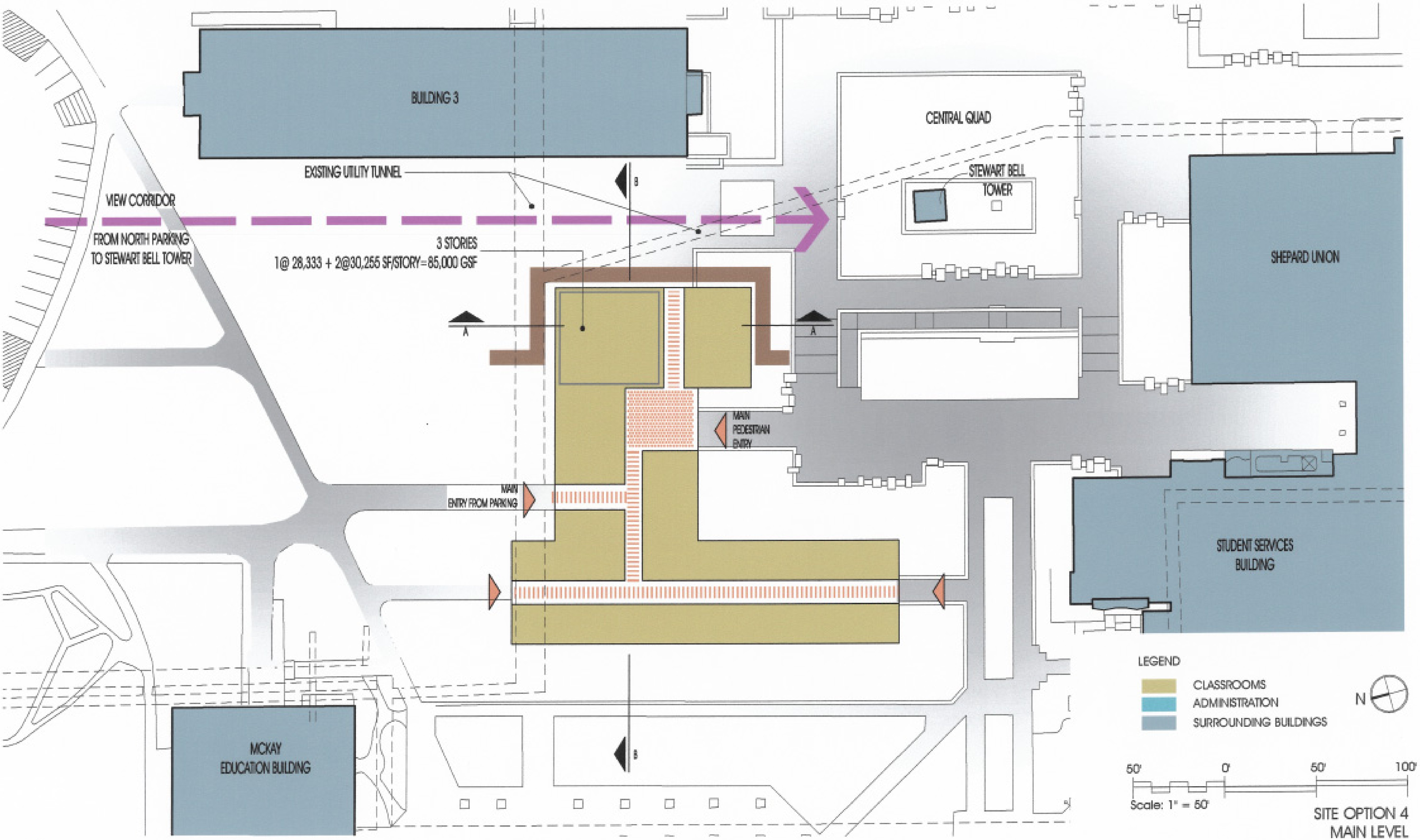
Spaces and the classroom spaces, based on view opportunities. During design, further discussion will be required to prioritize the best views for the faculty offices.

Three additional general siting options (labeled Option 1a, Option 1b, Option 2 and Option 3) that were considered not as favorable have been included in Section 7 Appendix.

Advantages of Option 4

Option 4

- North and east may be preferred views. Consider a variation of Option 4 that places the Administration Space on the East side of the building.
- Once the project moves into design, this Option will need to focus on more direct/simplified circulation for the Administration Space.
- This Option is more in line with the terraced nature of the overall campus design.
- Utility tunnel and associated utilities will be maintained in their current location.
- Footprint vs. real estate; the three story option makes more sense.
- Entrances to the building work best with this Option.
- This Option has more "grade A" space—allowing maximum views to the east.
- This Option provides space for future replacement building for Classrooms 3 and 4.
- This Option emphasizes the Bell Tower/Quad in a positive way.

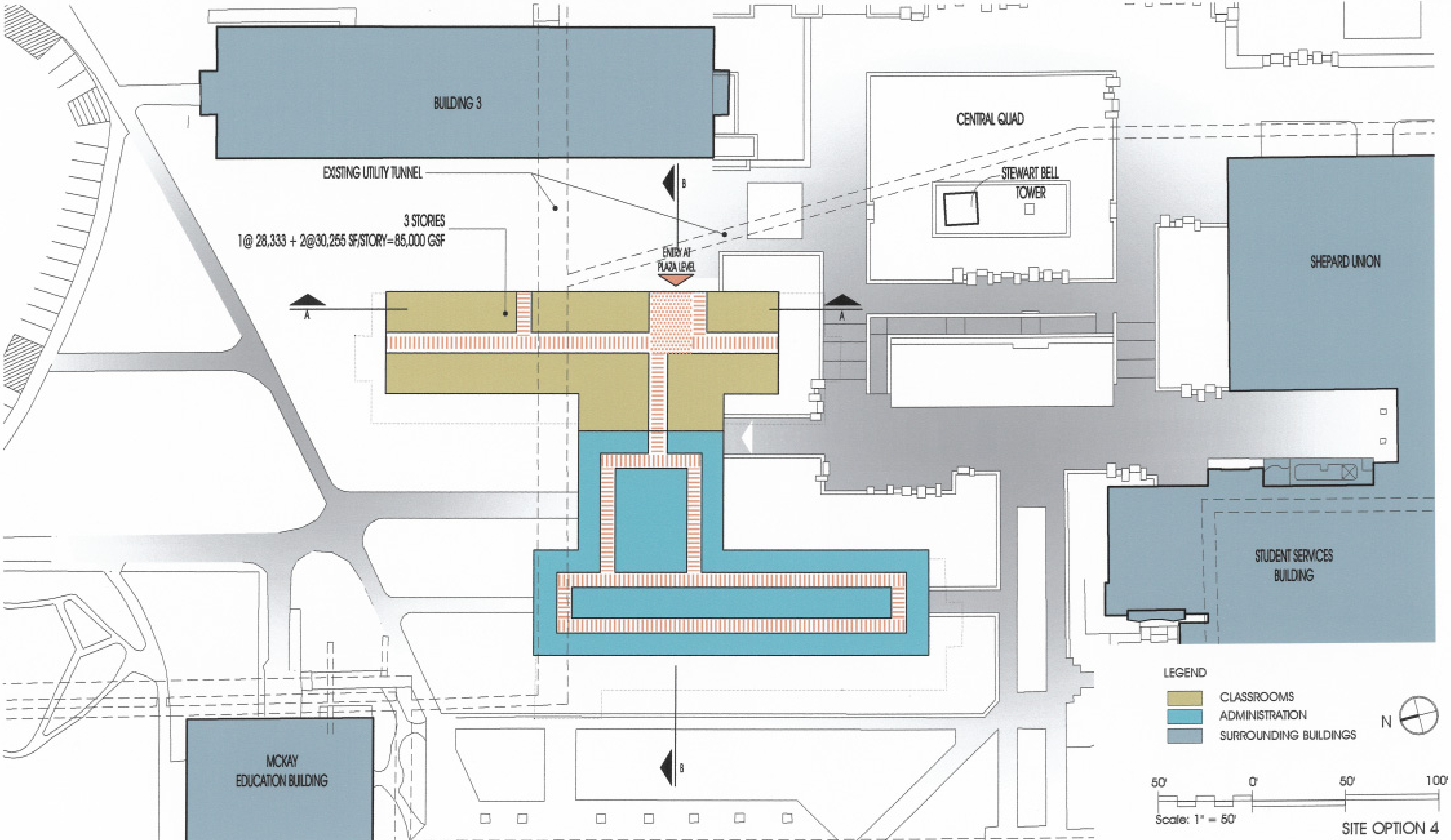


SITE OPTION 4
MAIN LEVEL

ajc architects

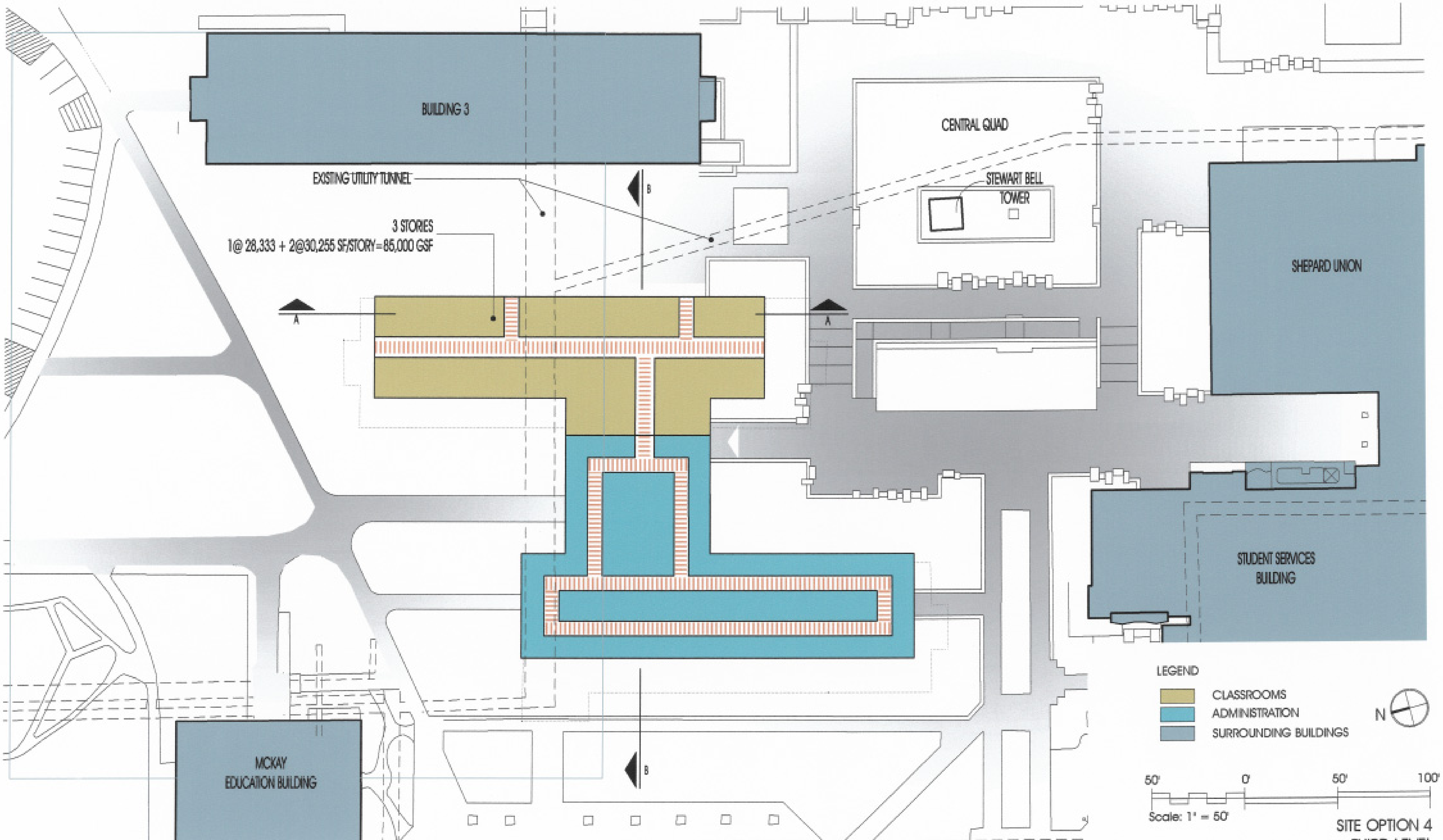
Humanities Building

Program Document

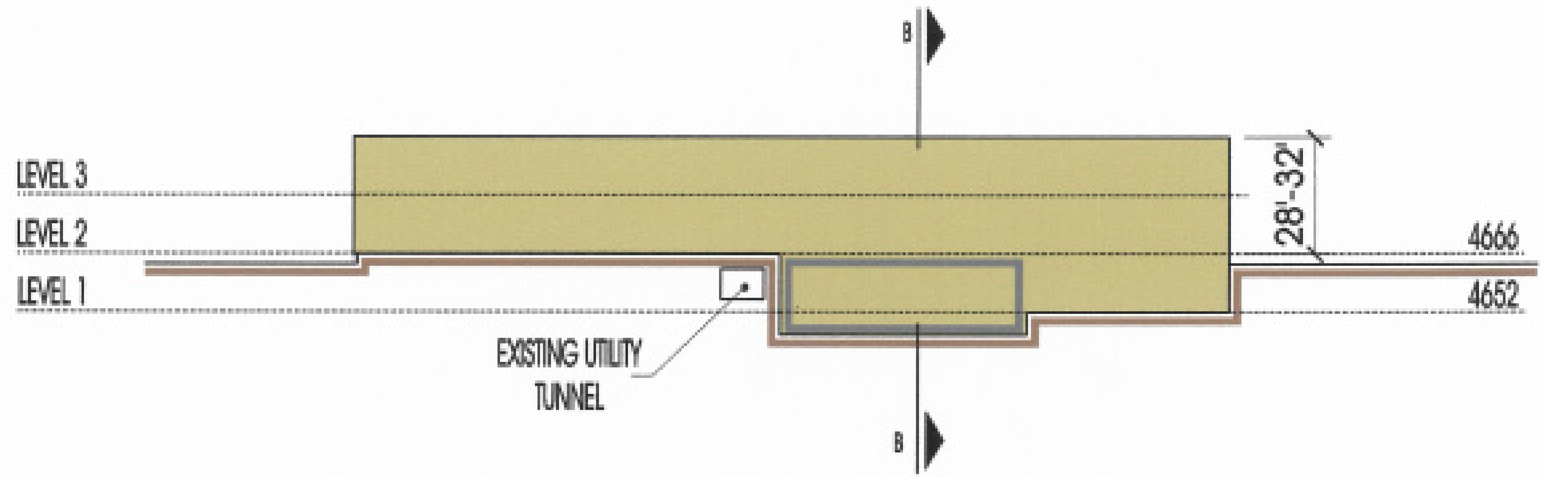


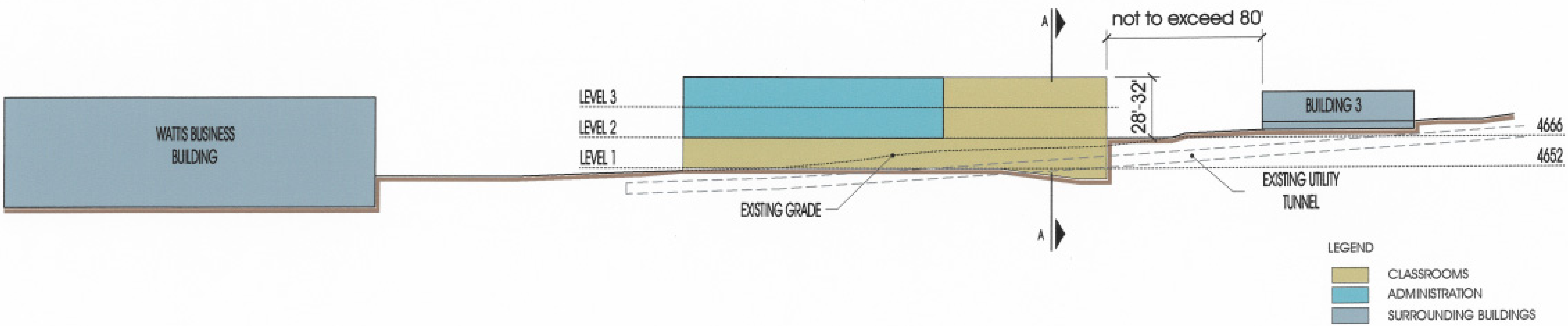
SITE OPTION 4
SECOND LEVEL

ajc architects



SITE OPTION 4
THIRD LEVEL


B
LEVEL 3
LEVEL 2
LEVEL 1
28'-32'
4666
4652
EXISTING UTILITY TUNNEL
B


A
not to exceed 80'
WATTS BUSINESS BUILDING
LEVEL 3
LEVEL 2
LEVEL 1
28'-32'
BUILDING 3
4666
4652
EXISTING GRADE
EXISTING UTILITY TUNNEL
A
LEGEND
CLASSROOMS
ADMINISTRATION
SURROUNDING BUILDINGS

3.0 BUILDING REQUIREMENTS

3.3.5 SYSTEM COMMISSIONING
3.3.6 LANDSCAPE DESIGN CRITERIA
3.3.7 VALUE ENGINEERING

3.4 SUSTAINABLE DESIGN

3.0 BUILDING REQUIREMENTS

3.1 GENERAL BUILDING REQUIREMENTS

3.1.1 IDENTIFICATION

Weber State University Mission

The mission of the University is to meet the educational needs of Utah through roles assigned by the State Board of Regents in the liberal arts and sciences and a variety of vocations and professions. Primarily committed to quality undergraduate education, the University offers degree programs which include advanced professional preparation.

College of Arts and Humanities Mission

The College of Arts and Humanities, the largest and the most diverse college in terms of faculty and programs, draws upon those strengths to foster a Liberal Arts education among the increasingly diverse student body of Weber State University. College programs provide students with rich learning opportunities in the arts, communication, languages, literatures, and writing, pivotal disciplines for life-long learning in the changing global environment.

Students pursuing liberal studies gain an understanding of humanities cultural and aesthetic heritage, develop abilities in critical thinking, and become informed world citizens. The Arts and Humanities faculty strives for excellence and relevance in curriculum so that students might aspire to the professions of the present and be equally capable of embracing the new specialties of the future.

Much of the curricula in the College incorporates an interdisciplinary focus or applied research to assist students in forging connections between theory and practice, professional and personal lives, work and leisure. Achieving these goals depends upon faculty members who continually pursue new knowledge in their disciplines through research and scholarship while serving the larger community with their commitment and expertise.

The College of Arts and Humanities is comprised of five excellent academic departments:

- English and Literature
    - English as a Second Language
- Communication
- Foreign Languages and Literatures
- Performing Arts
- Visual Arts

The essential mission of this project is to replace existing Building 1 and Building 2 with a new, multi-level, state-of-the-art research/learning facility. The following users currently occupy these buildings:

Current Building 1 Occupants

- Foreign Languages and Literatures
- Geography
- Air Force ROTC

Current Building 2 Occupants

- Foreign Languages and Literatures
- Telecommunication and Business Education (TBE)
- Printing

The new Humanities Building will have the following occupants:

Department	Current Location
English and Literature	Social Science, Annex 2, Annex 8
Communication	Building 3, Union, and Library
Foreign Languages and Literatures	Buildings 1 and 2
Telecommunications and Business Education (TBE)	Building 2

Geography will be relocated to the vacated space of English in the Social Science Building.
Air Force ROTC will be relocated to an Annex Building.
Printing will be relocated to the Stores and Receiving Building.

3.1.2 JUSTIFICATION

Existing Building 1 and Building 2 are two of the original buildings at Weber State University. These buildings were constructed in 1954, and have had minimal upgrades over the years. The buildings have antiquated mechanical and electrical systems, are not completely ADA accessible, contain asbestos, and are seismically unsafe for their current occupancy classification of A-3. In summary, the buildings have out-performed their life expectancy, and the cost to renovate/remodel would not be practical.

The existing Building 1 is approximately 24,300 gross square feet, and Building 2 approximately 18,300 gross square feet, for a total of 42,600 gross square feet on 1 level. The new Humanities Building will have the opportunity of multiple levels, providing a larger building in the same amount of space, yielding a greater use of prime real estate located in the center of campus.

The Humanities Departments of English, Communication and Foreign Languages and Literatures are currently located in 8 different buildings on campus. Part of the Vision and Mission for Humanities is to provide space that is interdisciplinary, where faculty, staff and students from different departments can interact. The new Humanities Building will provide an opportunity for 4 departments to be located in one building, allowing for this interaction and interdisciplinary approach to learning. Clustering humanities departments of the college also is more effective to administer, to facilitate cooperation and staff assignments, to share facilities such as conference rooms, large meeting rooms, etc. Currently, three humanities disciplines are located in four separate buildings (Social Sciences, Buildings 1, 2, 3). A new building is a propitious opportunity to bring together these three related disciplines that report to one dean/college.

There is also the opportunity for shared spaces in the new building that are now currently duplicated across campus. The 4 departments located in the new Humanities Building will share the following spaces:

- Faculty Work Rooms
- Faculty Break Rooms/Lounge
- Conference Rooms
- Adjunct Offices
- Student Lounges

This approach to space sharing has resulted in a reduction of required square footage per each department.

All departments in Arts & Humanities underwent external program review in Fall of 2005. While Visual and Performing Arts were recognized for the quality of their facilities, the humanities departments all had listed among weaknesses the lack of adequate physical plant for student classrooms and lack of specialized technical learning centers.

The humanities departments have no dedicated space for special events, invited guest speakers, large or combined class presentations. They must always search elsewhere for availability which results in inconvenient times and locations and less that ideal audiences. Having a dedicated space in a Humanities Building will promote and enhance curricular and co-curricular events.

Classroom Quantities

Classroom Needs: The following is a summary of classroom sizes utilized by English, Communication, Foreign Languages and TBE (Fall 2004):

1-10 students	=	15 courses	4.7%
11-20 students	=	85 courses	26.7%
21-30 students	=	168 courses	52.6%
31-40 students	=	36 courses	11.3%
41-50 students	=	14 courses	4.4%
51	=	1 course	

The classrooms for over 40 students are utilized by TBE, and are now being reduced to smaller classroom sizes. These numbers have been utilized in this program document to justify the size of classrooms needed for the 4 departments that will be occupying the building. From these statistics, it has been determined that the following classroom sizes are needed in the new building:

- 40 Person Classrooms
- 35 Person Classrooms
- 30 Person Classrooms
- 25 Person Classrooms

Classroom Utilization
In determining the average number of classrooms and specialty labs currently utilized by these 4 departments during peak hours (8:00 AM – 12:00 AM), the following was determined:

	Average # of Existing 20 Person	Average # of Existing 30 Person	Average # of Existing 40-50 Person
8:00 AM-12:00 PM	10 Total	28 Total	4 Total

The new Humanities Building has been programmed to accommodate the following classrooms and specialty labs:

New 25 Person	New 35 Person	New 30 Person	New 40 Person
9 Total	4 Total	10 Total	4 Total

It has been determined that even with the classrooms and specialty labs provided in the new Humanities Building, the 4 departments (English, Communication, Foreign Languages and Literatures and TBE) will still need to utilize existing classrooms around campus, as well as extend the peak hours for classrooms/labs to later in the day, such as 1:00 PM and 2:00 PM classes.

3.1.3 VISION AND PRINCIPLES FOR THE NEW HUMANITIES BUILDING

The following Vision Statements and Principles for the new Humanities Building were identified by the Steering Committee:

The new building will accommodate consolidation and cluster of faculty offices (for the identified departments) in one building.

The new building will have modern, high tech teaching space.

The new building will have student space for group/individual/study/community spaces.

The new building will be interdisciplinary, as well as provide spaces for faculty/students to interact.

The new building will be programmed and designed for flexible space and be adaptable to new technology.

3.14 HISTORY AND GROWTH

Department	Current Location	Square Feet Presently Used
English and Literature	Social Science	10,944 Net Square Feet
	Annex 2	1,378 Net Square Feet
English as a Second Language (ESL)	Social Science	1,244 Net Square Feet
	Annex 8	2,512 Net Square Feet
	Sub Total	*16,078 Net Square Feet*
Communication	Building 3	8,976 Net Square Feet
	Union	1,561 Net Square Feet
Multi Media Services	Library	5,167 Net Square Feet
	Sub Total	*15,704 Net Square Feet*
Foreign Languages and Literatures	Building 1	6,319 Net Square Feet
	Building 2	1,333 Net Square Feet
	Sub Total	*7,652 Net Square Feet*
Telecommunications and Business Education (TBE)	Building 2	5,437 Net Square Feet
	Sub Total	*5,437 Net Square Feet*
Total Existing Square Feet Presently Used		**44,871 Net Square Feet**

Growth
The Program spreadsheet has a total of 52,854 Net Square Feet assigned to English and Literature, Communication, Foreign Languages and Literatures and Telecommunications and Business Education. This

allows for approximately 17.5% growth in the next +/- 20 years. The growth provided for in the Program spreadsheet is in additional office space for faculty, staff and adjunct growth. 17.5% is consistent with past and projected growth patterns identified by the 4 departments.

3.1.5 MASTER PLAN RECONCILIATION

The College of Humanities and Arts, as well as Telecommunications and Business Education, do not have any previous master plan documents that apply to the Programming of the new Humanities Building. The only existing Master Plan Document that relates to this project is the Weber State University Central Quad Master Plan, DFCM Project no. 03214810. This master plan document focuses on the Central Quad area of the campus, to which the new Humanities Building will be adjacent. Section 2, Site Analysis of this Program Document, addresses the site relationships of the new Humanities Building that are consistent with the master plan document.

3.1.6 FUNCTION

People: The following people will be utilizing the new Humanities Building:

Departmental Statistics

English and Literature

Faculty	30
Staff	4
Adjunct Positions	60
Student Enrollment (Majors)	402

Communication

Faculty	18
Staff	2
Adjunct Positions	12
Student Enrollment (Majors)	348

Foreign Languages and Literatures

Faculty	15
Staff	2
Adjunct Positions	15
Student Enrollment (Majors)	120

Telecommunications and Business Education

Faculty	9
Staff	1
Adjunct Positions	23
Student Enrollment (Majors)	134

Expansion: The new Humanities Building has not been programmed for future building expansion. It is anticipated that the future expansion needs will not be to the new Humanities Building; rather expansion needs will be accommodated in the future new building that will some day replace Buildings 3 and 4.

General Module System Design: The new Humanities Building should be designed, as far as possible, with an economical, repetitive modular planning system. This system should be used for all building systems in an integrated design strategy including structural, MEP and architectural systems. Unlike a research building, the module system for an education building should not be determined in advance of design.

Building Module Planning/Flexibility Short-term Flexibility: Utilize movable partitions where possible to allow for changing room sizes. Use movable furniture unless built-ins provide a significant advantage. Provide for ongoing changes to all major systems and spaces. All MEP systems maintenance items shall be accessible and capable of replacement without demolition of architectural systems. Utilize drywall construction for partitions that are easily removed and replaced. Oversize elevators, corridors and key doorways to accommodate movement of large items of equipment. Plan the building architectural and MEP systems with a consistent modular strategy that allows for change without disrupting adjacent spaces.

Building Module Planning/Flexibility Long-Term Flexibility:
Consider the possibility of change, both within the current program and to different programs. For any sloped-floor teaching space, plan for future conversion to a flat-floor space without seriously disrupting building functions.

Space Type Summary: The types of spaces to be provided in the new Humanities Building are as follows:

<u>Administration Space</u>	
Offices (Enclosed)	93 Total
Offices (Open Work Stations)	15 Total
Shared Adjunct Offices (Open Work Stations)	24 Total
Storage Rooms	4 Total
Tutoring Rooms	3 Total
Conference Rooms	2 Total
Small Adjunct Meeting Rooms	3 Total
Shared Faculty Work Rooms	3 Total
Shared Faculty Break Rooms	2 Total
Shared Student Lounge	1 Total

Classroom/Specialty Lab Space

200 Person Auditorium	1 Total
40 Person Classroom	4 Total
35 Person Classroom	4 Total
30 Person Classroom	10 Total
25 Person Seminar	9 Total
40 Person Specialty Lab	3 Total
30 Person Specialty Lab	1 Total
Debate Special Use Lab	1 Total
34 Person Writing Center	1 Total
32 Person General Computer Lab	1 Total
24 Person General Tutoring	1 Total

Additional Specialty Areas
Electronic Media Production
TBE Audio Visual Recording Room

For additional information on the Function/Spaces in the Program, including adjacencies, zones of compatibility, and general function, see the Program Spreadsheet located in Section 4.

3.2 ARCHITECTURAL PLANNING ISSUES

3.2.1 BUILDING FORM AND MASSING

Quality and Image: The designated location for the new Humanities Building is where Buildings 1 and 2 are currently located. It is the intent for the new building to occupy the approximate area of the existing buildings. However, the new Building is programmed for 3 –levels; therefore allowing a larger building than the existing square feet of Buildings 1 and 2.

The location of the building is essentially the center of campus, which is appropriate for Humanities, being the largest College at Weber State. The new Humanities Building will also be located adjacent to the Central Quad. Therefore, the architectural image of this building should be significant for both its location and long term durability. The new building should blend in with the traditional architecture of the buildings located around the site, as well as explore new and modern day materials that are found on some of the recent buildings completed on campus.

It would be anticipated that brick masonry would be the dominant exterior material. But the use of concrete, glass and metal would also be appropriate. Due to the types of spaces programmed, extensive use of glass for day lighting and views would also be appropriate.

Building Space Utilization Efficiency: The Program spreadsheet uses a net-to-gross efficiency ratio of .65. This is typical and appropriate for classroom and administration buildings. The areas not included in the net square footage are:

Restrooms
Circulation
Walls, Columns, Structure and Partitions
Unassigned Storage and Maintenance Areas
Stairs
Elevators
Mechanical, Electrical and Communication Shafts and Spaces

3.2.2 INTERNAL RELATIONSHIPS

Maximize Natural Light into Occupied Spaces: As far as possible every space shall have natural light and views- in general nowhere in the building should be more than 35' from natural light.

Low-Rise Construction: Maximize walk-up opportunities with limited use of elevators required to access classrooms and heavily used spaces. Large classrooms and specialty labs should be located on the first two levels, with smaller classrooms and seminar rooms located on the third level.

Administration spaces should be located on the second and third levels.

Student oriented spaces should be located on the first level.

3.2.3 NATURAL LIGHT AND VIEWS

As far as possible every space shall have natural light and views- in general nowhere in the building should be more than 35' from natural light.

The building shall take advantage of daylight to promote connection to the exterior natural environment. Day lighting is to be incorporated into the design of spaces to supplement and supplant artificial lighting.

Daylight should be integrated into building circulation to reinforce connections to the exterior and relieve interior spaces.

Views as identified are to be incorporated into the design of the building. The goal is to take advantage of these views from the most public areas of the building.

3.2.4 CIRCULATION

Internal Circulation

Maximize interactions and efficiency by utilizing "branching" single corridors/routes wherever possible in lieu of multiple parallel corridors/routes.

Locate discussion areas outside classrooms along the internal circulation paths, to promote participation of students and faculty.

Locate interior entry lobby in close relation to outdoor public spaces, to strengthen the indoor/outdoor relationship and encourage activities to continue from one space to the other.

Locate high use areas such as the Student Lounges in central circulation nodes, for ease of access and maximum chance of encounters.

External Circulation

Use outdoor pedestrian pathways in combination with outdoor public spaces, to allow for a maximum number of casual encounters with students and faculty, and to provide continuity and sense of place within the "Education Corridor."

Locate pathways as an organizing way finding device for building entries.

Use deciduous trees and landscaping to delineate pathways, and have shade in the summertime.

3.2.5 PERSONNEL INTERACTION

In the true interdisciplinary character of the facility, interaction among the following groups should be encouraged to the highest degree possible:

Students among different departments and programs (English and Literature, Communication, Foreign Languages and Literatures, Telecommunications and Business Education)
Faculty of all schools and students of all schools

Graduate and undergraduate students from all departments

Faculty and Staff and all groups listed above

In order to promote interaction, all public and semi-public spaces should be very accessible, and in proximity to the major programmatic elements of the facility.

3.2.6 APPROACH TO MATERIALS AND FINISHES

As a vital campus facility, this building is to be planned as a long-term investment. Materials and finishes are to be selected for durability as well as aesthetics, assessing life-cycle costs in comparison with project financial projections and value engineering considerations.

Building Exterior Materials and Finish Goals

Exterior wall finishes and structure to be 100-year materials.
Exterior wall fenestration to be 50-year materials.
Roofing and waterproofing to be 20-year materials.
Below-grade waterproofing to be 100-year materials.

3.2.7 PROGRAM SPECIFIC GOALS

Classrooms: Design for classrooms shall be flexible to support the educational goals, as incorporated into the room layout sheets provided herein. Sightlines for flat floor and sloped floor venues are to be adjusted in accordance with audio/visual planning requirements. Integration of technologies is essential to these areas including state-of-the-art audio/visual equipment, wired and wireless networking, and support for distance teaching/learning and video-conferencing capabilities.

3.2.8 BUILDING SECURITY

Programmatic building security requirements are as follows:

- The building's security system shall provide for separate security for the main functions of the building. These are:
  - Pedestrian Circulation
  - Student Activity Areas
  - Classrooms
  - Administrative Offices

- The building shall be equipped with a card access security system which can be programmed to be "open" during a time frame as required by building occupants.
- The building shall have a University compliant card access system for all exterior entries, with controlled access as programmed.
- The door locking system for all interior spaces shall follow Weber State University Design Guidelines.
- Video Monitoring.

3.2.9 CODES, REGULATIONS AND SAFETY

The governing codes for this project are listed below. The Design Team and Architect of Record will need to verify at the beginning of the design phase all required codes and regulations. It is the Design Team and Architect of Record's responsibility to utilize all latest revisions, editions and adopted versions. The following list presents currently applicable code issues and is not a complete list of applicable codes.

International Building Code (IBC) 2003 with Utah Amendments
International Plumbing Code (IPC) 2003
International Mechanical Code (IMC) 2003
International Fire Code (IFC) 2003
Life Safety Code NFPA 101 with Utah Amendments
National Electric Code (NEC) with Utah Amendments 2002
Laws, Rules and Regulations of the Utah State Fire Marshall
The Utah Code for Energy Conservation in New Building Construction (ASHRAE Standard 9.1-1989)
International Energy Conservation Code 2003
ASHRAE Indoor Air Quality 62-2001 and Addendum 62n

Planning and Design Criteria to Prevent Architectural Barriers for Aged and Physically Handicapped (Fourth Revision, with lever hardware amendment)
Americans with Disabilities Act Title III, 1991/1998 (ADA)
DFCM Design Criteria for Architects and Engineers
Weber State University Design Standards
ANSI A117-119- 1968/1998 Accessibility Design Standards
American Society of Heating, Refrigeration and Air Conditioning (ASHREA)
Sheet Metal and Air Conditioning Contractor National Association (SMACNA)
Underwriters Laboratory (UL)
American Society of Testing Materials (ASTM)

In addition, the Design Team and Architect of Record will be required to coordinate their efforts with Weber State University Facilities Management and DFCM.

Recommended additional codes, standards and guidelines include:
ANSI/ASHRAE Z9.5
Weber State University Central Quad Master Plan

Occupancy Classification
The occupancy determination must be confirmed by the Architect of Record with the University Fire Marshall and the State Fire Marshall.

Weber State University Facilities Management is the representative of the University with authority over all aspects of the design and construction processes. All contact should be directed through the Project Manager from Weber State University.

Based on the 2003 IBC
Programmed Area: 85,700 gross SF, 3 stories

Item	Value	Section / Notes
Sprinklers	Fully Sprinkled	903
Occupancy	B A-3	304.1 Offices / Classrooms 303.1 Auditorium / 20% NASF
Construction Type	IIA or IIB	602.2 Building elements are non-combustible. Construction type limits single floor allowed area. Total allowed floor area is sufficient either building type.
Allowable Height / Area	B= 5/37,000 A-3= 3/15,000	Table 503
Increase in Height	B= 6 stories 85ft total A-3 4 stories 85ft total	504.2
Area Increase	IIB/ A = 35,625 per floor **106,875 total** IIA/ A = 58,125 per floor **174,375 total**	302.3.1 Area increase based on assuming most restrictive occupancy is Group A-3 & applying it to the whole building to achieve "Non separated uses." 506.1. Calculation not shown. Refer to code section. 506.2. Assuming greater than 30ft side yards all around for 75% increase. 506.4. Assuming 3 stories.
Occupancy Separation	Not required.	302.3.1 See area calculations above.
Fire Rating of Building Elements	IIB **Element Rating /hr** Structural frame 0 Bearing walls 0 Non-bearing walls 0 Floor 0 Roof 0 IIA **Element Rating /hr** Structural frame 1 Bearing walls 1 Non-bearing walls 0 Floor 1 Roof 1	Table 601

Stairs	1 hr = 3 stories 2 hr = 4 stories	1019.1
Shafts	1 hr = 3 stories 2 hr = 4 stories	707.2, 707.4
Occupant Load	600	1004.1. Assuming occupant load equal to 75% of the total NASF.
Fixture Count	WC= 1/50= 12 Lavatories= 1/50= 12 Drinking fountain 1/100= 6	Table 2902.1 Assuming Educational classification and equal fixtures for men and women (Total fixtures required shown).

ADA Accessibility
The new Humanities Building and site are required to be in compliance with the American with Disabilities Act, Title III, 1991/1998 (ADA). The Utah State Building Board has adopted the following additional requirements:

- All public entries to the building will be ADA compliant with automatic door operators including required vestibule doors.
- One set of accessible restroom doors shall be equipped with automatic door operators including vestibule doors if applicable.
- ADA compliant parking shall be addressed.

<u>3.2.10 TESTING AND INSPECTIONS</u>
The Architect/Engineer, and the selected testing lab, shall perform periodic construction observations, testing, and special inspections, as outlined in section 4.6 of the DFCM Design Criteria for Architects and Engineers. The design engineer shall list all required special inspections on the contract drawings, and perform periodic construction observations as required by the A/E agreement. Costs for special inspections and testing services will be paid for directly by the owner.

3.3 BUILDING SYSTEMS DESIGN CRITERIA

3.3.1 STRUCTURAL

The structural design for this project should provide a building system which will integrate with the program requirements for space layout, as well as with the architectural and building service needs, while meeting current code standards for vertical and horizontal load carrying capacity. User needs in terms of current flexibility of the spaces and future adaptability of use should be considered.

Structural / Service Coordination

Layout of the structural grid will need to respect the classroom, and office planning module established for the various building functions. During the design phase, a completely integrated approach to building systems is recommended. Distribution of HVAC, plumbing and electrical services must be carefully coordinated with the structural elements, particularly at framing intersections and major crossover points. This close coordination must be achieved in order to avoid conflicts and limit penetrations of major structural members.

Foundation System

A soils report for the project is not yet available. However, it is anticipated that the foundation system will be of conventional spot and continuous footings bearing on suitable, natural, undisturbed soils or on compacted fill extending to suitable, natural, undisturbed soils. The allowable soil bearing pressure will likely range from about 2,000 psf to 3,000 psf. The actual allowable soil bearing pressure will be determined by the Soils Engineer. The frost cover to be provided from final exterior grades to the bottom of exterior footings will be a minimum of 30 inches. Interior footings will likely have a minimum embedment depth of about 18 inches below final interior slab on grade elevations.

The slabs on grade will be a minimum of 4" thick. In the basement area, they may need to be thicker to accommodate a mechanical equipment room. The slabs on grade will be reinforced with at least 0.001 ratio of deformed reinforcing steel in two directions based upon the gross section of concrete. The slab will likely be placed over 4" of free draining granular fill and appropriate moisture barriers. Slabs will be designed and detailed with control and construction joints spaced such that cracking is minimized.

Elevator pits will need to be incorporated into the foundation design.

Some structural work to relocate the utility tunnel will be needed.

Floor System

The suspended floors of the new building will be of 3.1/2" of lightly reinforced normal weight concrete over 3" composite phosphatized/painted steel deck (6.1/2" total thickness) supported by composite steel beams. The floors are to be designed to limit vibrations to those expected for typical office and educational floors. The steel beams will be supported on steel columns. This is also a very efficient and economical framing system. The floors will need to be designed to support some heavy "UPS" equipment. The floors will need to accommodate openings for elevators and mechanical shafts.

Roof System

The roof system will be 1 ½ inch, 20 gauge, type "B" galvanized steel roof deck over open web steel joists and steel beams. The steel joists will be supported on steel girders. The steel girders and steel beams will be supported on steel columns. This is a very efficient and economical framing system. The roof will need to be designed to support snow loads, snow drifts and any miscellaneous mechanical loads (including penthouses or screen walls). It will also need to be designed and detailed to support any window washing equipment. The roof will need to be designed to accommodate the loads and openings of the elevator equipment.

Structural/Architectural Exterior Walls

The type of exterior walls to be used has not yet been determined but will likely be of brick veneer over steel studs. These walls are not load bearing and do not provide lateral support for the building. They will need to be detailed to accommodate lateral story drift caused by wind and seismic forces. The design and detailing of these walls will be covered by the architectural drawings.

Lateral Force Resisting System

The lateral force resisting system will be of the roof and floor systems steel roof deck acting as diaphragms, which will distribute the lateral loads to the vertical force resisting system. The vertical force resisting system will be special moment resisting steel frames or concentric special steel braced frames or concrete walls or a combination of those systems. The redundancy factor for the project is to less than 1.1. The lateral forces will then be delivered into the foundation system by the vertical force resisting system. The foundation system will be designed for both overturning and sliding forces.

The building is located approximately ¼ mile from a fault that runs along Skyline Drive.

Codes

The 2003 International Building Code will be used as the minimum code and standard for this project. This includes the current editions of the standards referenced by the 2003 International Building Code. The project will also need to conform to the design standards of the Division of Facilities and Construction Management (DFCM).

Structural Design Criteria and Material Strengths

The final design criteria and material strengths are to be clearly shown on the final structural documents.

Structural Design Criteria and Material Strengths

Listed below are the minimum required structural design criteria and material strengths. The criteria and strengths will continue to be evaluated as the design progresses. The structural design will be according to the 2003 International Building Code (IBC 2003). The building is to be classified as a Category III building per the IBC 2003.

Design Criteria:

1. Roof Snow Load

Snow Ground Load	P_g = 44 psf
Snow Importance Factor	I = 1.10
Exposure Factor	C_e = 1.0
Thermal Factor	Ct = 1.0
Flat Roof Snow Loads	P_f = .7*Pg*I*Ce*Ct

2. Seismic Loads

Short Period Mapped Acceleration	S_S = 1.80
Long Period Mapped Acceleration	S_1 = 0.78
Soil Site Class	D
Short Period Site Coefficient	F_a = 1.50
Long Period Site Coefficient	F_v = 1.00
Design Spectral Response Acceleration	S_{DS} = 2/3 * F_a * S_S
Design Spectral Response Acceleration	S_{D1} = 2/3 * Fv * S1
Seismic Importance Factor	I_e = 1.25
Response Modification Coefficient	R = 8
Seismic Response Coefficient	C_s = .161
W Dead Loads of Structure	
Building Seismic Design Category	E
Base Shear	V= C_S * W = (Strength Design)

3. Wind Loads:

Basic Wind Velocity (3 Second Gust)	110h
Exposure Type	C
Importance Factor	1.15

Working Stresses for Materials:

1. Concrete (28 day strength):

Footings	3,000 psi
Foundation Walls	4,000 psi
Interior Slabs on Grade	3,500 psi
Concrete over Steel Deck	3,500 psi
Exterior Slabs on Grade	4,000 psi

2. Reinforcing Steel ASTM 615 Grade 60 — F_y = 60 ksi

3. Structural Steel

Wide Flange Shapes	ASTM A992 (50 ksi)

Other Shapes and Plates	ASTM A36
Steel Tube Columns	ASTM A500 Grade B (46 ksi)

Miscellaneous
Blast loading was not a required design parameter for this project.

Future expansion of the building was not a design parameter for this project and is not anticipated.

3.3.2 MECHANICAL, Plumbing and Fire Protection

General Mechanical
The design and construction of the Humanities Building at Weber State University shall comply with the current Utah State Division of Facilities and Construction Management's updated Design Criteria as well as the current Weber State University Design Standards.

The mechanical and plumbing systems for the buildings shall be energy conserving and suitable for the building occupancy. Systems and equipment shall have a proven history of providing efficiency and optimal energy conservation. Per the Governor's directive, the building systems shall be 20% more energy efficient than current codes.

Automatic temperature controls shall be suitable for the building systems and occupancy. The control system shall be an electronic DDC system tied into the Johnson Metasys central campus control system. The new controls shall be 100% compatible and integrated with the existing campus system.

Provide complete operation and maintenance manuals at the completion of the project as well as a complete set of record drawings and specifications.

All equipment shall be clearly labeled. Equipment, piping and ductwork shall be painted and labeled as required by the Weber State University design guidelines.

Design Conditions
The mechanical system shall be designed to maintain comfort condition in accordance with the Utah State Energy Code, DFCM A/E Design Guide, and WSU Design and Construction Standards.

Elevation: 4350 Ft.

Lat / Long. 41°15′ N, 111°57′ W

Ambient: (ASHRAE 2-1/2%, 97%)

Summer	95°F DB 65°F WB
Winter	5°F DB

Indoor Conditions

Summer	75°F
Winter	72°F

Envelope U-values

Building envelope shall be designed in coordination with mechanical systems in order to achieve energy performance of 20% better than ASHRAE 90.1 – 2001.

Ventilation Rates: ASHRAE 62-1 – 2001

Internal Heat Gain:

People: ASHRAE Estimates for Level Activity

Equipment: ASHRAE Estimates for Following

- Computers
- Copy Machines
- TV Monitors

Lights: Assume 2.5 Watts / Sq. Ft. general. Adjust for special occupancy or task requirements.

Applicable Codes

The mechanical system throughout the building shall be designed and installed in accordance with the most recently adopted of the following codes and standards:

- Life Safety Code
- International Building Code (IBC) including all appendices
- International Mechanical Code (IMC)
- International Plumbing Code (IPC)
- International Energy Conservation Code (IECC)
- International Fuel Gas Code (IFGC)
- National Electrical Code (NEC)
- National Fire Protection Association (NFPA)
- ASHRAE 90.1 - 2001-2003
- ASHRAE Standard for Ventilation 62-1 2001
- ASHRAE Guides and Standards (ASHRAE)
- State of Utah Boiler and Pressure Vessel Rules and Regulations
- American Society of Mechanical Engineers (ASME)
- American Standards Association (ASA)
- American Society of Testing Materials (ASTM)
- Sheet Metal and Air conditioning Contractors National Association (SMACNA)
- Occupational Safety and Health Administration (OSHA)
- DFCM Indoor Air Quality Criteria
- Utah State Division of Facilities and Construction Management (DFCM) ~ Architect / Engineer Design Guide.

- Weber State University Design Guide

Heating, Ventilating and Air Conditioning

The building shall be heated, cooled, and ventilated with systems suitable for the building function and occupancy in accordance with ASHRAE and DFCM standards. HVAC systems must compare with other mechanical systems designed for classroom and administration areas. The primary mechanical system for the Humanities building shall be VAV with reheat.

Heating System

Heating source shall be campus supplied high pressure steam. Steam pressure shall be reduced at a PRV station at the building, and connected to a plate and frame heat exchanger with a 1/3 and 2/3 control station. Steam shall be converted to 180°F heating water and shall be distributed through a two pipe, direct return system to the building. Hot water pre-heat coils shall be installed at air handling units, and hot water re-heat coils shall be installed at the VAV boxes.

The hot water pumps shall be designed with 100% redundancy. The hot water system shall consist of hot water distribution pumps, standby pumps, variable frequency drives, pre-heat coil circulating pumps, air eliminator, and expansion tank complete with automatic make-up water system. The entire hot water system shall be controlled by a DDC control system, and completely integrated into the existing campus central control system. Provide a building steam meter to measure instantaneous flows (in BTUH), as well as cumulative flows (in BTU's). Flow meter shall have a manual reading at the building, as well the ability to communicate readings via the central control system.

The existing condensate pump below building #1 serves all 4 buildings. The existing low pressure condensate piping from buildings 3 and 4 shall be tied into the new condensate pump for the Humanities Building. Provide two new condensate pumps for redundancy. The condensate pump shall be a steam powered condensate pump with no electrical requirements. Existing condensate pump shall be salvaged to the owner.

Cooling System

Cooling source shall be chilled water provided by the central chiller plant. Chilled water piping shall be tied into existing piping near the Bell Tower, and routed in the existing tunnels to the building mechanical room. Chilled water piping in tunnel shall be sized to accommodate the Humanities Building load, as well as the future anticipated load for the replacement of buildings 3 and 4 (approx 8"). See campus chilled water survey. Building chilled water loop shall consist of a building chilled water pump with a variable frequency drive, air eliminator, and expansion tank. In addition, provide an automatic bypass 3-way valve upstream of the chilled water pump. This valve shall be controlled by the BMS. It shall bypass the pumps when the central pumping system is capable of meeting the chilled water demand. This shall be measured by chilled water return temperature. When the campus pumping system cannot meet the building chilled water demand, the bypass shall open to the pump, and the building chilled water pump VFD shall modulate to meet demand.

Building chilled water system shall be completely integrated with the campus central control system. Chilled water supply piping shall supply 45° F chilled water to the cooling coils located in the building air handling units. Coils shall be designed for a 10° F water temperature rise. Provide a building chilled water flow meter to measure instantaneous flows (in gpm), as well as cumulative flows in (in gallons). Flow meter shall have a manual reading at the building, as well the ability to communicate readings via the central control system.

Computer server rooms shall be provided with independent dedicated cooling units.

Air systems

Air system for the buildings shall be a combination of variable volume air handling units, with VAV boxes for individual zones. Each classroom shall have a dedicated VAV box. Individual rooms in the administration area shall be zoned together with other rooms of similar loading, function, outdoor exposure, etc. No more than 3 individual offices shall be combined on the same VAV box. The number of air handling units and their locations shall be determined by space location and usage, individual zone requirements, and economics. Each air handling unit shall be provided with hot water pre-heat coils, and chilled water cooling coils. Each air handling unit shall have 100% economizer capability. The use of return/relief fans shall be determined during design. Return fans are encouraged where there are large pressure drops through return air systems, or where additional control of building static pressure will be required.

Roof mounted belt driven exhaust fans shall be provided for the toilet rooms, custodial closets, laundry room, copy room, elevator rooms and kitchens. Rooms with similar use, function, and schedule may be combined in the same fan systems. The exact number and location of the fans shall be determined during design. Exhaust ducts shall be routed to roof fans. Building exhaust fans shall be controlled via the BMS.

Outside air ventilation shall comply with ASHRAE Standard 62-1 2001. Outside air shall be controlled by carbon dioxide sensors to provide adequate ventilation, as well as improved energy efficiency. The systems shall be capable of 100% outside air and 100% relief air in economizer load. The number and location of fresh air inlets, and relief air outlets shall be determined during design.

The air handling system shall be controlled by a DDC control system that is 100% integrated into the campus central control system. Building air handling system controls shall include air handler VFD control with duct static pressure re-set, air handler discharge temperature control, VAV box space temperature and discharge temperature control, building static pressure control, outside air damper control, etc. Additional specifics of the controls system shall be coordinated with the University during design.

All ductwork shall be insulated metal duct with volume dampers for each diffuser or grille. Classroom and office air distribution systems shall be designed to provide a quiet comfortable learning and working environment.

Plumbing Systems

Plumbing systems shall be designed to meet the International Plumbing Code as adopted by the State of Utah, D.F.C.M. Guidelines and Weber State University Design and Construction Standards.

Currently domestic hot water for Buildings #1 and #2 is being provided by a heat exchanger under building #3. These existing domestic hot water lines shall be removed and capped. Domestic hot water piping for the Humanities building shall be provided by a new semi-instantaneous steam powered water heater. The water heater shall be a plate and frame steam to water heat exchanger fed by campus supplied steam from the tunnels. Domestic water system shall include building hot water re-circulation with pump and hot water re-circulating line.

Plumbing fixtures shall be manufactured by the same source. Provide ADA compliant fixtures as required by code, and where called out in the individual space requirements. Provide water closets, sinks, lavatories, and any other fixtures as detailed in the individual space requirements.

Provide floor mounted service sinks and wall mounted hand sinks in the custodial closets indicated in the individual space requirements.

Provide mixing valves on ADA bathroom fixtures.

As required by the design, lavatories shall be either cabinet mounted or wall mounted self supporting fixtures.

Water closets shall be wall mounted flush valve type with elongated bowl and open front seat.

Floor drains shall be provided in all bathrooms, custodial closets, mechanical equipment rooms and laundry rooms.

Water treatment for the heating hot water and chilled water systems shall be provided and system shall match existing campus system. The WSU water treatment organization is West Water and Energy Systems Technology.

Exterior Hydrants shall be provided for landscape and hose connections.

Fire Protection Systems

Fire sprinkler protection shall be provided suitable for the building type and occupancy. The entire building shall be sprinkled. System shall comply with NFPA, Campus Fire Marshal and State of Utah Fire Marshal requirements.

Fire alarm main panels shall be installed by the main front entrance used by the fire department, and the exact placement shall be decided during design in conjunction with the campus Fire Marshal.

The fire sprinkler inspector's test shall be piped into a drain or sewer to prevent water damage.

The fire sprinkler inspector test shall be of the simulated sprinkler head type, and not the glass bulb type.

The fire alarm contractor shall provide a "dry" set of contacts to tie into the central campus annunciator panel.

All fire rated doors shall be supplied with a magnetic door hold open that is tied into the fire alarm system. Upon activation of a fire alarm or power failure, they shall release.

The contractor shall provide documentation of the acceptability of all fire-safing materials used.

3.3.3 ELECTRICAL

Codes and Standards

Codes, which are applicable to the design of the electrical systems, are listed below. Comply with each of the latest adopted publications:

- ADA, Americans with Disabilities Act
- ASHRAE 90.1 Energy Code
- EIA/TIA, Electronics Industries Association/Telecommunications Industry Association
- IBC 2003, International Building Code
- IEEE 1100-1999, Recommended Practice for Power and Grounding Electronic Equipment
- IESNA, Illuminating Engineering Society of North America
- NFPA, National Fire Protection Association (applicable sections including but not limited to):
  - NFPA 70, National Electrical Code
  - NFPA 72, National Fire Alarm Code
- UL, Underwriter's Laboratories
- Utah State Fire Marshal Laws, Rules and Regulations
- DFCM, Division of Facilities Construction and Management, Design Criteria
- Weber State University Design Guidelines

Site Utilities

Medium Voltage Power Distribution System

Existing five (5) way medium voltage switch is to be replaced with a new six (6) way medium voltage SF6 switch. The new switch should be installed on grade outside of the building. Existing switch is tied to building #4, building #2, union building #1, student services building and a spare switch. Weber State University prefers the new switch to be manufactured by S&C. Spare switch can be utilized temporarily to provide power to new on grade switch to reduce length of power outages. This will allow existing feeder cables to be extended to new switch one at a time. New switch must be located close to where existing is to reduce or eliminate number of splices.

The medium voltage switch, which provides power to new Humanities building, must have fuse protection.

Existing three (3) 167 kva single-phase medium voltage transformers are to be replaced with a new pad-mounted transformer (approximately 1,000 kva). New pad-mounted transformer is to be located next to the Medium Voltage Switch.

The new medium voltage switch should provide power to a new oil-filled, air-cooled, pad-mounted transformer. Primary voltage for new transformer should be 12,470 volt Delta; secondary voltage should be 480/277 volts 3-phase WYE connection.

Telecommunication Distribution

The MDF room in the new Humanities building should have connections to the campus distribution network. A total of four (4) 4" conduits should run from this building to existing utility tunnel. MDF room should be located in close proximity to the existing utility tunnel.

Telecommunication work should comply with the Weber State University telecommunications design standards and all work should be coordinated with Weber State University telecommunications.

Powers Distribution Systems

Existing main distribution switchboard is old and parts are hard to find. Under this project, the entire switchboards, panelboard, feeder conduit and conductors should be removed and replaced with new equipment.

The main electrical room should be constructed to house a 480/277-volt and a 208/120-volt main distribution switchboard.

This room should be located as close as possible to the pad-mounted high voltage transformers to reduce the length of feeder conduit and conductors.

The 480/277 volt main distribution switchboard should be free standing and equipped with Square D. "Powerlogic"- type digital metering and should be tied to the campus central power monitoring system via a data line.

The 480/277 volt main distribution switchboard should be utilized to provide power to branch lighting panelboards, 480 volt machines, elevators, and large mechanical equipment such as air handlers, pumps, chillers, fans, etc.

The 208/120 volt main distribution switchboard should be utilized to provide power to branch power distribution panelboards for computer equipment, owner furnished equipment, duplex outlets, small mechanical equipment, etc.

Electrical rooms should be constructed on each floor to house the 480/277-volt and 208/120-volt branch panelboards.

Electrical rooms should be stacked on top of each other to reduce length of feeder runs.

Electrical rooms should have a minimum of 25% additional space for future growth.

Separate branch panelboards should be installed to feed power to computer equipment. Computers and any sensitive equipment should be tied to separate panelboards to isolate them from other equipment such as small mechanical equipment and general-purpose duplex outlets. Main distribution switchboards and branch panelboards should have 50% excess capacity for future growth and flexibility.

Transient voltage surge suppressors should be provided for 480/277 volt and 208/120-volt main distribution switchboards, also for computer equipment branch panelboards.

All conductors should be copper. Conductors for branch circuits should be sized to prevent voltage drop exceeding 3% at the farthest point with 80% of circuit breaker demand load (duplex outlets, equipment, etc.). The total voltage drop on both feeders and branch circuits should not exceed 5%.

All conductors shall be installed in conduit. Minimum size of conduit to be ¾ ". Type MC cable may be used for light fixtures whip. Length of conduit runs to cable trays should not exceed 50'. Install cable trays in the corridors. Provide pull strings in all empty conduit.

A fault current and selective device coordination study should be done to indicate available fault current at all points in the 15 kV and building power distribution system. New switchboards, panelboards, etc., should be adequately rated for the available fault current. Fuses and circuit breakers should be selected to ensure minimum system power outage due to overloads or faults. Circuit breakers with adjustable long time, short time, instantaneous and/or ground fault setting shall be set at levels for optimum system coordination.

Mechanical equipment requiring variable frequency drives (VFDs) should comply with DFCM standards for VFDs included in the "Design criteria for Architects and Engineers" posted on the DFCM website.

Standby Power Distribution System

Provide a standby diesel engine generator with a skid mounted fuel tank and walk-around sound attenuated enclosure to support new building life safety equipment, network equipment, A/C equipment for network computer equipment, outlets in IDF rooms, and other standby outlets as designated by the users. Standby diesel engine generator should have approximately 20% excess capacity for future growth and flexibility.

New engine generator should be equipped with demand power meters alarm indicating control panel. Dry contacts should be available for remote monitoring of engine and fuel system alarms.

Fuel tank should be sized for 24 hours of engine operation at 100% load. University campus should have the ability to refill the tank during an extended commercial power outage.

A separate automatic transfer switch should be provided for life safety equipment.

Outlets

Locations and number of outlets should be coordinated for each space with users and comply with their needs and requirements. The following is to be used as general guidance:

Offices: For each workstation, provide two duplex outlets dedicated to computer terminals and one additional normal outlet for every 6' of wall space.

Conference and Board Rooms: One outlet for every 6' of wall space, plus one outlet dedicated to computer terminals on all walls. Provide floor outlets underneath conference room tables.

Lounges/Break rooms/Kitchenettes: GFI outlets on dedicated circuits every 4' on counter top plus dedicated outlets for refrigerator, microwave, and disposal (switched at counter top), plus one outlet for every 6' of other wall space in room.

Counter tops (in general): One outlet every 4'; GFI where within 8' of a sink.

Classrooms, Lecture Halls, Teaching Labs and other Instructional Spaces: Provide outlets for instructor's station, audio/visual equipment and each student. Ensure that there is at least one outlet for each 6' of wall space. Provide floor outlets where stations or equipment cannot be served directly from the wall without crossing aisle space. Where tables are fixed in place, coordinate power outlets mounted directly into the millwork.

Research Labs: Provide outlets for instruments, each table/desk, dedicated outlets for refrigerators, etc. Provide plug strip at counters. Provide a general-purpose outlet in each lab to be used for cleaning and maintenance. General-purpose outlets should not be tied to the lab equipment outlets or counter top outlets.

Student Commons Areas, Lounges and Study Areas: Provide power outlets for laptop computers, at least one four-plex for each group of four seats, but no less that one outlet per each 6' of wall space. Provide floor outlets where stations or equipment cannot be served directly from the wall without crossing aisle space.

Telecommunication Rooms: Provide emergency outlets for equipment and a normal power duplex outlet for general-purpose use.

Electrical Rooms: At least one outlet on emergency power, designated by a red outlet with a red cover plate and labeled "EMERGENCY POWER".

Restrooms/Shower Rooms: One GFI outlet near each lavatory counter top.

Corridors: Provide at least one outlet every 25', on alternating sides of the corridor.

Lobbies: Provide at least one outlet every 6', on alternating sides of the lobby.

Stairs: One outlet at the landing of each level.

Storage Rooms (small), Janitors Closets: Two duplex outlets.

Building Exterior: One WP/GFI outlet near each entrance, and adequately spaced in the outside display and student interaction areas.

Grounding: Grounding Conductors

Grounding conductors should be installed with all feeder and branch circuits.

Provide a grounding riser system throughout the telecommunication rooms with grounding bus bars mounted on the wall in each room.

Lighting

General

Lighting design should comply with illuminance levels and uniformity criteria of IESNA and its recommended practices. Comply with RP1-93 "Office Lighting", RP3-00 "Lighting for Educational Facilities", and RP-33-99 "Lighting for Exterior Environments". Except for specialized applications, design lighting with a minimum efficacy of 64 lumens per watt. Specify maximum 20% THD electronic ballasts. In addition, design lighting with a CRI exceeding 82, except in storage, mechanical, electrical, and similar non-public applications. Where appropriate, different lamp types should be minimized. Use 4' T-8 lamps with CRI of 86 or greater wherever possible. Lamps should be specified to comply with EPA TCLP requirements.

Comply with ASHRAE 90.1 requirements, except that overall energy target requirements should be exceeded by 15%. Design lighting control to harvest day lighting where practical, to control based upon occupancy, and according to programmable scheduling as applicable to the application.

Only campus standard lighting fixtures should be used for walkways, compatible with the campus surroundings. Exterior lighting should be controlled by combination photocell and time schedule.

Interior Lighting

In general, low-glare fluorescent lighting with electronic ballasts should be utilized. Pendant indirect lighting should be strongly considered, but must be carefully coordinated in rooms with projectors so that the fixtures will not interfere with the projected image. Select luminaries for areas where VDTs are planned which are designed to minimize veiling reflections, and provide multilevel lighting control and task lighting to reduce the illuminance on the VDT. In addition, in rooms with audio/visual, provide lighting with variable or switched levels as indicated with a separate controlled zone to reduce glare and illuminance on the audio/visual display. In rooms with projectors, provide a separate bank of lighting control switches or station near the instructor position for ease of controlling lighting during presentations. Comply with RP-3-00 for classroom lighting, except increase illuminance to 75 fc (variable). Comply with RP-1-93 for office lighting.

Occupancy sensors should be used for the appropriate applications and control for daylight harvesting. Specify dual technology ceiling mounted directional sensors in private offices and classrooms with manual off-switches. Ultrasonic sensors should be in restrooms. Programmable lighting control with manual timed overrides should be in all common areas such as open offices, corridors, lobbies, and similar areas.

Provide exit lighting to comply with IBC. Emergency lighting should be designed for means of egress to 1 fc minimum to comply with IBC. Include emergency lighting in restrooms, electrical rooms, communication rooms, etc.

Provide emergency lighting in the exterior of the building by the entrance doors to illuminate path of egress.

Fire Alarm System

Fire alarm system should be designed to comply with Utah State Fire Marshall's "Rules and Regulations" and Weber State University Design Standards. Only Notifier as distributed by Mountain Alarm is allowed on campus. An addressable fire alarm system should be designed capable of networking with the campus system and reporting back to central campus fire alarm system. Design strobes visible from all locations except private offices.

Horn installation should comply with NFPA including for higher ambient noise requirements. Where smoke control systems are required, the integration of the fire alarm with the smoke control systems should be coordinated. Provide duct detectors and fan shutdown where required by NFPA and the IMC, including detection of smoke at all return air shafts servicing multiple floors. Coordinate location of the building fire alarm control panel and annunciator panel with the Campus fire marshal.

Telecommunication System

The MDF room should be located next to the existing utility tunnel. Four (4) 4" conduit should be installed between the MDF room and the utility tunnel.

IDF rooms should be constructed on each floor and should be stacked on top of each other. Cable length between IDF and Voice/Data outlets should not exceed 290 feet.

Size of MDF and IDF rooms should be coordinated with Weber State telecommunication group.

Four (4) 4" conduit should be installed between IDF rooms and between MDF room and closest IDF room to MDF room.

All the walls in the MDF room and IDF room should be constructed with ¾ " plywood and painted with two (2) coats of fire retardant paint.

Cable tray should be installed next to all the walls in MDF and IDF rooms.

Cable trays should be installed in the corridors and should tie to cable trays in the IDF and MDF rooms.

J-boxes for all voice/data jacks should be 4" x 4" x 2⅜" with single gang mud rings. Two (2) 1" conduit should run from each J-box to the cable trays or directly to IDF or MDF room, whichever is closest.

Pull box should be provided after total of 180° bend in each conduit run. Maximum conduit distance from each voice/data outlet to cable tray should not exceed 50 feet.

Security Systems
Security system should comply with campus standards. Security system should annunciate alarm condition to, and be completely monitored by the Weber State University campus police department.

Clock System
Simplex clock system should be provided throughout the building in common areas; Locations should be coordinated with the users.

3.3.4 VERTICAL TRANSPORTATION

Elevator Performance Standards

Utilize standards previously recommended for evaluating elevator performance in the new Humanities Building. From these standards, which cover the quality and quantity of elevator service, the following planning criteria are recommended. These criteria are based on five minutes of heavy two-way traffic:

Building Passenger Elevators

Average Interval	Less than 40 seconds
Handling Capacity	To suit needs of each elevator group or building element

3.3.5 SYSTEM COMMISSIONING

Mechanical System Commissioning
In order to comply with 1999 ASHRAE 90.1, commission the mechanical system in accordance with the 1996 ASHRAE Guideline 1 "The HVAC Commissioning Process". A commissioning authority will be hired directly by the State to oversee the commissioning.

Electrical System Commissioning
Complete commissioning specifications are required for this project to ensure that the products specified are tuned and adjusted properly. Commissioning shall include testing and adjusting all electrical and systems equipment, preparing documentation of the testing results, preparing O&M manuals, and providing owner training as specified in each section of the electrical and systems specifications.

3.3.6 LANDSCAPE DESIGN CRITERIA

Outdoor Space Types and Features

Create a variety of campus space-types: quiet--active, green--paved, open--closed, shaded--sunny, etc. Limit hardscape areas to those that will attract large gatherings; in principle most outdoor spaces should not be hardscape. Because of the plan to create a large area of hardscape at the Clock Tower Plaza, extensive hardscape at the Humanities Building should be limited to an outdoor gathering areas just outside the entrances. The building and site must provide for quality key open space. The building site offers an opportunity to create additional outdoor activity areas and to enhance the existing outdoor activity areas/green spaces. Provide fixed and movable site furniture at strategic quiet and busy locations to accommodate both quiet lounging and interactions.

Site Accessibility

Paths to building entrances shall meet ADA criteria for slope and landings. Wherever possible, all other site paths shall meet ADA criteria. If this is unfeasible in a particular location, provide elevator access within the Humanities Building that will allow wheelchair users to transition the non-compliant grade condition. All usable outdoor spaces shall be fully accessible.

Bicycles

Provide for bicycle usage along the north pedestrian corridor, and secure bicycle storage adjacent to the entrance. Bicycle racks, rather than bicycle lockers, should be located conveniently near building entrances.

Trash and Recycling Containers

Locate receptacles near building entrances and in areas where people are encouraged to congregate. Recycle bins should be located adjacent to trash bins to encourage use.

Plant Materials

Indigenous plant materials should constitute a majority of the plant palette and be able to withstand drought conditions during the heat of summer months. Deciduous trees are encouraged along pedestrian walks and in plaza areas to provide shade. Mass shrub plantings should avoid creating areas of security hazard (i.e. along pedestrian walks and entryways).

Irrigation

Irrigation should not be considered as the primary source of plant vitality. Limited focal areas may be considered for irrigation, with consideration of minimal water consumption. Large expansive lawns are to be avoided due to the limited water availability. High drought tolerant grass species should be specified. Alteration of the topography to concentrate water in plant beds and lawn areas instead of storm drains should be considered. Xeriscape design concepts should be incorporated and coordinated with Weber State Facilities Management.

Site Lighting
Lighting is to be provided along pedestrian walks for security. High cut-off fixtures should be used to avoid light wash pollution to adjacent buildings and the sky.

Paving Alternatives
Consider using permeable pavements in areas of low pedestrian concentration or tertiary circulation patterns. Permeable pavements potentially reduce the amount of storm water run-off.

Designated Smoking Areas
Exterior designated smoking areas should be provided that offer shelter from the elements.

3.3.7 VALUE ENGINEERING
Weber State University may conduct a Value Engineering Workshops with the Value Based Selected Contractor (CM/GC) at the Schematic Design Phase and the Design Development Phase submittal stage. The VE sessions should include a presentation of the project by the Design Team, and evaluation/recommendations by the CM/GC and Owner. The University may also invite a "cold team" to participate in these workshops.

3.4 SUSTAINABLE DESIGN

Definition
The American Institute of Architects defines sustainability as "the ability of society to continue functioning in the future without being forced into decline through exhaustion or overloading of the key resources on which that system depends." In simple terms it is the principal of accommodating human needs without diminishing the health and productivity of natural systems.

Current building practices do not represent a sustainable approach to design. The reality is that buildings consume nearly a third of America's energy—much of it wasted by inefficient design—while land-use decisions influence another third used in transportation. However, sustainable design practices represent a healthy balance between human needs and natural systems described above.

This balance can be put into two categories, Resource Efficiency and Community Sensitivity. Resource Efficiency is the practice of utilizing resources such as land, water, soils, minerals, fossil fuels and electricity to their fullest capability. Community or cultural sensitivity connects people to places, nature, and other people.

Benefits
Sustainable design can lead to a variety of benefits, many of which are economic. These benefits can include reduced capital costs of some building components. There are also the obvious reduced operating and maintenance costs that come from a reduction in energy and water costs that come from an efficient design. The reduced operating costs range from 10-50% less than traditional building methods and designs.

There are also numerous studies that link healthy, day lit buildings to decreased absenteeism and increased productivity as much as 2 to 15 percent. Sustainable buildings also provide reduced liability risks by limiting occupant exposure to poor indoor air quality and other known chemical pollutants.

Finally, sustainable buildings can provide opportunities for positive public relations through education programs showing positive solutions and examples of successful buildings.

Sustainable Design Components
Restorative Site Development Strategies

1. Reduce pollution and land development impacts from automobile use by providing and accommodating alternatives such as public transportation, pedestrian links to other campus buildings, and bicycle transportation.
2. Encourage opportunities for urban wildlife by developing and restoring landscaped areas with native and compatible adaptive plant species.
3. Maximize landscaped areas to minimize peak storm flows, increase on-site filtration of solids and phosphorous contaminants.
4. Reduce the negative effects of urban heat-islands by providing shade on paved areas with canopy trees and light colored paving materials.
5. Use high-reflectance (Energy Star) roof and paving materials to reduce heat-island effects.
6. Provide safe & uniform exterior lighting with no offsite light trespass.

Enhanced Water Efficiency

1. Limit the use of potable water for landscape irrigation by designing high-efficiency irrigation systems and grouping plants with like water requirements to reduce irrigation requirements.
2. Include plumbing fixtures with proven history of reduced water use.

Energy-Saving Design Opportunities

1. Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended by engaging an independent commissioning authority.
2. Reduce design energy costs compared to code-required levels by a minimum of 20%.
3. Building envelope design to reduce energy use (solar orientation, shading devices at eaves and glazing, high R-value roof and wall assemblies).
4. Design fenestration to provide daylight in occupied spaces to reduce need for artificial illumination.
5. Design electrical switchgear to accommodate future renewable energy producing devices.
6. Building design to include opportunities for future renewable energy devices such as photo-voltaic panels.
7. Reduce ozone depletion and support early compliance with the Montreal Protocol by designing refrigeration systems that do not contain CFC's, HCFC's or Halon.
8. Provide for the ongoing optimization of building energy and water consumption performance over time by including measurement and verification technology.

Materials to Facilitate Healthy Environments

1. Provide multiple recycling areas to accommodate the collection, separation and removal of recyclables to reduce waste that is disposed of in landfills.
2. Divert construction debris from landfill disposal by developing and implementing a waste management plan for construction activities.
3. Prioritize the potential use of building materials with recycled content (tiles, masonry units, steel, carpeting, etc.).
4. Reduce effects of transportation and support local economy by specifying materials manufactured and assembled locally.
5. Encourage environmentally responsible forest management by using wood-based materials certified in accordance with the Forest Stewardship Council Guidelines.

Indoor Environmental Quality

1. Provide for a thermally comfortable environment that supports the productive and healthy performance of the building occupants.
2. Reduce air contaminants coming from building materials by creating a construction Indoor Air Quality Plan.
3. Include capacity for indoor air quality monitoring (CO_2) for occupant health and comfort.
4. Provide increased quantities of fresh air to support health, safety and comfort of building occupants.
5. Specify low V.O.C. emitting paints, adhesives, sealants and other products to enhance the health benefits to occupants.
6. Minimize cross-contamination of pollutants in occupied spaces by separating potentially hazardous chemicals.
7. Provide a connection between indoor and outdoor environments through the introduction of sunlight and views into the occupied areas of the building.

Community Outreach

1. Utilize the opportunity to provide outreach and education for site and building green design features.

University Support

Weber State University supports the goal of sustainable design which incorporates energy savings, while meeting Program and Facilities needs within scope and budget.

4.0 INDIVIDUAL SPACE OUTLINE

4.0 INDIVIDUAL SPACE OUTLINE

4.1 SPACE PROGRAM AND AREA SUMMARY

The following sheets provide the square foot requirements for each area included in the new Humanities Building.

Weber State University
ajc architects

Rough-Order-of-Magnitude (ROM) Spaces Program
1-Oct-05

	Function Area		Space Name	Description	Notes	Adjacency	Building Level	Occ #	SF / P	NASF	#	Program NASF
A.	**English and Literature**											
1	Administration Offices	a.	Private Office	Department Chair and Advising Office	Individual private office with meeting space for 2-3 in office.	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	180	180	2	360
		b.	Private Office	Faculty Office- Current	Individual private office	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	120	120	30	3,600
		c.	*Private Office*	*Faculty Office-Growth*	*Individual private office*	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	*1*	*120*	*120*	*3*	*360*
						Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)					
		d.	Administration Support	Secretary Work Station	2 full time secretary/receptionists.	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	81	81	2	162
		e.	Reception Waiting Area	Open space for chairs	Reception area--during registration may have "lines going out of the door."	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	8	15	120	1	120
		f.	Reception-Computer Station	Computer Station	Computer station located in the reception area for student use.	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	30	30	1	30
		g.	Work Study	Work Station for Work Study-Current		Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	81	81	1	81
		h.	*Work Study*	*Work Station for Work Study-Growth*		Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	*1*	*81*	*81*	*2*	*162*
2	Administration Support Spaces	a.	Record Storage Space	Secure Storage Rooms for Records	Should be located close to faculty work room.	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	150	150	1	150
		b.	General Storage	Secure Storage Room	Storage for forms and files, currently have (3) lateral files / 3-4 high. Storage also for equipment on carts.	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	200	200	1	200
		c.	Library	Resource Library	Small library for video tapes, textbooks under review and resources, archives of old catalogs.	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	6	25	150	1	150
3	English as a Second Language	a.	Private Office	Faculty Office-Current	Individual private office	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	120	120	4	480
		b.	Administration Support	Receptionist	Receptionists	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	81	81	1	81
		c.	Reception Waiting Area	Open space for chairs	Reception area.	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	8	15	120	1	120

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Function Area			Space Name	Description	Notes	Adjacency	Building Level	Occ #	SF / P	NASF	#	Program NASF
		d.	Work Study	Work Station for Work Study-Current		Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	81	81	1	81
		e.	Tutoring Rooms	Tutoring-Current	Private meeting room for 1 on 1 tutoring	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	2	50	100	2	200
		f.	*Tutoring Rooms*	*Tutoring-Growth*	*Private meeting room for 1 on 1 tutoring*	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	*2*	*50*	*100*	*1*	*100*
4	Outreach Programs	a.	Weber Studies	Private Office	A journal published out of the English Department	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	120	120	1	120
		b.	Metaphor	Private Office	A student literary journal	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	120	120	1	120
		c.	Undergraduate Literary Conference	Private Office		Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	120	120	1	120
		d.		Work Station	Secretary for Weber Studies	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	81	81	1	81
		e.	Work Room	Room with work surfaces, cabinets and storage	Copy machines, fax, printers, scanners, work surfaces for collating and sorting.	Strong Adjacency: All English Department Administration Spaces Secondary Adjacency: Communication, Foreign Language and TBE Administration Spaces	Upper Level(s)	8	15	120	1	120
					English Department Sub Total NSF							**6,998**
					English Department Total GSF (ASF / 0.65 Efficiency)							**10,766**

B. Foreign Languages and Literatures

Function Area			Space Name	Description	Notes	Adjacency	Building Level	Occ #	SF / P	NASF	#	Program NASF
1	Administration Offices	a.	Private Office	Department Chair	Individual private office with meeting space for 2-3 in office	Strong Adjacency: All Foreign Language Department Administration Spaces Secondary Adjacency: English, Communication and TBE Administration Spaces	Upper Level(s)	1	180	180	1	180
		b.	Private Office	Faculty Office- Current	Individual private office	Strong Adjacency: All Foreign Language Department Administration Spaces Secondary Adjacency: English, Communication and TBE Administration Spaces	Upper Level(s)	1	120	120	15	1,800
		c.	*Private Office*	*Faculty Office-Growth*	*Individual private office*	Strong Adjacency: All Foreign Language Department Administration Spaces Secondary Adjacency: English, Communication and TBE Administration Spaces	Upper Level(s)	*1*	*120*	*120*	*2*	*240*
		d.	Administration Support	Secretary Work Station	1 full time secretary/receptionists	Strong Adjacency: All Foreign Language Department Administration Spaces Secondary Adjacency: English, Communication and TBE Administration Spaces	Upper Level(s)	1	81	81	1	81
		e.	Reception Waiting Area	Reception Area	Open space with chairs for seating	Strong Adjacency: All Foreign Language Department Administration Spaces Secondary Adjacency: English, Communication and TBE Administration Spaces	Upper Level(s)	8	15	120	1	120

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Function Area			Space Name	Description	Notes	Adjacency	Building Level	Occ #	SF / P	NASF	#	Program NASF
		f.	Work Study	Work Station for Work Study-Current		Strong Adjacency: All Foreign Language Department Administration Spaces Secondary Adjacency: English, Communication and TBE Administration Spaces	Upper Level(s)	1	81	81	1	81
2	Administration Support Spaces	a.	General Storage	Secure Storage Room	General Office Storage.	Strong Adjacency: All Foreign Language Department Administration Spaces Secondary Adjacency: English, Communication and TBE Administration Spaces	Upper Level(s)	1	150	150	1	150
					Foreign Language Sub Total NSF							**2,652**
			Foreign Language Program Total GSF (ASF / 0.65 Efficiency)									**4,080**
C.	**Communication**											
1	Administration Offices	a.	Private Office	Department Chair	Individual private office with meeting space for 2-3 in office.	Strong Adjacency: All Communication Department Administration Spaces Secondary Adjacency: English, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	180	180	1	180
		b.	Private Office	Faculty Office- Current (One of these offices to be for Debate and located adjacent to Communication Debate Lab.	Individual private office	Strong Adjacency: All Communication Department Administration Spaces Secondary Adjacency: English, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	120	120	17	2,040
		c.	*Private Office*	*Faculty Office-Growth*	*Individual private office*	Strong Adjacency: All Communication Department Administration Spaces Secondary Adjacency: English, Foreign Language and TBE Administration Spaces	Upper Level(s)	*1*	*120*	*120*	*2*	*240*
		d.	Administration Support	Secretary Work Station	1 full time secretary/receptionists.	Strong Adjacency: All Communication Department Administration Spaces Secondary Adjacency: English, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	81	81	1	81
		e.	Reception Waiting Area	Reception Area	Open space with chairs for seating	Strong Adjacency: All Communication Department Administration Spaces Secondary Adjacency: English, Foreign Language and TBE Administration Spaces	Upper Level(s)	8	15	120	1	120
		f.	Work Study	Work Station for Work Study-Current		Strong Adjacency: All Communication Department Administration Spaces Secondary Adjacency: English, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	81	81	1	81
2	Administration Support Spaces	a.	General Storage	Secure Storage Room	Storage.	Strong Adjacency: All Communication Department Administration Spaces Secondary Adjacency: English, Foreign Language and TBE Administration Spaces	Upper Level(s)	1	200	200	1	200
3	Meeting Rooms	a.	Small Meeting Room off of Chair's Office	Meeting Room	Small Meeting Room.	Strong Adjacency: All Communication Department Administration Spaces Secondary Adjacency: English, Foreign Language and TBE Administration Spaces	Upper Level(s)	4	25	100	1	100
					Communication Department Sub Total NSF						**25**	**3,042**
			Communications Department Total GSF (ASF / 0.65 Efficiency)									**4,680**

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	Function Area		Space Name	Description	Notes	Adjacency	Building Level	Occ #	SF / P	NASF	#	Program NASF
D.	**Telecommunications and Business Education (TBE)**											
1	Administration Offices	a.	Private Office	Department Chair	Individual private office with meeting space for 2-3 in office.	Strong Adjacency: All TBE Department Administration Spaces Secondary Adjacency: English, Foreign Languages and Communication Administration Spaces	Upper Level(s)	1	180	180	1	180
		b.	Private Office	Faculty Office- Current	Individual private office	Strong Adjacency: All TBE Department Administration Spaces Secondary Adjacency: English, Foreign Languages and Communication Administration Spaces	Upper Level(s)	1	120	120	8	960
		c.	*Private Office*	*Faculty Office-Growth*	*Individual private office*	Strong Adjacency: All TBE Department Administration Spaces Secondary Adjacency: English, Foreign Languages and Communication Administration Spaces	Upper Level(s)	*1*	*120*	*120*	*2*	*240*
		d.	Administration Support	Secretary Work Station	1 full time secretary/ receptionists.	Strong Adjacency: All TBE Department Administration Spaces Secondary Adjacency: English, Foreign Languages and Communication Administration Spaces	Upper Level(s)	1	81	81	1	81
		e.	Reception Waiting Area	Reception Area	Open space with chairs for seating	Strong Adjacency: All TBE Department Administration Spaces Secondary Adjacency: English, Foreign Languages and Communication Administration Spaces	Upper Level(s)	8	15	120	1	120
		f.	Work Study	Work Station for Work Study- Current	5 Part-time works study students--space to accommodate up to 2 people.	Strong Adjacency: All TBE Department Administration Spaces Secondary Adjacency: English, Foreign Languages and Communication Administration Spaces	Upper Level(s)	1	81	81	2	162
2	Administration Support Spaces	a.	General Storage	Secure Storage Room	General storage.	Strong Adjacency: All TBE Department Administration Spaces Secondary Adjacency: English, Foreign Languages and Communication Administration Spaces	Upper Level(s)	1	150	150	1	150
		b.	Computer Equipment Storage	Secure Storage Room	Storage for computer equipment.	Strong Adjacency: All TBE Department Administration Spaces Secondary Adjacency: English, Foreign Languages and Communication Administration Spaces	Upper Level(s)	1	150	150	1	150
					TBE Department Sub Total NSF						**17**	**2,043**
					TBE Department Total GSF (ASF / 0.65 Efficiency)							**3,143**
E.	**Administration Support Spaces**											
1	General Support/Shared	a.	Faculty Workroom	Room with work surfaces, cabinets and storage	Copy machines, fax, printers, scanners, work surfaces for collating and sorting, mail distribution.	Strong Adjacency: All Administrative Spaces	If three-levels, 1 per each level	12	25	300	3	900
		b.	Break Room/Faculty Lounge	Break Room	Microwave, fridge, sink, place to sit and eat lunch.	Strong Adjacency: All Administration Spaces	Upper Level(s)	12	25	300	2	600
		c.	Conference Room	Conference Room	To be used as a conference room and also as a formal meeting space.	Strong Adjacency: All Administration Spaces	Upper Level(s)	20	30	600	2	1,200
		d.	Shared Office	Adjunct	Open space for work stations to be shared by adjunct faculty. Approximately 60 adjunct faculty to share 10 open work stations. Adjunct faculty to use conference room as necessary to meet with students privately.	Strong Adjacency: All Administration Spaces	If three-levels, 1 per each level	8	81	648	3	1,944

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Function Area			Space Name	Description	Notes	Adjacency	Building Level	Occ #	SF / P	NASF	#	Program NASF
		e.	Adjunct Small Meeting Room	Meeting Room	Small Meeting Room to be shared by Adjunct Faculty to meet privately with students.	Strong Adjacency: All Administration Spaces	If three-levels, 1 per each level	4	30	120	3	360
		f.	Student Lounge	Study Space		Strong Adjacency: Classrooms and Seminar Rooms	Main Level	20	25	500	1	500
			Administration Support Spaces Sub Total NSF									**5,504**
			Admin. Support Spaces Total GSF (ASF / 0.65 Efficiency)									**8,468**
					TOTAL ADMINISTRATION SPACE NSF							**20,239** NSF

TOTAL ADMINISTRATION SPACE GSF (ASF / 0.65 EFFICIENCY) **31,137 GSF**

F. Humanities and TBE Classrooms

			Space Name	Description	Notes	Adjacency	Building Level	Occ #	SF / P	NASF	#	Program NASF
1	Classroom	a.	Classroom	Classroom	Flat floor, moveable seating and tables. Make sure AV equipment includes international all-zone DVD players.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	40	25	1,000	4	4,000
		b.	Observation Classroom	Classroom	Observation classroom to support research in interpersonal and small group communication.	Adjacent to one of the 40 person classrooms	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	10	10	100	1	100
		c.	Classroom	Classroom	Flat floor, moveable seating and tables. Make sure AV equipment includes international all-zone DVD players.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	35	25	875	4	3,500
		d.	Classroom	Classroom	Flat floor, moveable seating and tables. Make sure AV equipment includes international all-zone DVD players.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	30	25	750	10	7,500
		e.	Classroom/Seminar	Classroom	Flat floor, moveable seating and tables. (English Composition)	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	25	25	625	9	5,625

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Function Area			Space Name	Description	Notes	Adjacency	Building Level	Occ #	SF / P	NASF	#	Program NASF
2	Specialized Classrooms/Labs	a.	English/Commnication Multi Media Lab	Computer Lab	View demonstrations with screen in the front. Also to be utilized for Media Convergence.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	40	35	1,400	1	1,400
		b.	Tiered Classroom	Classroom	Place to hold poetry jams, visiting writers.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	200	15	3,000	1	3,000
		c.	Foreign Languages Media Learning Lab	Computer Lab	Space to accommodate 30 students with 30 computers. Needs to be able to be configured for different activities. Also to be used for oral testing.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	30	35	1,050	1	1,050
		d.	Electronic Media Production	Audio Recording Studio	Suitable for quality musical recordings and foley work as well as dramatic work and commercials, voice over (announcing) booth and audio control room (big enough for a class of 12-15 observing students)	Strong Adjacency: Electronic Media Production Video Equipment Storage and Check Out room and Video Editing Rooms Secondary Adjacency: Student Spaces and Communication Administration Space	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.			1,000	1	1,000
		e.	Electronic Media Production	Video Field Equipment Storage Check-Out Room	Storage for video cameras, lighting equipment and tripods, plus a computer for logging student use of equipment, and a small test bench at one end for minor repairs, cleaning of equipment.	Strong Adjacency: Electronic Media Production Audio Recording Studio and Video Editing Rooms Secondary Adjacency: Student Spaces and Communication Administration Space	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.			250	1	250
		f.	Electronic Media Production	Video Editing Rooms for Observation	Used for classroom instruction (up to 15 students observing)	Strong Adjacency: Electronic Media Production Video Equipment Storage and Check Out room and Audio Recording Studio Secondary Adjacency: Student Spaces and Communication Administration Space	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.			200	1	200
		g.	Electronic Media Production	Video Editing Rooms	Used for editing video shot with the field equipment.	Strong Adjacency: Electronic Media Production Video Equipment Storage and Check Out room and Audio Recording Studio Secondary Adjacency: Student Spaces and Communication Administration Space	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.			70	2	140
		h.	Special Use Lab	Communication Debate Lab	2 practice rooms and storage (Near Admin. Offices)	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces and Communication Administration Space	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.			700	1	700
		i.	TBE Audio Visual Recording Room	Audio Visual Recording Room	Recording room with storage for AV equipment, blue screen.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	6	50	300	1	300

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	Function Area		Space Name	Description	Notes	Adjacency	Building Level	Occ #	SF / P	NASF	#	Program NASF
		j.	TBE Computer Lab	40-Person	1 of these labs to be dividable into a 20-person testing center with monitoring capabilities.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	40	35	1,400	2	2,800
		k.	TBE Computer Lab	30-Person		Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	30	35	1,050	1	1,050
3	Testing Center (Carl Porter)	a.	Writing Center	Classroom/Lab	Currently in the Student Center-Needs 7 tutor tables for 4 people each; 6 computers	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	34	25	850	1	850
		b.	Private Office for Director of Writing Center	Director	Individual private office with meeting space for 2-3 in office.	Strong Adjacency: Writing Center	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	1	180	180	1	180
		c.	Open General Computer Lab/Classroom	Open Lab	Increase available computers on campus--30 students 2 lab aides.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	32	35	1,120	1	1,120
		d.	General Tutoring	Open Meeting Space	Currently in S7BS Building snf SSC/tutoring for communications, foreign languages, etc. Needs 6 tutor tables for 4 people each.	Strong Adjacency: All Classrooms, Labs and Seminar Rooms Secondary Adjacency: Student Spaces	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	24	25	600	1	600
		e.	Office Lab Tech	Tech Office	ASSP Tech--maybe increase of staff shared with CofA&H to support faculty, staff and lab.	Strong Adjacency: Open and General Lab/Classroom	Large Classrooms and Labs located on first and second level. Smaller classrooms/seminar rooms on third level.	1	100	100	1	100
					HUMANITIES AND TBE CLASSROOMS NSF							**35,465 NSF**

HUMANITIES AND TBE CLASSROOMS TOTAL GSF (ASF / 0.65 EFFICIENCY) **54,562 GSF**

TOTAL HUMANITIES BUILDING GSF (ASF / 0.65 EFFICIENCY) **85,698 GSF**

4.2 BUILDING ORGANIZATION

The building organization will be the result of a synthesis of a number of forces operating upon the project. The primary forces affecting the building organization will be:

- Access to natural light and views,
- The social goals of the program,
- Internal circulation and interdisciplinary approach to organization of offices,
- Internal adjacencies, and
- The result of site forces that will shape the building.

All of these forces are discussed in detail elsewhere in this document. In addition,

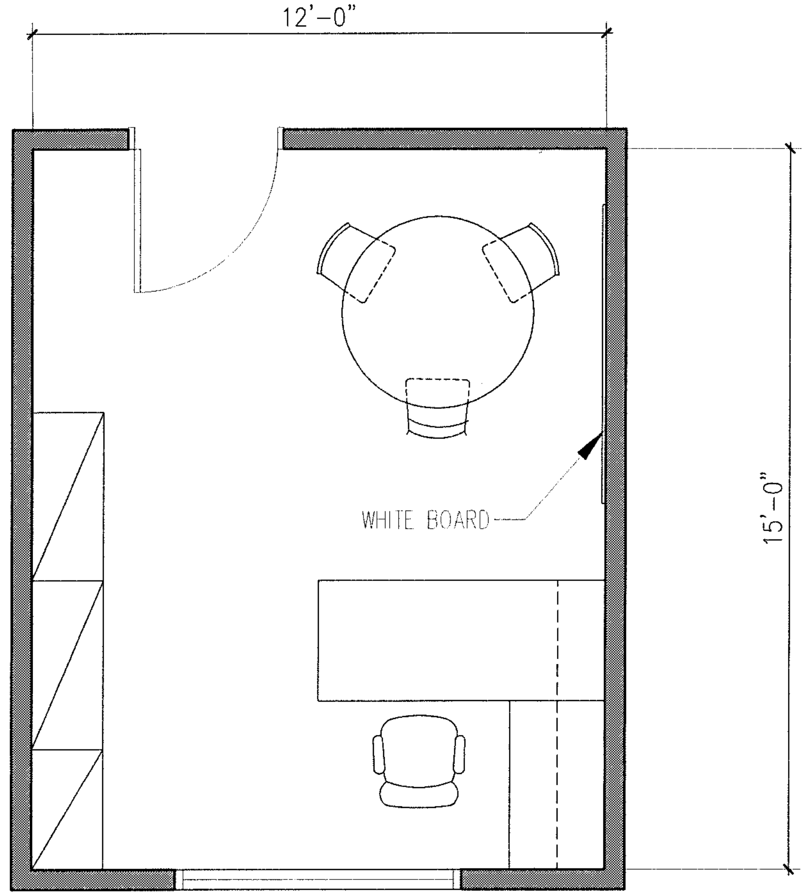
- Particular program locations will have an impact on building organization:

A major component of the new Humanities Building program is classrooms, computer labs and seminar rooms. In particular, several 30, 35 and 40 person classrooms along with a 200 person auditorium are proposed. All of these classrooms, computer labs and the 25-person seminar rooms should be located low in the building, near entrances and in close proximity to large public spaces, student lounges and study areas. This will allow the public spaces to double as pre-function spaces for the larger meeting spaces.

4.3 INDIVIDUAL ROOM DATA SHEETS

The following room data sheets and floor plan diagrams represent the general space needs for the new Humanities Building.

Room Data Sheets



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(A-1a) ENGLISH & LITERATURE
INDIVIDUAL PRIVATE OFFICE

- 180 NASF EACH # 2

Room Name:	**English & Literature Individual Private Office**

1. SPACE PROGRAM:

General Space Description	Individual private office with meeting space
Total New SF Area	180 NSF
Purpose of Space	Office, work area, and meeting for 2-3
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all English Department administration offices. Also close by Communication, Foreign Languages, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

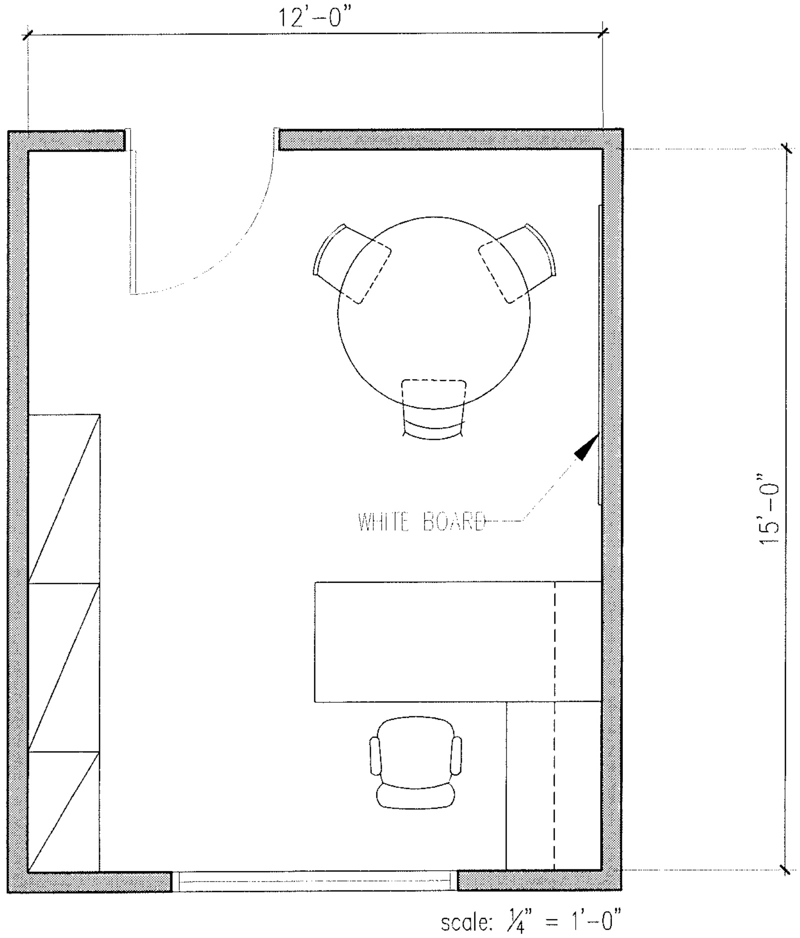
Window	Yes, view preferred
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Work area and office

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND ACCESSORIES:

Desk work station with return, file storage, bookshelves, small conference table, marker board, coat hooks, task chair and guest chairs



B-1a

FOREIGN LANGUAGES & LITERATURE
INDIVIDUAL PRIVATE OFFICE

• 180 NASF # 1

Room Name:	**Foreign Languages & Literature Individual Private Office**

1. SPACE PROGRAM:

General Space Description	Individual private office with meeting space
Total New SF Area	180 NSF
Purpose of Space	Office, work area, and meeting for 2-3
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level(s) and adjacent to all Foreign Languages Department administration offices. Also close by Communication, English, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

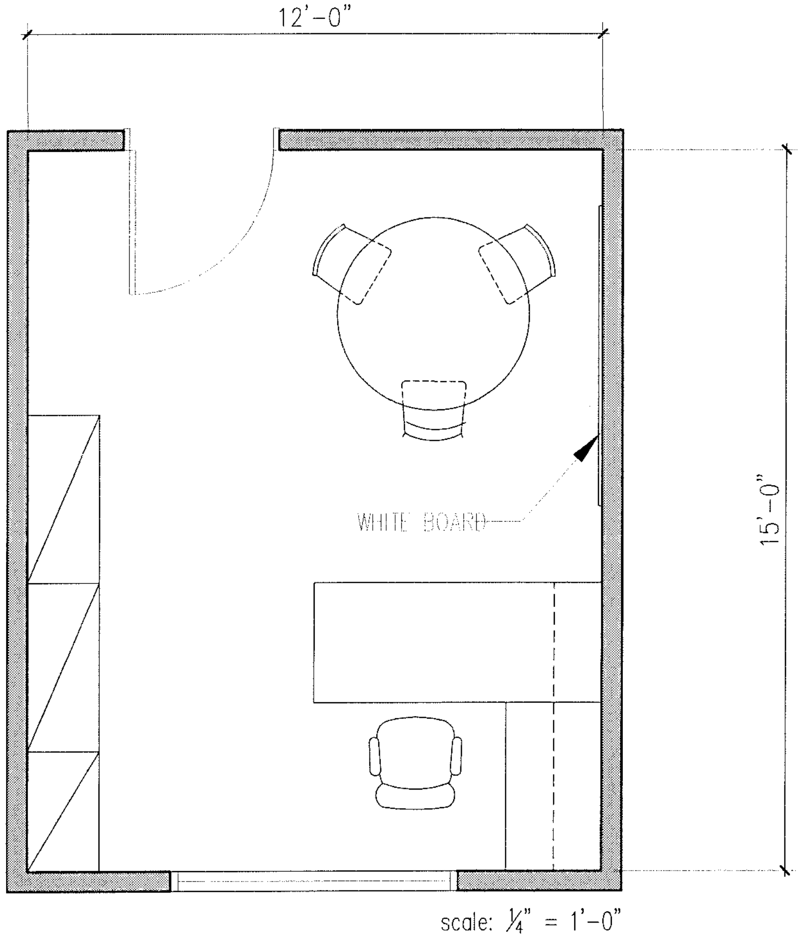
Window	Yes, view preferred
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Work area and office

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND ACCESSORIES:

Desk work station with return, file storage, bookshelves, small conference table, marker board, coat hooks, task chair and guest chairs



COMMUNICATION
INDIVIDUAL PRIVATE OFFICE

C-1a

• 180 NASF

1

Room Name:	**Communication** **Individual Private Office**

1. SPACE PROGRAM:

General Space Description	Individual private office with meeting space
Total New SF Area	180 NSF
Purpose of Space	Office, work area, and meeting for 2-3
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all Communication Department administration offices. Also close by English, Foreign Languages, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

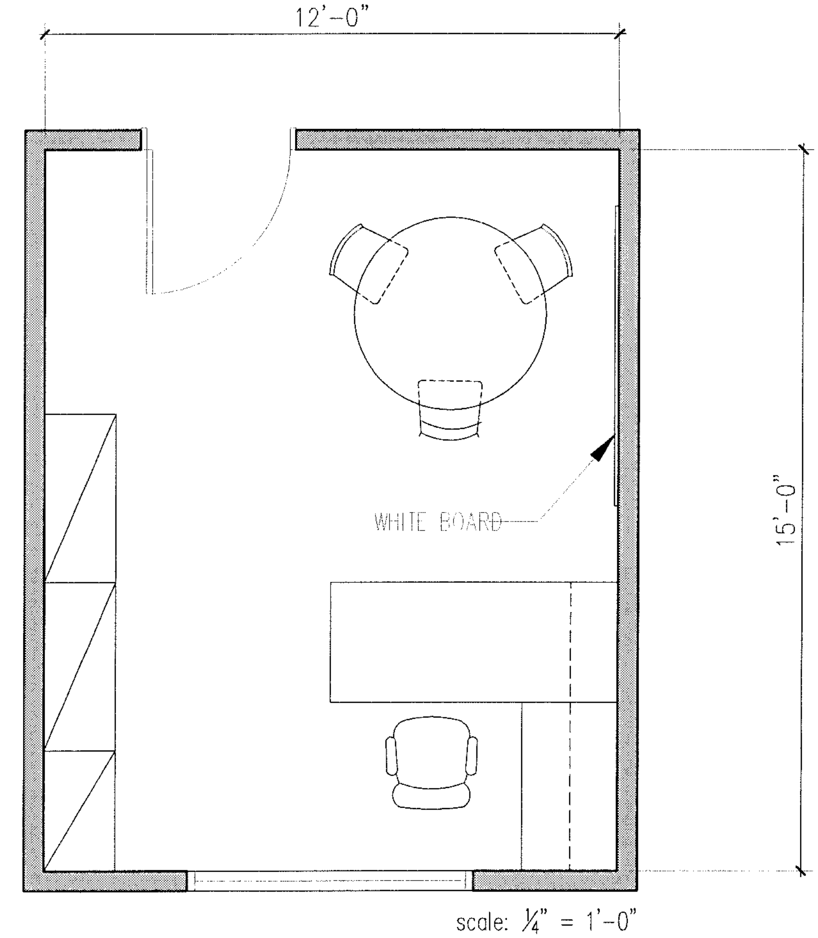
Window	Yes, view preferred
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Work area and office

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND ACCESSORIES:

Desk work station with return, file storage, bookshelves, small conference table, marker board, coat hooks, task chair and guest chairs



D-1a

TBE
INDIVIDUAL PRIVATE OFFICE

- 180 NASF

1

Room Name:	**TBE** **Individual Private Office**

1. SPACE PROGRAM:

General Space Description	Individual private office with meeting space
Total New SF Area	180 NSF
Purpose of Space	Office, work area, and meeting for 2-3
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all TBE Department administration offices. Also close by Communication, Foreign Languages, and English administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

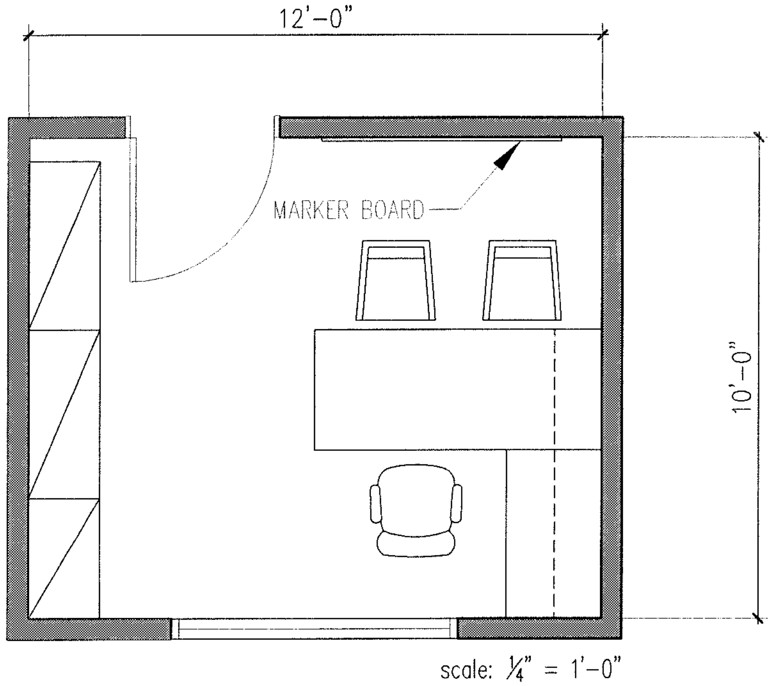
Window	Yes, view preferred
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Work area and office

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND ACCESSORIES:

Desk work station with return, file storage, bookshelves, small conference table, marker board, coat hooks, task chair and guest chairs



A-1b ENGLISH & LITERATURE
INDIVIDUAL PRIVATE OFFICE-CURRENT
- 120 NASF EACH # 30

A-1c ENGLISH & LITERATURE
INDIVIDUAL PRIVATE OFFICE-GROWTH
- 120 NASF EACH # 3

A-3a ENGLISH & LITERATURE
INDIVIDUAL PRIVATE OFFICE-CURRENT
- 120 NASF EACH # 4

A-4a WEBER STUDIES
INDIVIDUAL PRIVATE OFFICE
- 120 NASF # 1

A-4b METAPHOR
INDIVIDUAL PRIVATE OFFICE
- 120 NASF # 1

A-4c UNDERGRADUATE LITERARY CONFERENCE
INDIVIDUAL PRIVATE OFFICE
- 120 NASF # 1

Room Name:	**English & Literature, Weber Studies, Metaphor, Undergraduate Literary Conference** **Individual Private Office**

1. SPACE PROGRAM:

General Space Description	Individual private office
Total New SF Area	120 NSF
Purpose of Space	Office, work area
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all English Department administration offices. Also close by Communication, Foreign Languages, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

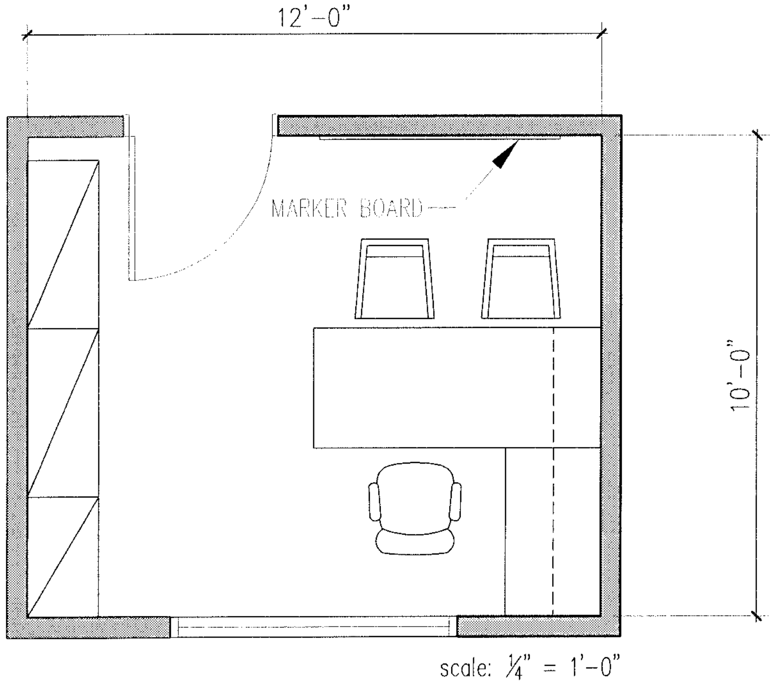
Window	Yes, view preferred
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Work area and office

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND ACCESSORIES:

Desk work station with return, file storage, bookshelves, coat hooks, task chair, guest chairs, marker board



B-1b — FOREIGN LANGUAGES & LITERATURE
INDIVIDUAL PRIVATE OFFICE-CURRENT

- 120 NASF EACH — # 15

B-1c — FOREIGN LANGUAGES & LITERATURE
INDIVIDUAL PRIVATE OFFICE-GROWTH

- 120 NASF EACH — # 2

Room Name:	**Communication** **Individual Private Office**

1. SPACE PROGRAM:

General Space Description	Individual private office
Total New SF Area	120 NSF
Purpose of Space	Office, work area
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all Communication Department administration offices. Also close by Foreign Languages, English, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

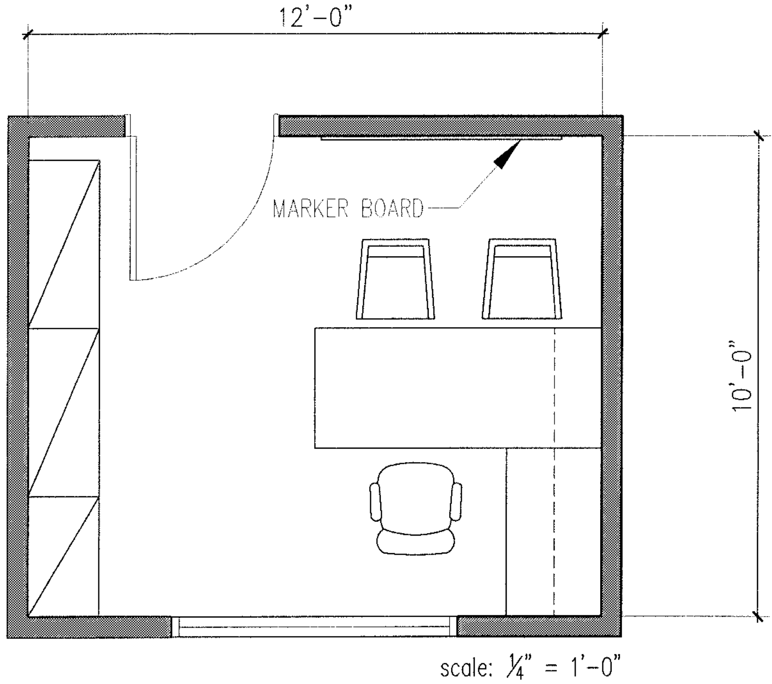
Window	Yes, view preferred
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Work area and office

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Desk work station with return, file storage, bookshelves, coat hooks, task chair, guest chairs, marker board



(D-1b) TBE
INDIVIDUAL PRIVATE OFFICE-CURRENT

- 120 NASF EACH # 8

(D-1c) TBE
INDIVIDUAL PRIVATE OFFICE-GROWTH

- 120 NASF EACH # 2

Room Name: **TBE**
Individual Private Office

1. SPACE PROGRAM:

General Space Description	Individual private office
Total New SF Area	120 NSF
Purpose of Space	Office, work area
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all TBE Department administration offices. Also close by Communication, English, and Foreign Languages administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

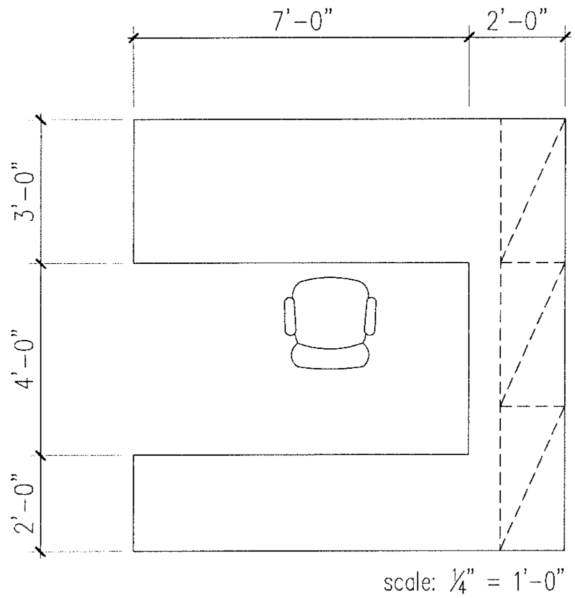
Window	Yes, view preferred
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Work area and office

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Desk work station with return, file storage, bookshelves, coat hooks, task chair, guest chairs, marker board



A-1d — ENGLISH & LITERATURE
SECRETARY WORK STATION

- 81 NASF EACH — # 2

A-1g — ENGLISH & LITERATURE
WORK STATION FOR WORK STUDY-CURRENT

- 81 NASF — # 1

A-1h — ENGLISH & LITERATURE
WORK STATION FOR WORK STUDY-GROWTH

- 81 NASF EACH — # 2

A-3b — ENGLISH & LITERATURE
RECEPTIONIST

- 81 NASF — # 1

A-3d — ENGLISH & LITERATURE
WORKSTATION FOR ESL WORK STUDY

- 81 NASF — # 1

A-4d — ENGLISH & LITERATURE
WORKSTATION FOR OUTREACH PROGRAM

- 81 NASF EACH — # 1

Room Name:	**English & Literature** **Secretary Work Station** **Receptionist Work Station** **Work Study Workstation** **ESL Work Study Workstation** **Outreach Program Workstation**

1. SPACE PROGRAM:

General Space Description	Individual work station
Total New SF Area	81 NSF
Purpose of Space	Work area for 1 person
Number of Occupants	1
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all English Department administration offices. Also close by Communication, Foreign Languages, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

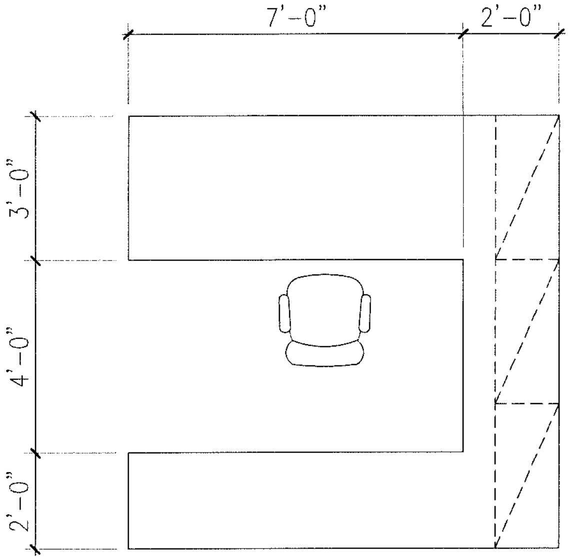
Window	None
Doors	None
Floor	Carpet
Wall	None
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Work station

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power distributed to systems furniture
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Phone & data distributed to systems furniture w/ wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Systems furniture w/ low panels, task chair



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B-1d FOREIGN LANGUAGES & LITERATURE
SECRETARY WORK STATION

- 81 NASF # 1

B-1f FOREIGN LANGUAGES & LITERATURE
WORK STATION FOR WORK STUDY-CURRENT

- 81 NASF # 1

Room Name:	**Foreign Languages & Literatures Secretary Work Station Work Study Work Station**

1. SPACE PROGRAM:

General Space Description	Individual work station
Total New SF Area	81 NSF
Purpose of Space	Work area for 1 person
Number of Occupants	1
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level(s) and adjacent to all Foreign Laguages Department administration offices. Also close by Communication, English, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

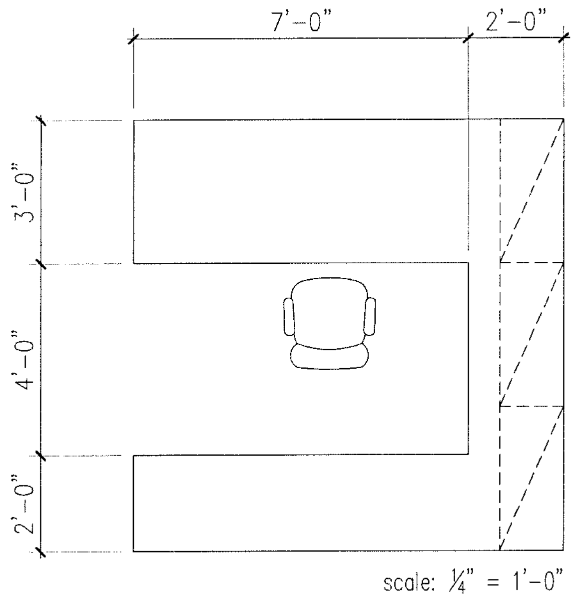
Window	None
Doors	None
Floor	Carpet
Wall	None
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Work station

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V distributed to systems furniture
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Phone & data distributed to systems furniture w/ wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Systems furniture w/ low panels, task chair



C-1d COMMUNICATION
SECRETARY WORK STATION

- 81 NASF # 1

C-1f COMMUNICATION
WORK STATION FOR WORK STUDY-CURRENT

- 81 NASF # 1

Room Name:	**Communication** **Secretary Work Station** **Work Study Work Station**

1. SPACE PROGRAM:

General Space Description	Individual work station
Total New SF Area	81 NSF
Purpose of Space	Work area for 1 person
Number of Occupants	1
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all Communication Department administration offices. Also close by English, Foreign Languages, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

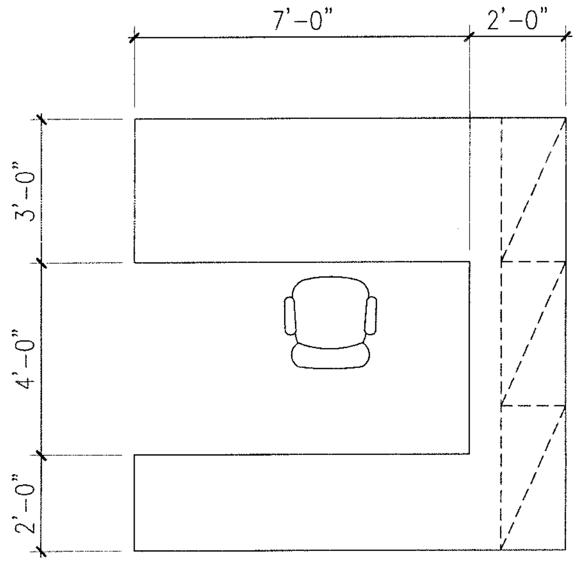
Window	None
Doors	None
Floor	Carpet
Wall	None
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Work station

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V distributed to systems furniture
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Phone & data distributed to systems furniture w/ wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Systems furniture w/ low panels, task chair



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TBE
SECRETARY WORK STATION

(D-1d)

- 81 NASF EACH # 1

TBE
WORK STATION FOR WORK STUDY-CURRENT

(D-1f)

- 81 NASF EACH # 2

Room Name:	**TBE** **Secretary Work Station** **Work Study Work Station**

1. SPACE PROGRAM:

General Space Description	Individual work station
Total New SF Area	81 NSF
Purpose of Space	Work area for 1 person
Number of Occupants	1
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all TBE Department administration offices. Also close by Communication, Foreign Laguages, and English administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

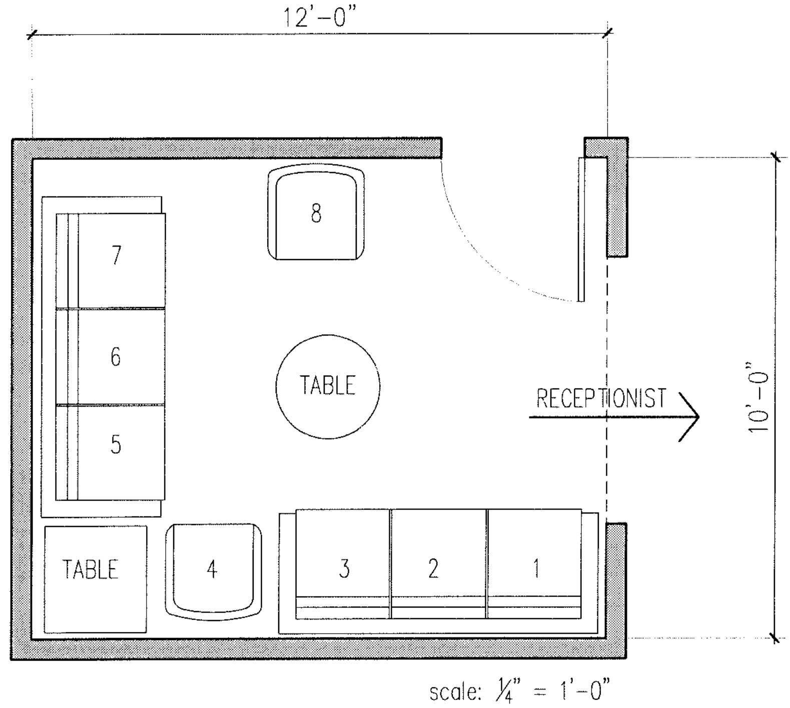
Window	None
Doors	None
Floor	Carpet
Wall	None
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Work station

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V distributed to systems furniture
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Phone & data distributed to systems furniture w/ wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Systerms furniture w/ low panels, task chair



(A-1e) ENGLISH, LITERATURE & ESL RECEPTION AREA

- 120 NASF — # 1
- OPEN SPACE W/ CHAIRS

(A-3c) ENGLISH, LITERATURE & ESL RECEPTION AREA

- 120 NASF — # 1
- OPEN SPACE W/ CHAIRS

Room Name:	**English & Literature** **Reception Waiting Area** **English as a Second Language Reception Area**

1. SPACE PROGRAM:

General Space Description	Open space with chairs & couches
Total New SF Area	120 NSF
Purpose of Space	Waiting area for students & visitors
Number of Occupants	8
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

Primary adjacency - Reception
To be located on upper level (s) and adjacent to all English Department administration offices. Also close by Communication, Foreign Languages, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

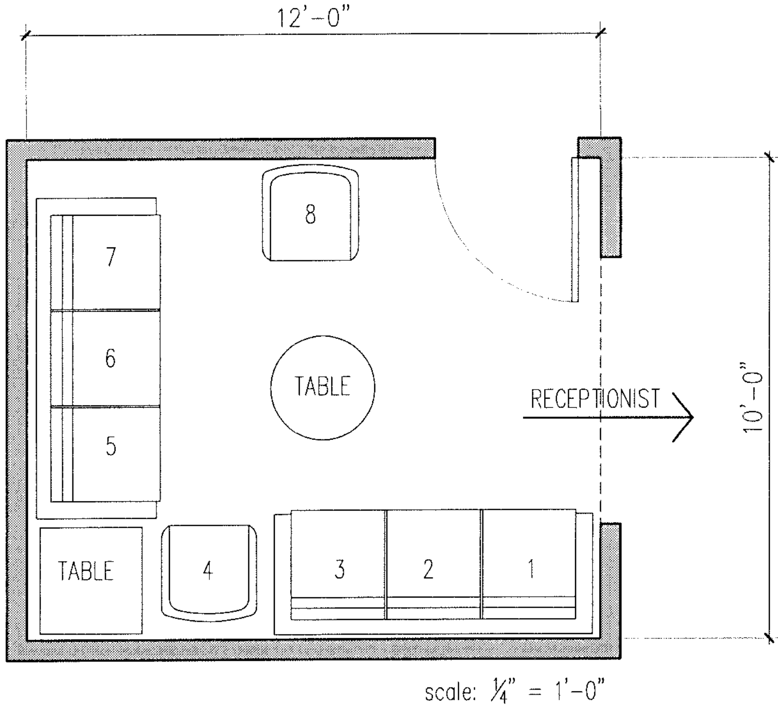
Window	If possible
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Open space, "Front Door" to department

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures & decorative fixtures
Phone/Data	Wall outlets along w/ wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Upholstered chairs & couches, corner table, coffee table



B-1e

FOREIGN LANGUAGES & LITERATURE
RECEPTION AREA

- 120 NASF # 1
- OPEN SPACE W/ CHAIRS

Room Name:	**Foreign Languages & Literature Reception Waiting Area**

1. SPACE PROGRAM:

General Space Description	Open space with chairs & couches
Total New SF Area	120 NSF
Purpose of Space	Waiting area for students & visitors
Number of Occupants	8
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

Primary adjacency - Reception
To be located on upper level(s) and adjacent to all Foreign Laguages Department administration offices. Also close by Communication, English, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

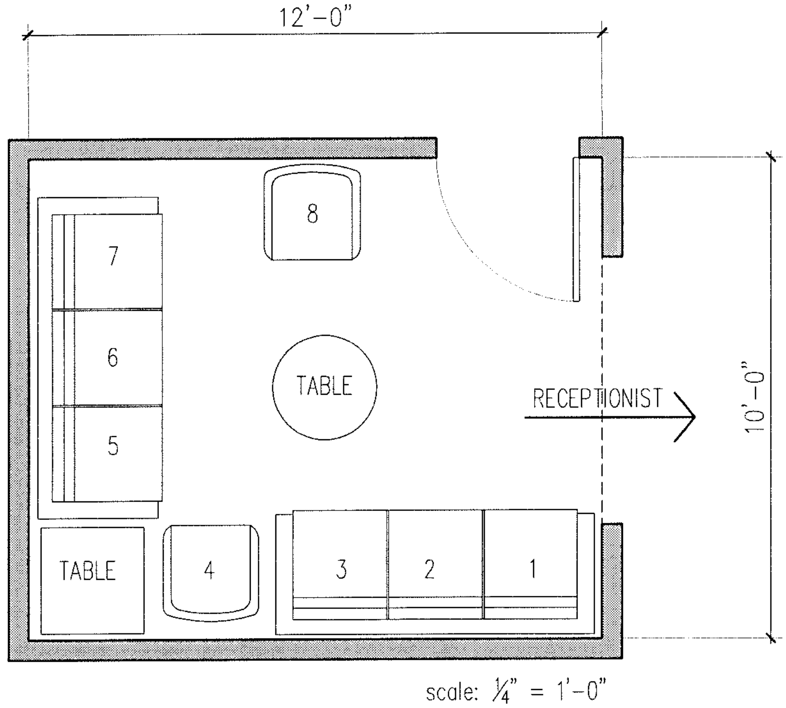
Window	If possible
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Open space, "Front Door" to department

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures & decorative fixtures
Phone/Data	Wall outlets along w/ wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Upholstered chairs & couches, corner table, coffee table



C-1e COMMUNICATION RECEPTION AREA

- 120 NASF # 1
- OPEN SPACE W/ CHAIRS

Room Name:	**Communication Reception Waiting Area**

1. SPACE PROGRAM:

General Space Description	Open space with chairs & couches
Total New SF Area	120 NSF
Purpose of Space	Waiting area for students & visitors
Number of Occupants	8
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

Primary adjacency - Reception
To be located on upper level (s) and adjacent to all Communication Department administration offices. Also close by English, Foreign Languages, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

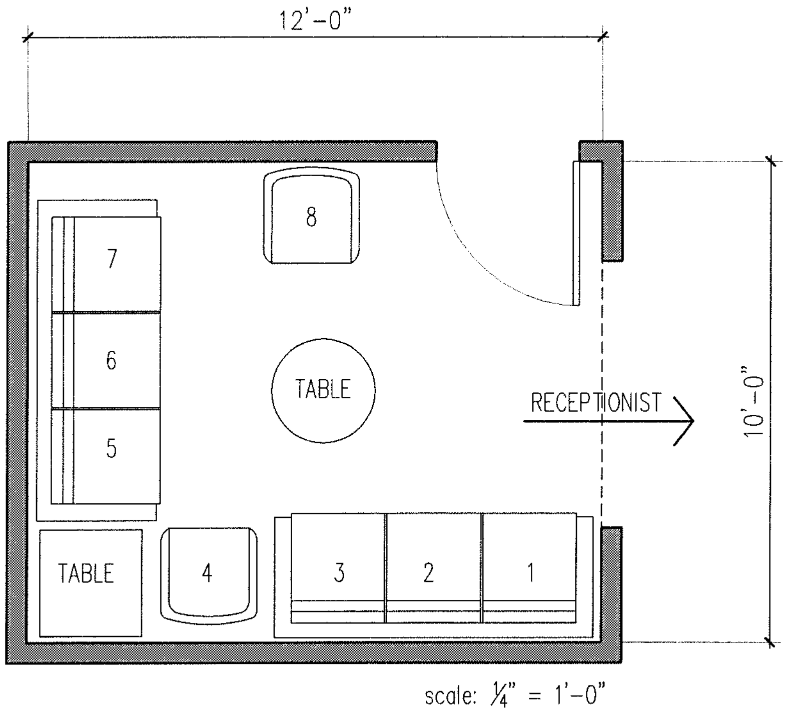
Window	If possible
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Open space, "Front Door" to department

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures & decorative fixtures
Phone/Data	Wall outlets along w/ wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Upholstered chairs & couches, corner table, coffee table



D-1e

TBE
RECEPTION AREA

- 120 NASF EACH # 1
- OPEN SPACE W/ CHAIRS

Room Name:	**TBE** **Reception Waiting Area**

1. SPACE PROGRAM:

General Space Description	Open space with chairs & couches
Total New SF Area	120 NSF
Purpose of Space	Waiting area for students & visitors
Number of Occupants	8
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

Primary adjacency - Reception
To be located on upper level (s) and adjacent to all TBE Department administration offices. Also close by Communication, Foreign Languages, and English administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

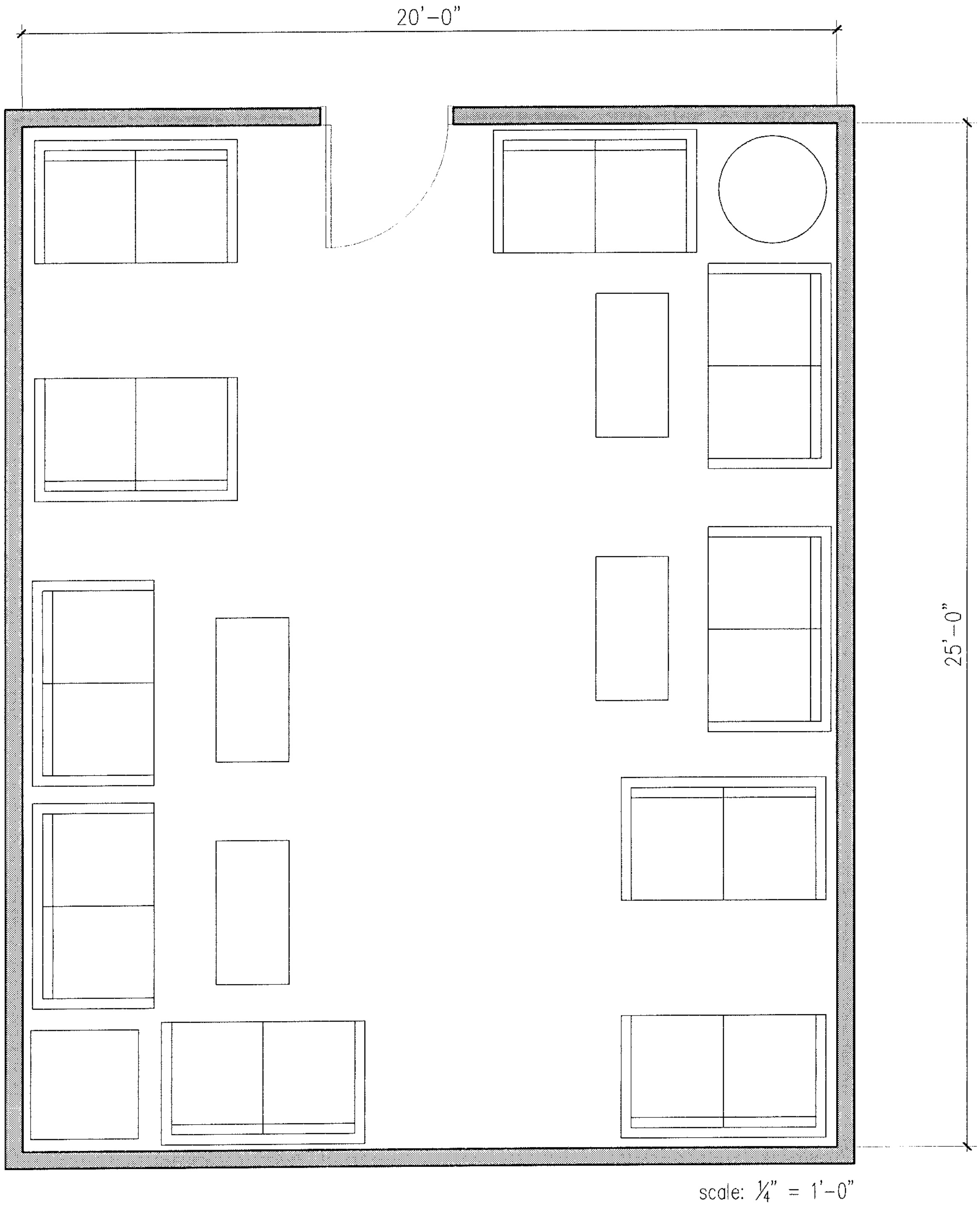
Window	If possible
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Open space, "Front Door" to department

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures & decorative fixtures
Phone/Data	Wall outlets along with wireless capabilities
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Upholstered chairs & couches, corner table, coffee table



E-1f STUDENT LOUNGE

• 500 NASF

1

Room Name:	**All Departments Student Lounge**

1. SPACE PROGRAM:

General Space Description	Informal gathering space
Total New SF Area	500 NSF
Purpose of Space	Large room w/ multiple seating areas for student gathering & interaction
Number of Occupants	20
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

Classrooms and Seminar rooms

3. ARCHITECTURAL CHARACTERISTICS:

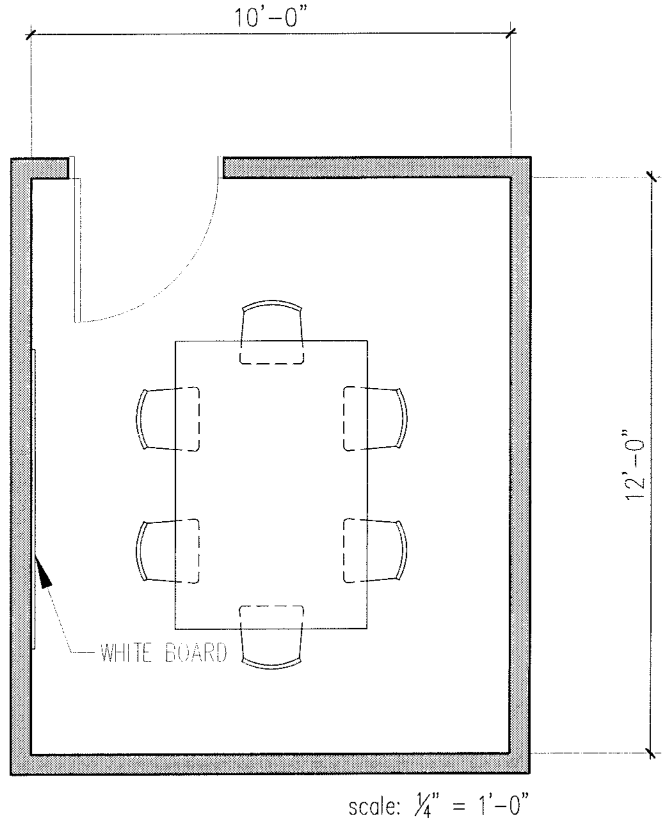
Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Student gathering and lounge area

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures & decorative fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Upholstered chairs & couches, coffee tables



E-1e ADJUNCT SMALL MEETING ROOM

- 120 NASF EACH # 3

Room Name:	**Adjunct Small Meeting Room** **All Departments**

1. SPACE PROGRAM:

General Space Description	Meeting room
Total New SF Area	120 NSF
Purpose of Space	Small meeting area for adjuncts to have private meetings
Number of Occupants	2 - 6
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

Primary adjacency - Adjunct offices (work stations)
All administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

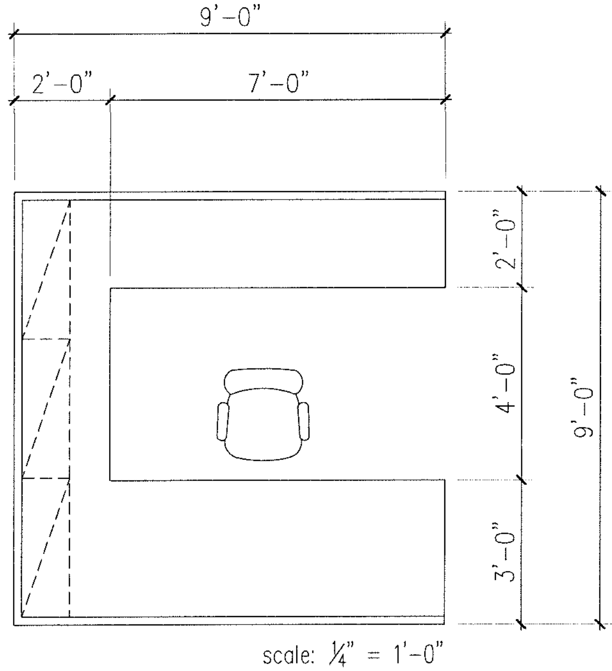
Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Private, quiet

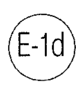
4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Small conference table with chairs, white board





SHARED OFFICE

- 81 NASF EACH # 24

Room Name:	**Adjunct Shared Office**

1. SPACE PROGRAM:

General Space Description	Adjunct Shared office area
Total New SF Area	81 NSF
Purpose of Space	Large open area for open offices
Number of Occupants	1 (total of 8 per space x 3 floors)
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

Primary adjacency - Adjunct small meeting room
All administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

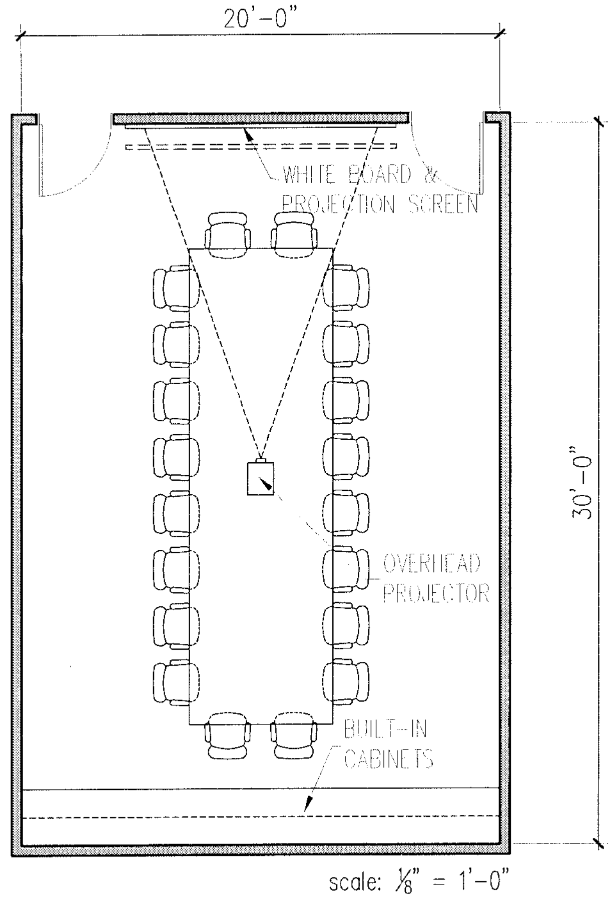
Window	Yes
Doors	Yes 3'-0" single leaf entry door into large open spaces
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	No special treatment
General Character of Room	Open space with workstation furniture systems

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Phone & data distribution to systems furniture w/ wireless capabilities
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Systems furniture w/ privacy panels



E-1c CONFERENCE ROOM

- 600 NASF EACH # 2

Room Name:	**Conference Room**

1. SPACE PROGRAM:

General Space Description	Conference room
Total New SF Area	600 NSF
Purpose of Space	Conference room and meeting space
Number of Occupants	20
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

All administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

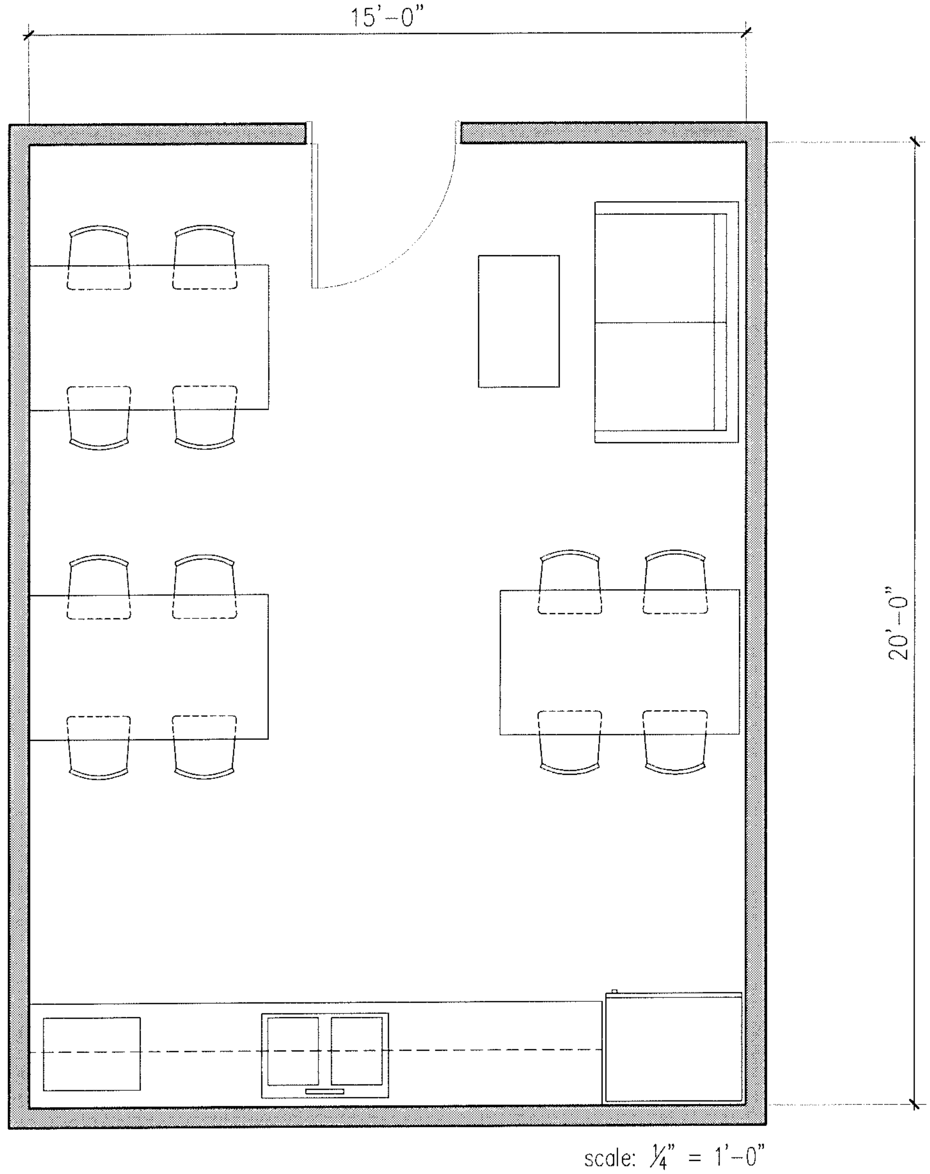
Window	Yes
Doors	Yes (2)3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	Sound insulation in walls
General Character of Room	Private, quiet

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Conference table, conference chairs, white board, built in millwork/ cabinets, overhead projector, projector screen



E-1b BREAK ROOM

• 300 NASF EACH # 2

Room Name:	**Break Room/Faculty Lounge**

1. SPACE PROGRAM:

General Space Description	Break room
Total New SF Area	300 NSF
Purpose of Space	Place to sit, eating area, general lounge
Number of Occupants	12
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

All administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

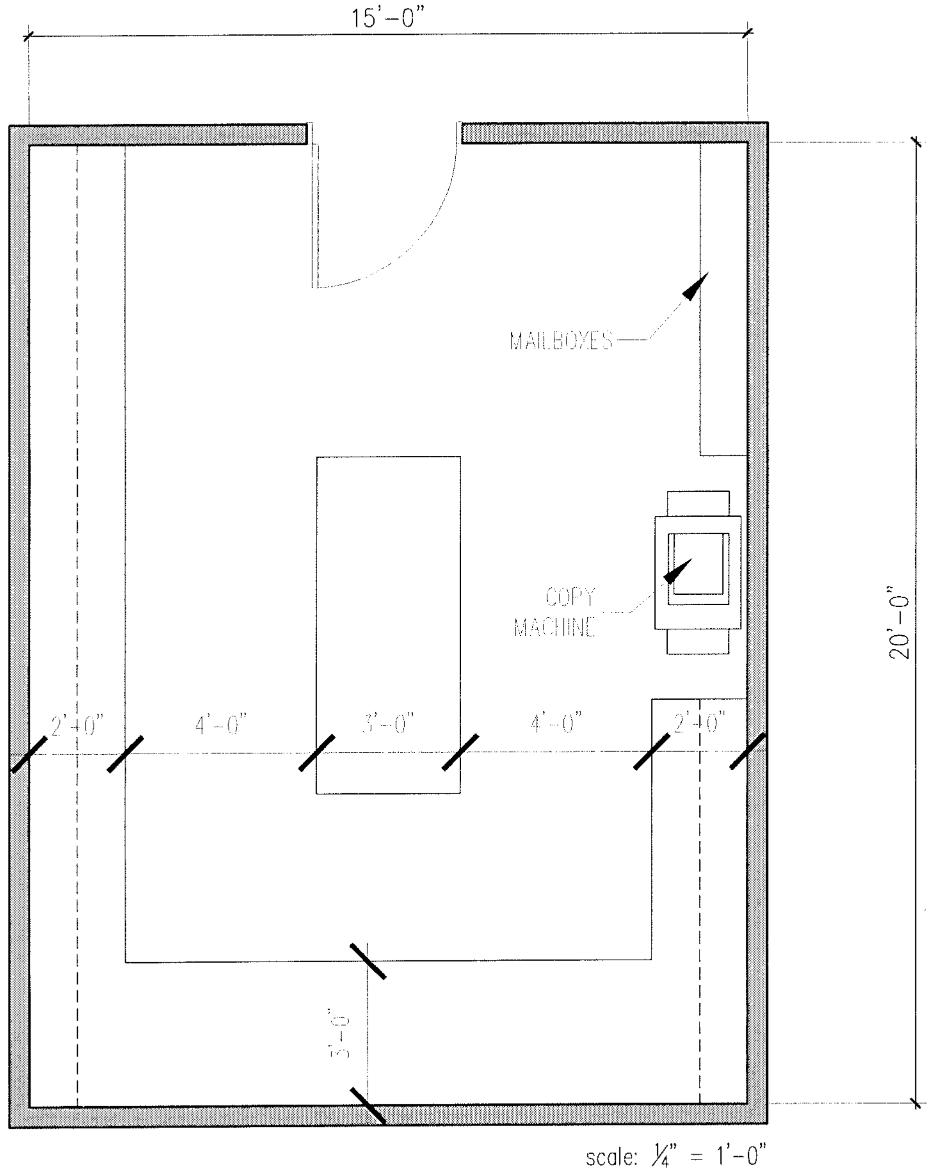
Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Vinyl composition tile
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open plan for table, chairs & couches, flexible space

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	Sink with hot and cold water, water supply line for the refrigerator
Lighting	Low-glare fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Tables, chairs, couches, microwave, refrigerator



E-1a FACULTY WORKROOM

- 300 NASF EACH # 3

Room Name:	**Faculty Work Room**

1. SPACE PROGRAM:

General Space Description	Room with work surfaces, cabinets and storage
Total New SF Area	300 NSF
Purpose of Space	Room for production, distribution and storage of documents, mail, copy & fax
Number of Occupants	12
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

All administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

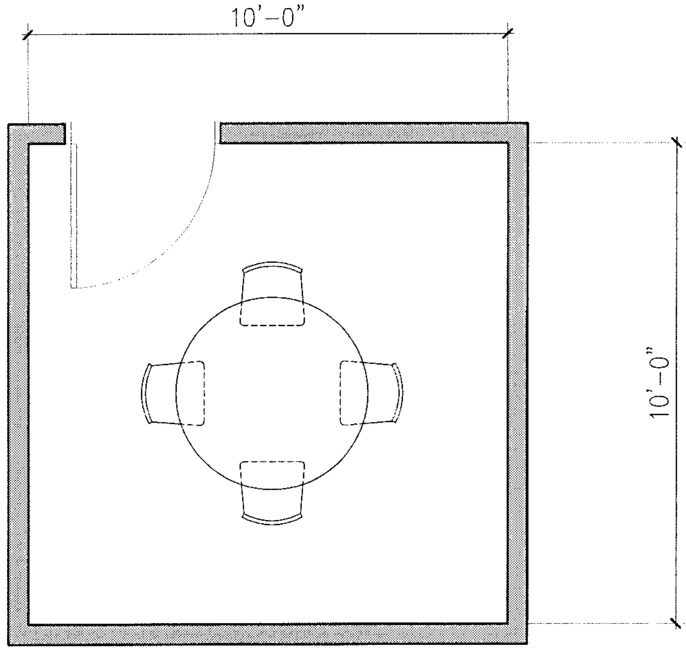
Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Vinyl composition tile
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	General work room w/ large work surface areas & storage

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	Power for copy machine

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Copy machines, fax, printers, scanners, built in cabinets & work surfaces



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C-3a SMALL MEETING ROOM

- 100 NASF # 1

Room Name:	**Communication Small Meeting Room**

1. SPACE PROGRAM:

General Space Description	Meeting room adjacent to department chair's office
Total New SF Area	100 NSF
Purpose of Space	Private meeting room
Number of Occupants	2 - 6
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

Primary adjacency - Department chair's office
To be located on upper level(s) and adjacent to all Communication Department administration offices. Also close by English, Foreign Languages, and TBE Administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

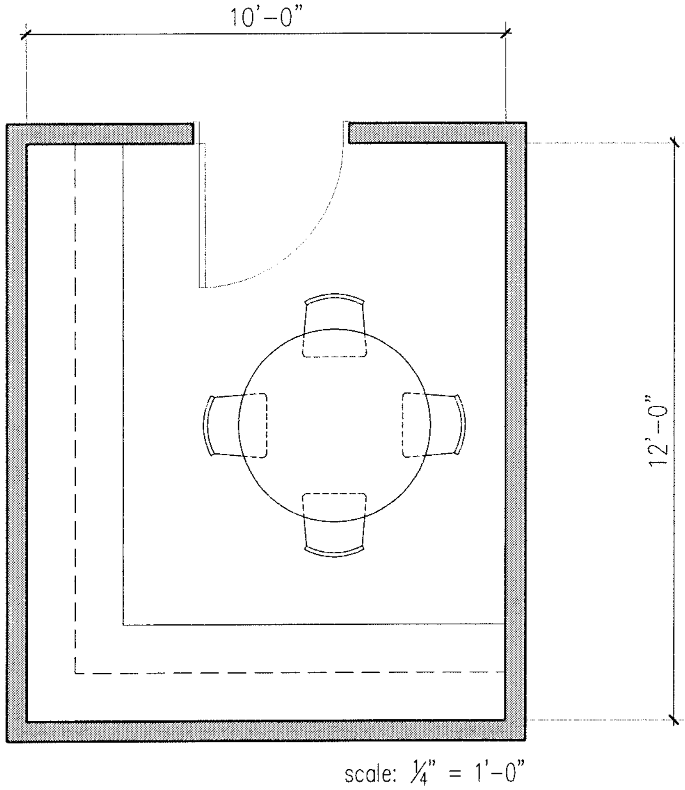
Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	Sound insulation in walls
General Character of Room	Private, quiet

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Small conference table and chairs



A-4e OUTREACH PROGRAM WORKROOM

- 120 NASF # 1

Room Name:	**Outreach Program Work Room**

1. SPACE PROGRAM:

General Space Description	Work room with work surface, cabinets and storage
Total New SF Area	120 NSF
Purpose of Space	Room for production, distribution and storage of documents
Number of Occupants	8
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

Primary adjacency - Outreach programs
To be located on upper level(s) and adjacent to all English Department administration offices. Also close by Communication, Foreign Languages, and TBE Administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

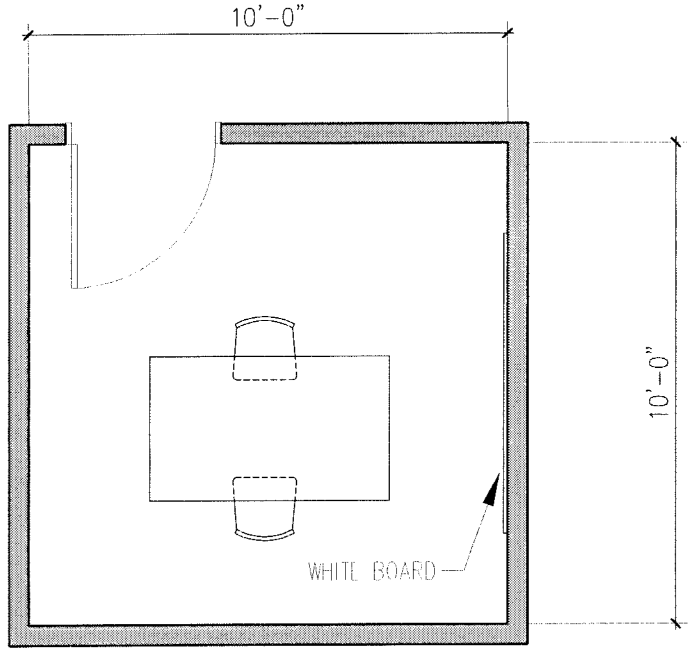
Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Vinyl composition tile
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	General work room w/ storage capabilities

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Copy machines, fax, printers, scanners, work surfaces, built in cabinets, small meeting table, task chairs



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A-3e ENGLISH TUTORING ROOM

- 100 NASF EACH # 2

A-3e ENGLISH TUTORING ROOM - GROWTH

- 100 NASF EACH # 1

Room Name:	**English & Literature Tutoring Room**

1. SPACE PROGRAM:

General Space Description	Tutoring room
Total New SF Area	100 NSF
Purpose of Space	Room for student tutoring
Number of Occupants	2
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level(s) and adjacent to all English Department administration offices. Also close by Communication, Foreign Language, and TBE Administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

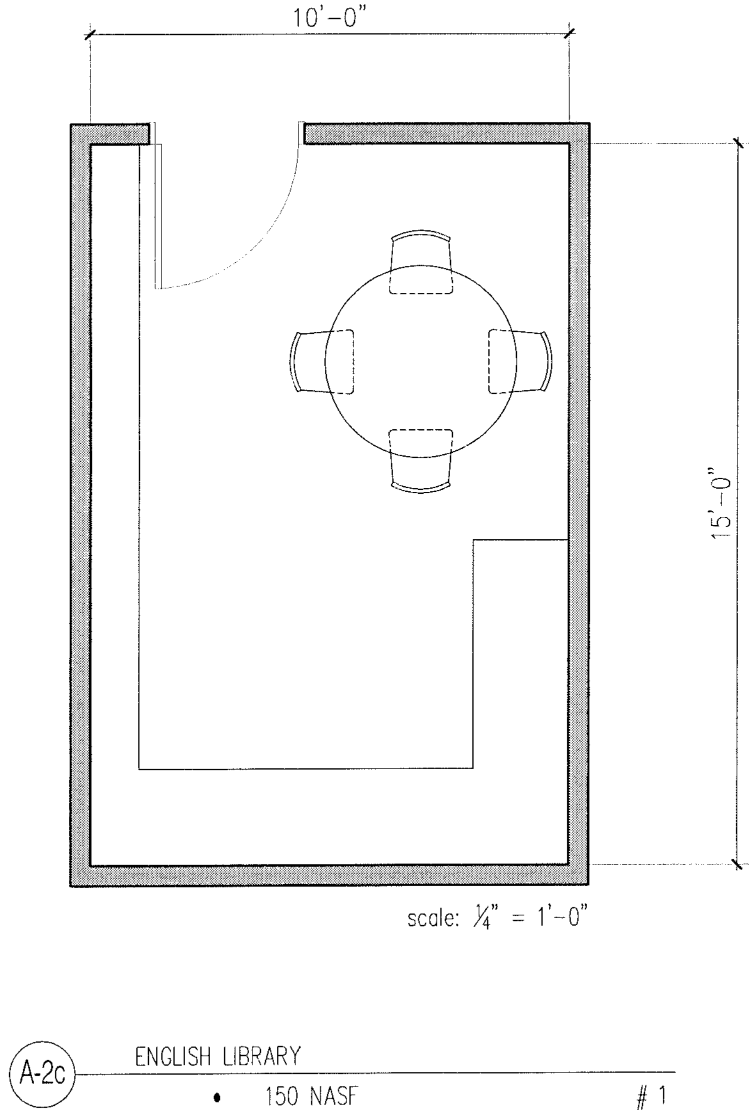
Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Private, quiet

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Table and task chairs, whiteboard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A-2c
ENGLISH LIBRARY
• 150 NASF
1

Room Name:	**English Library**

1. SPACE PROGRAM:

General Space Description	Library for storage & general distribution of resources
Total New SF Area	150 NSF
Purpose of Space	Small library for videos, textbooks and archives of old catalogs
Number of Occupants	6
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level(s) and adjacent to all English Department administration offices. Also close by Communication, Foreign Language, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

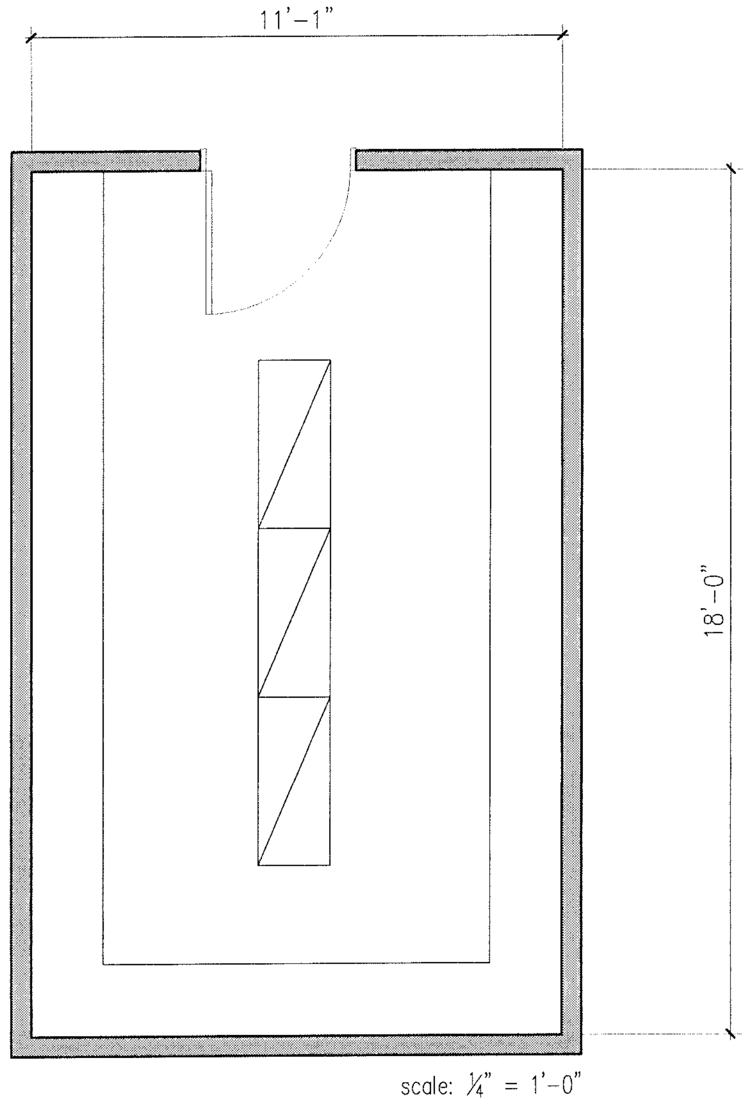
Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Quiet

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Storage cabinets & shelves for video tapes, books and catalogs, small table & chairs



(A-2b) SECURE STORAGE ROOM

- 200 NASF # 1

(C-2a) SECURE STORAGE ROOM

- 200 NASF # 1

Room Name:	**General Storage**

1. SPACE PROGRAM:

General Space Description	Secure storage room
Total New SF Area	200 NSF
Purpose of Space	Storage room for forms and files
Number of Occupants	N/A
Hours and Days Used	8 am - 5 pm

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level(s) and adjacent to all administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

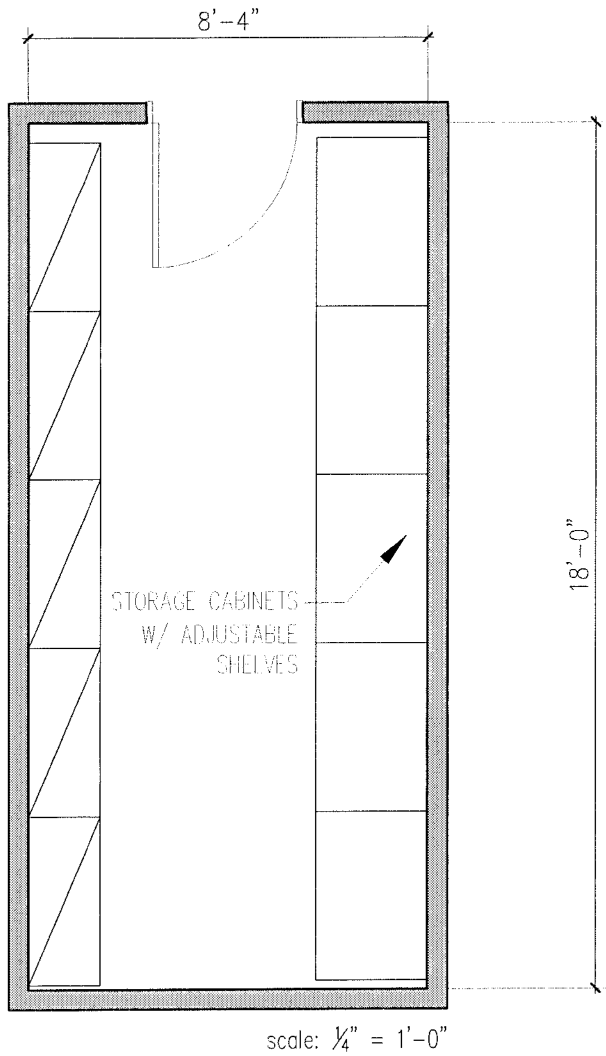
Window	None
Doors	Yes 3'-0" single leaf
Floor	Vinyl composition tile
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Secure storage

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Lateral files, storage cabinets, adjustable shelves



A-2a SECURE STORAGE ROOM

- 150 NASF # 1

B-2a SECURE STORAGE ROOM

- 150 NASF # 1

D-2a SECURE STORAGE ROOM

- 150 NASF # 1

D-2b SECURE STORAGE ROOM

- 150 NASF # 1

Room Name:	**General Storage**

1. SPACE PROGRAM:

General Space Description	Secure storage room
Total New SF Area	150 NSF
Purpose of Space	Storage room for records
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

To be located on upper level (s) and adjacent to all English Department administration offices. Also close by Communication, Foreign Language, and TBE administration spaces

3. ARCHITECTURAL CHARACTERISTICS:

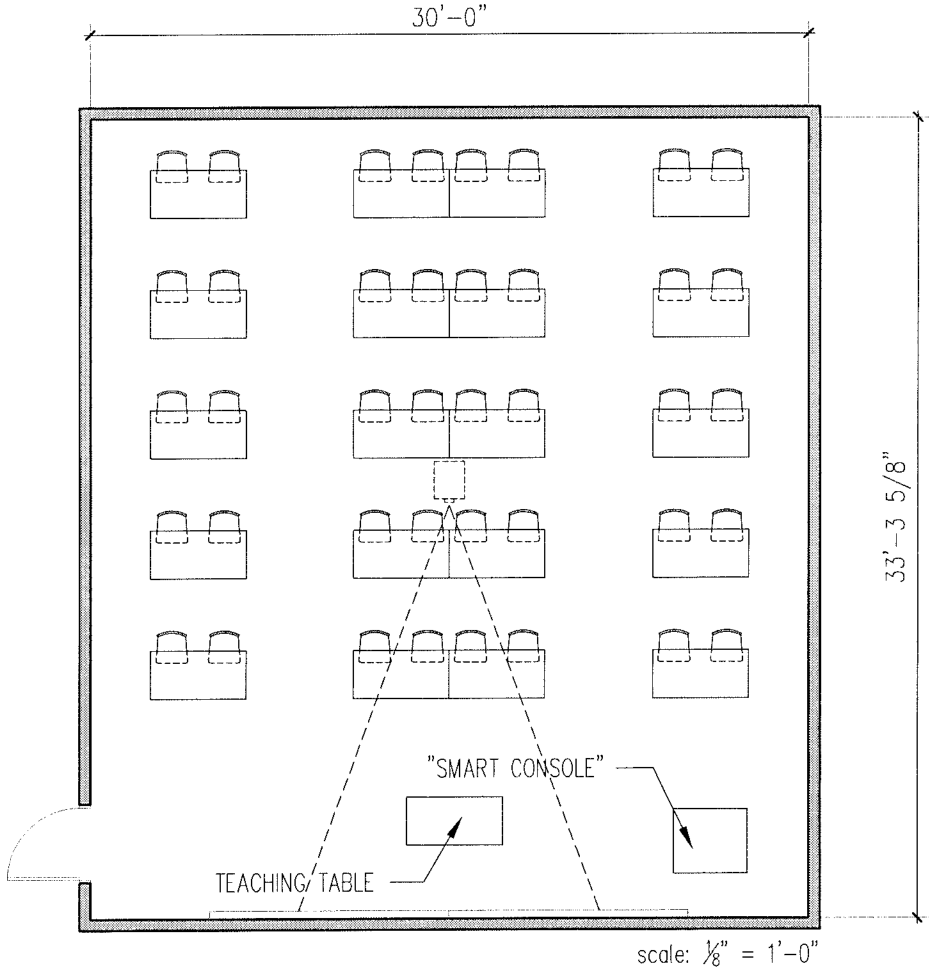
Window	None
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Secure storage

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Lateral files



F-1a

40 PERSON CLASSROOM

- 1000 NASF EACH # 4
- 40 STUDENTS
- 25 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**40 Person Classroom**

1. SPACE PROGRAM:

General Space Description	Classroom
Total New SF Area	1000 NSF
Purpose of Space	Classroom
Number of Occupants	40
Hours and Days Used	All day - evenings as required

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

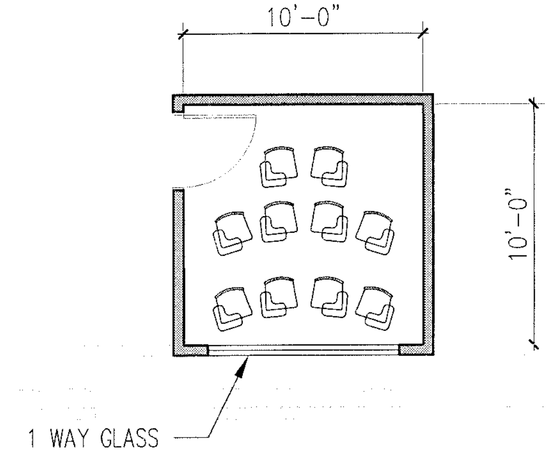
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Card key access, cameras
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures, incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	International all-zone DVD player

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable seats and tables, marker boards, clock, overhead projector, projector screen, "smart" console (moveable) & teaching table w/ casters



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F-1b 10 PERSON OBSERVATION CLASSROOM

- 100 NASF
- 10 STUDENTS
- 10 SF PER SEAT

1

Room Name: **Observation Classroom**

1. SPACE PROGRAM:

General Space Description	Classroom
Total New SF Area	100 NSF
Purpose of Space	Observation classroom to support research in Communication
Number of Occupants	10
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

Adjacent to one of the 40 person classrooms

3. ARCHITECTURAL CHARACTERISTICS:

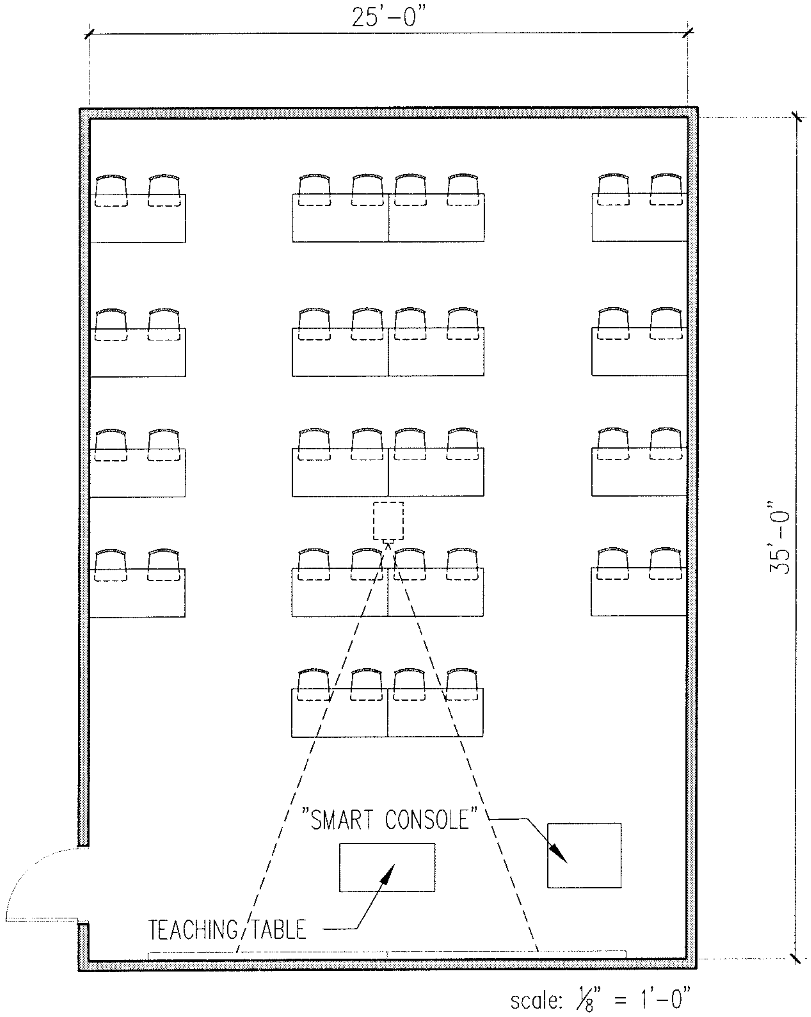
Window	Yes, 1-way into classroom
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	Sound insulation in walls
General Character of Room	Quiet

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Chairs with built in task surface



F-1c 35 PERSON CLASSROOM # 4

- 875 NASF EACH
- 35 STUDENTS
- 25 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**35 Person Classroom**

1. SPACE PROGRAM:

General Space Description	Classroom
Total New SF Area	875 NSF
Purpose of Space	Classroom
Number of Occupants	35
Hours and Days Used	All day - evenings as required

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

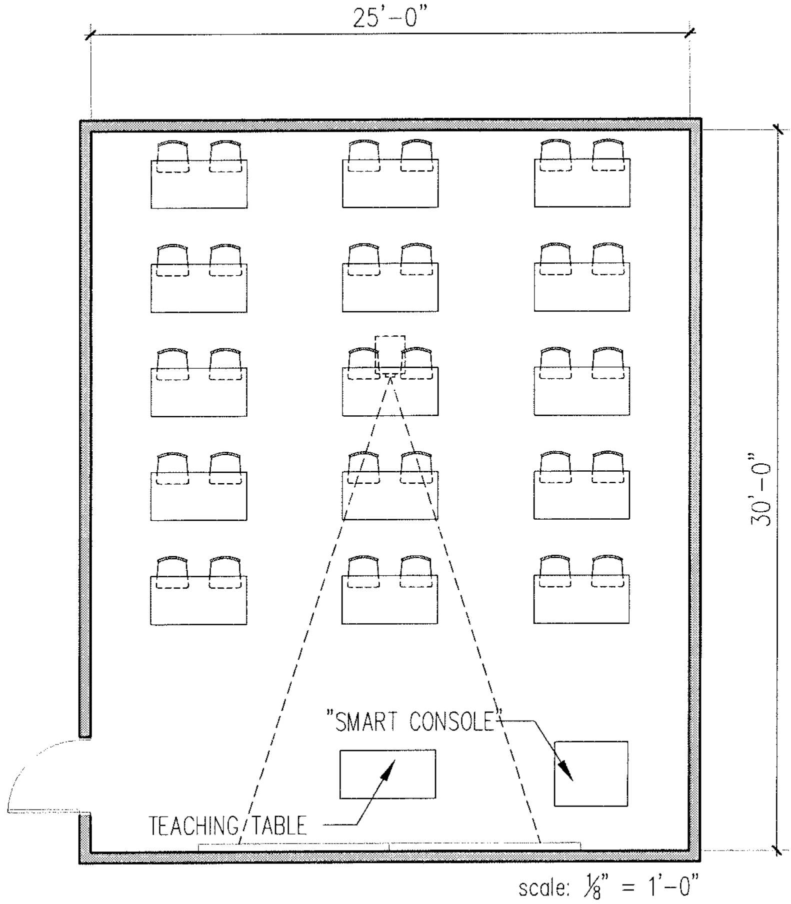
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Card key access, cameras
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures, incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	International all-zone DVD player

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable seats and tables, marker boards, clock, overhead projector, projector screen, "smart" console (moveable) & teaching table w/ casters



F-1d 30 PERSON CLASSROOM

- 750 NASF EACH # 10
- 30 STUDENTS
- 25 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**30 Person Classroom**

1. SPACE PROGRAM:

General Space Description	Classroom
Total New SF Area	750 NSF
Purpose of Space	Classroom
Number of Occupants	30
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

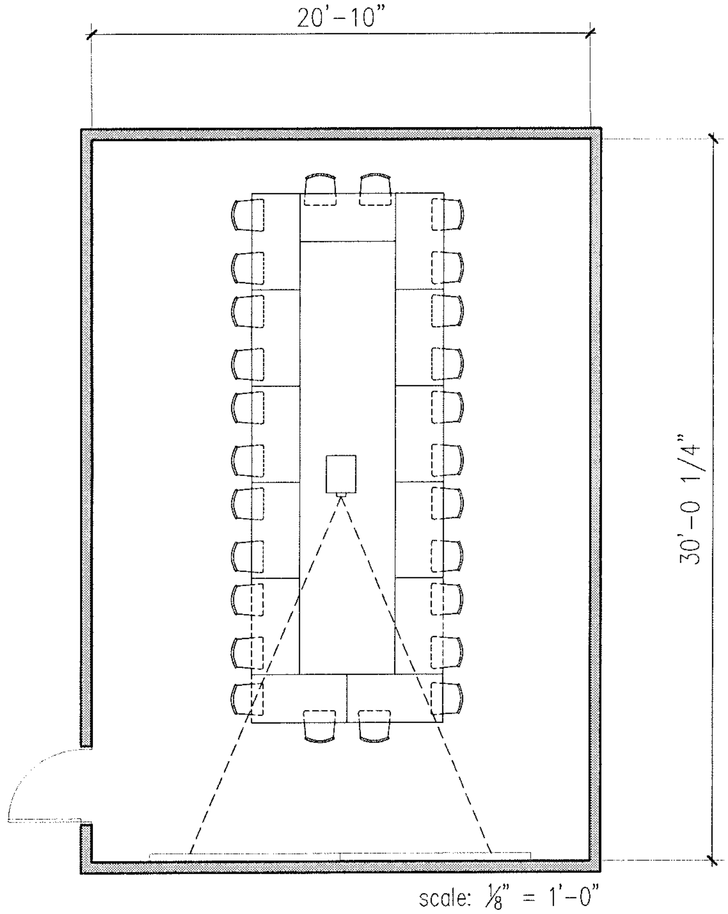
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Card key access, cameras
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures & incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	International all-zone DVD player

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable seats and tables, marker boards, clock, overhead projector, projector screen, "smart" console (moveable), teaching table w/ casters



F-1e

25 PERSON CLASSROOM/SEMINAR/ALTERNATE LAYOUT

- 625 NASF # 9
- 25 STUDENTS
- 25 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**25 Person Classroom/Seminar**

1. SPACE PROGRAM:

General Space Description	Classroom
Total New SF Area	625 NSF
Purpose of Space	Classroom
Number of Occupants	25
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

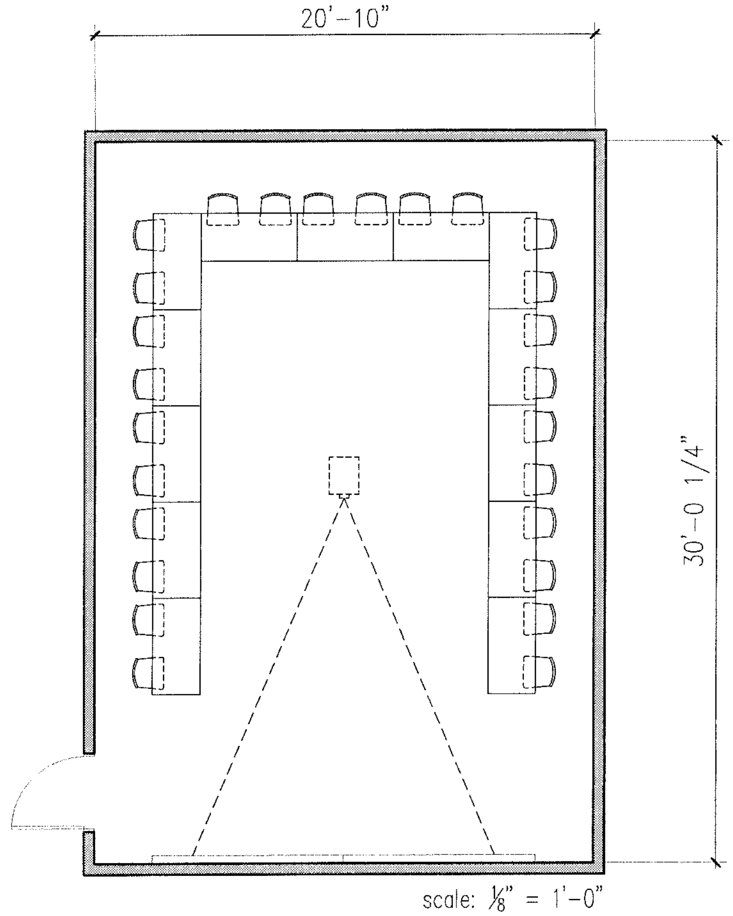
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Card key access, cameras
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures & incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	International all-zone DVD player

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable seats and tables, marker boards, clock, overhead projector, projector screen, "smart" console



F-1e

25 PERSON CLASSROOM/SEMINAR/ALTERNATE LAYOUT

- 625 NASF — # 9
- 25 STUDENTS
- 25 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**25 Person Classroom/Seminar**

1. SPACE PROGRAM:

General Space Description	Classroom
Total New SF Area	625 NSF
Purpose of Space	Classroom
Number of Occupants	25
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

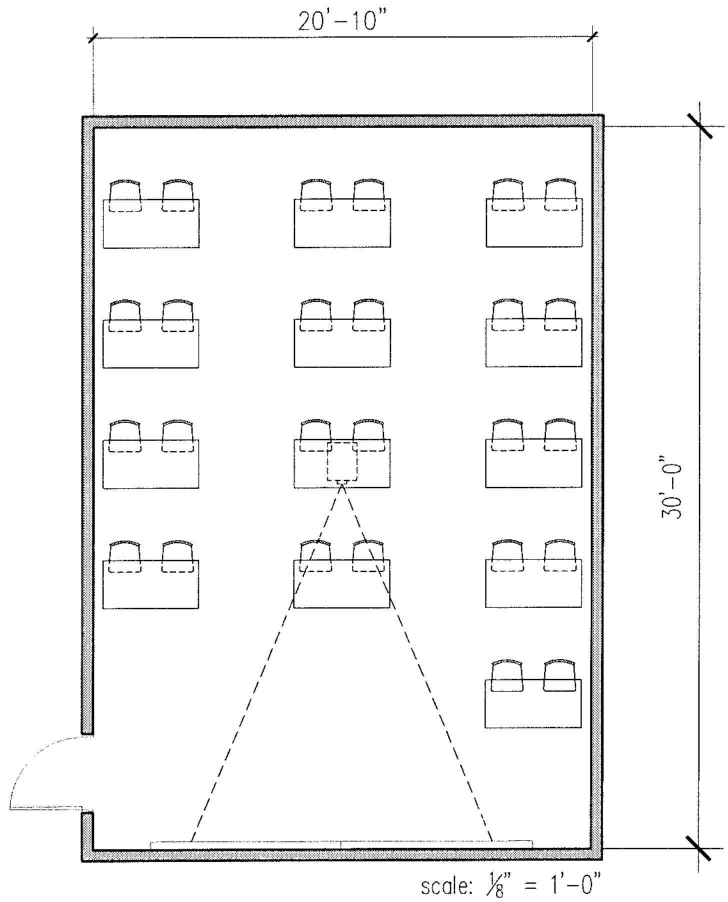
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Card key access, cameras
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures & incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	International all-zone DVD player

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable seats and tables, marker boards, clock, overhead projector, projector screen, "smart" console



F-1e

25 PERSON CLASSROOM/SEMINAR

- 625 NASF # 9
- 25 STUDENTS
- 25 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**25 Person Classroom/Seminar**

1. SPACE PROGRAM:

General Space Description	Classroom
Total New SF Area	625 NSF
Purpose of Space	Classroom
Number of Occupants	25
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

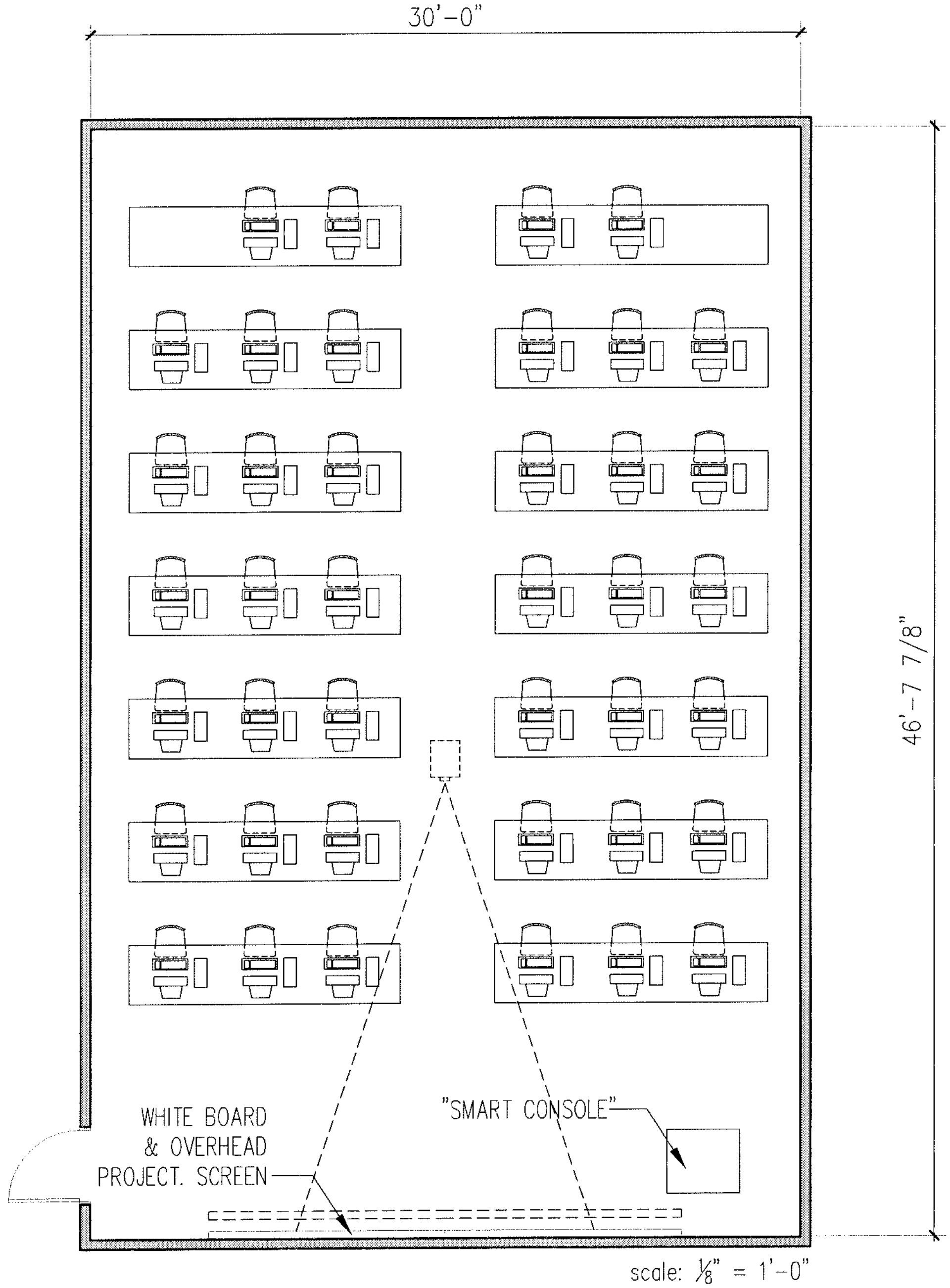
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Card key access, cameras
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent downlight fixtures & incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	International all-zone DVD player

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable seats and tables, marker boards, clock, overhead projector, projector screen, "smart" console



F-2a

40 PERSON ENGLISH/COMMUNICATION MULTI-MEDIA LAB

- 1400 NASF # 1
- 40 STUDENTS
- 35 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name: **English/Communication Multi Media Lab**

1. SPACE PROGRAM:

General Space Description	Computer Lab
Total New SF Area	1400 NSF
Purpose of Space	Classroom & multi media lab - Media convergence to utilize this space
Number of Occupants	40
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

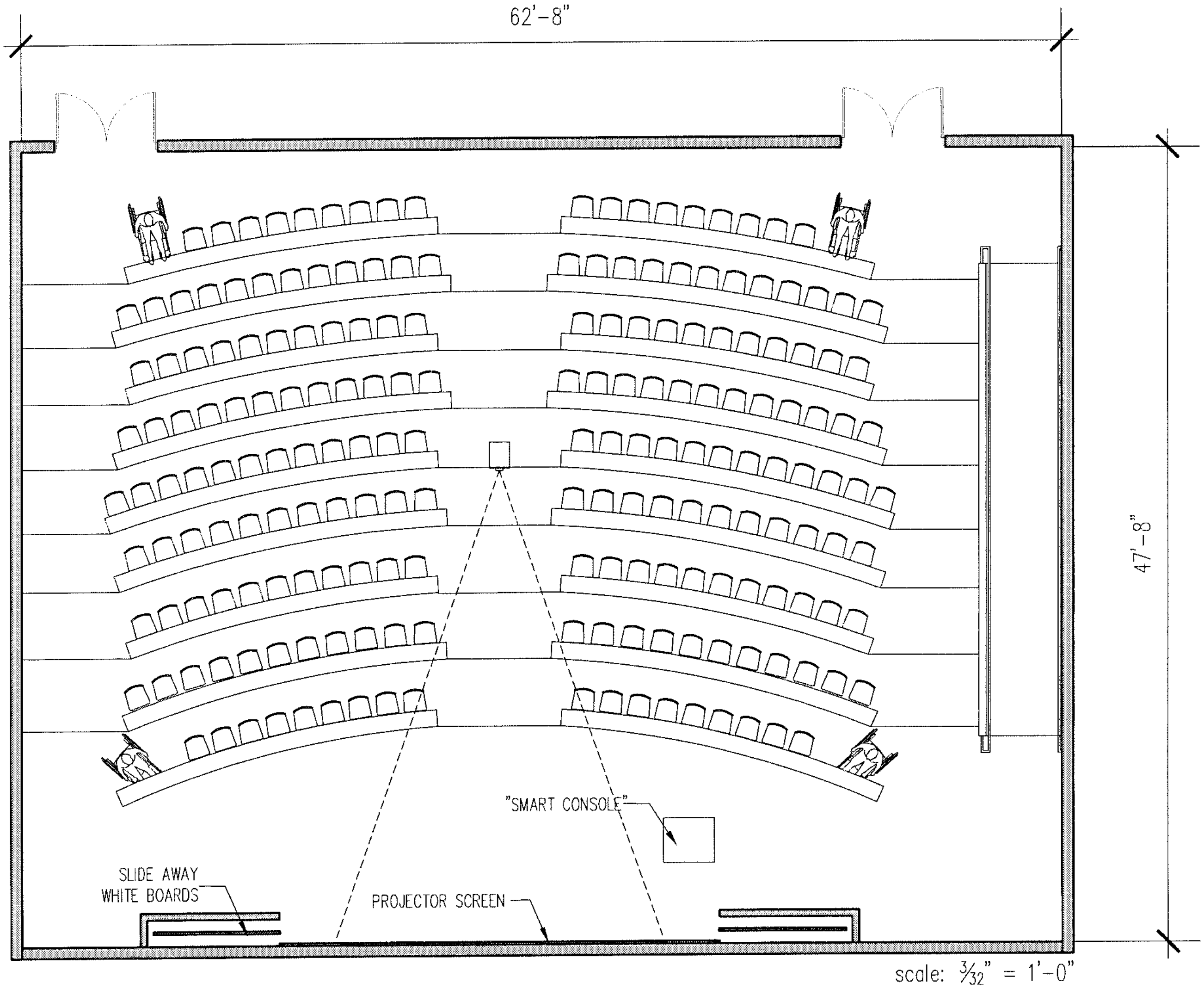
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Card key access, cameras
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable computer tables and chairs, marker boards, clock, over-head projector, projector screen, "smart" console



F-2b

200 PERSON TIERED CLASSROOM

1

- 3000 NASF
- 200 STUDENTS
- 15 SF PER SEAT
- FIXED WORK SURFACE AND FIXED CHAIRS

Room Name:	**200 Person Tiered Classroom**

1. SPACE PROGRAM:

General Space Description	Classroom
Total New SF Area	3000 NSF
Purpose of Space	Place to hold poetry jams, visiting writers
Number of Occupants	200
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

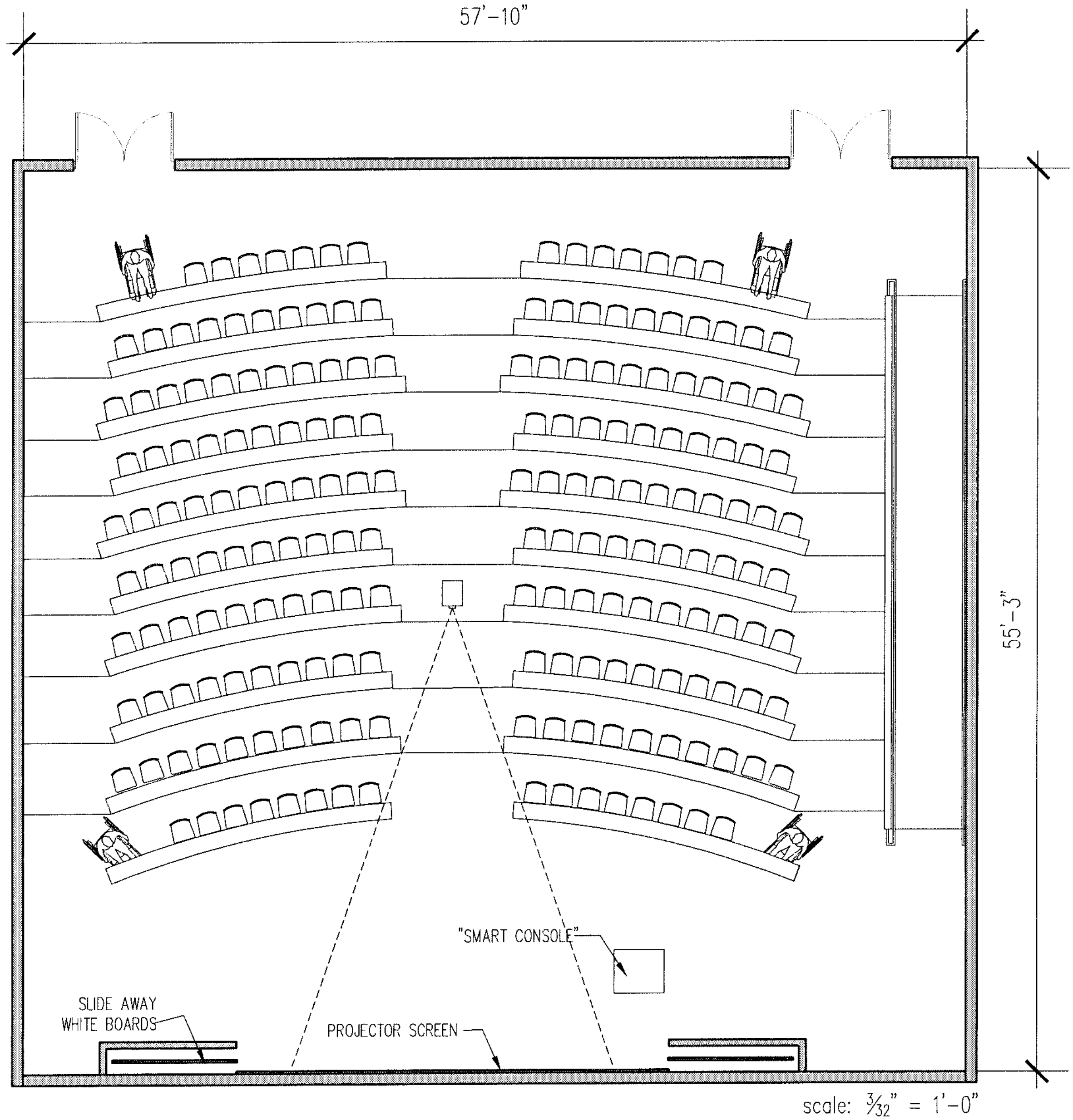
Window	Optional
Doors	Yes (2), 3'-0" double leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Ceiling to be sloped & acoustically treated
Ceiling Height	Varies
Acoustics	Wall surfaces to be acoustically treated
General Character of Room	Fixed, tiered seating

4. ENGINEERING SYSTEM:

Security	Card key access, cameras
HVAC	Standard air exchange
Electrical	120V power wall outlets, outlets @ each fixed seat
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Fixed work surface and fixed chairs, slide away marker boards, clock overhead projector, projector screen, "smart" console



F-2b

200 PERSON TIERED CLASSROOM

1

- 3000 NASF
- 200 STUDENTS
- 15 SF PER SEAT
- FIXED WORK SURFACE AND FIXED CHAIRS

Room Name:	**200 Person Tiered Classroom**

1. SPACE PROGRAM:

General Space Description	Classroom
Total New SF Area	3000 NSF
Purpose of Space	Place to hold poetry jams, visiting writers
Number of Occupants	200
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

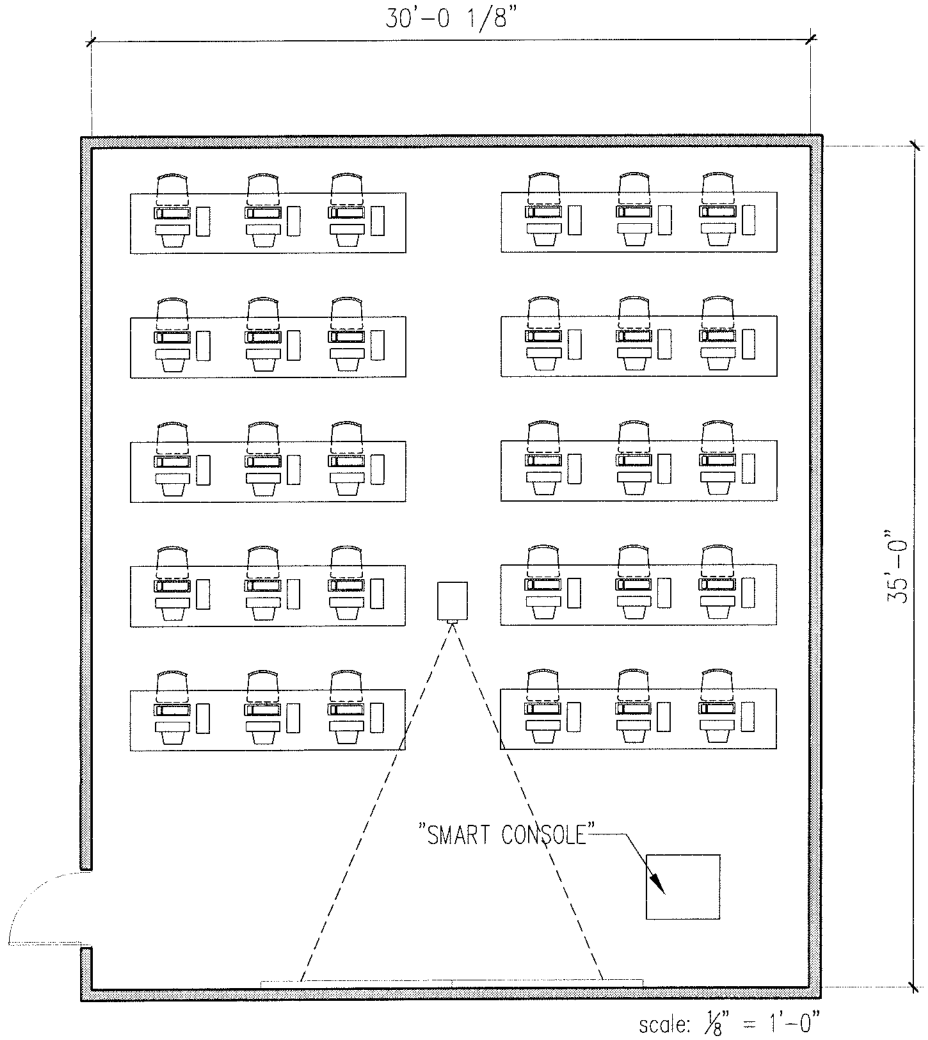
Window	Optional
Doors	Yes (2), 3'-0" double leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Ceiling to be sloped & acoustically treated
Ceiling Height	Varies
Acoustics	Wall surfaces to be acoustically treated
General Character of Room	Fixed, tiered seating

4. ENGINEERING SYSTEM:

Security	Card key access, cameras
HVAC	Standard air exchange
Electrical	120V power wall outlets, outlets @ each fixed seat
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Fixed work surface and fixed chairs, slide away marker boards, clock, overhead projector, projector screen, "smart" console



F-2c

30 PERSON FOREIGN LANGUAGE MEDIA COMPUTER LAB

1

- 1050 NASF
- 30 STUDENTS
- 35 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**Foreign Languages Media Computer Lab**

1. SPACE PROGRAM:

General Space Description	Computer Lab
Total New SF Area	1050 NSF
Purpose of Space	Space to accommodate 30 students with 30 computers
Number of Occupants	30
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

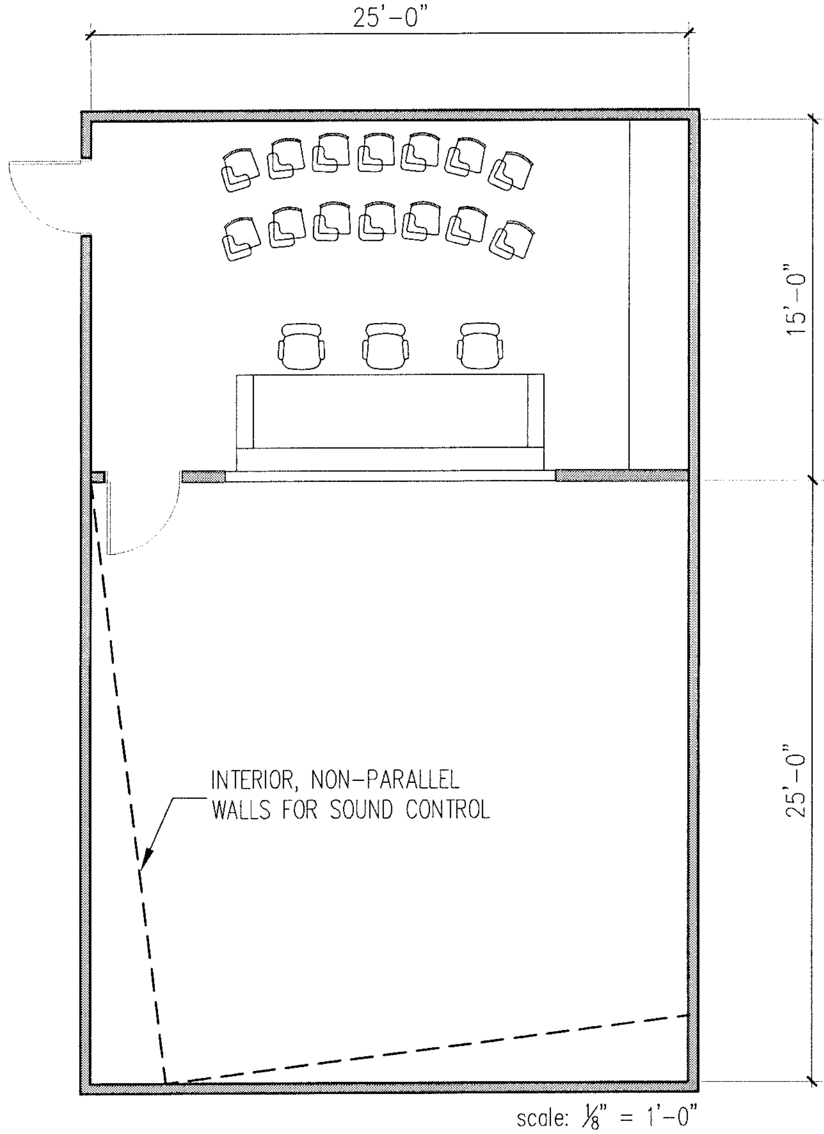
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	International all-zone DVD player

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable computer tables and chairs, overhead projector, projector screen, "smart" console, white board



F-2d

ELECTRONIC MEDIA PRODUCTION
AUDIO RECORDING STUDIO

- 1000 NASF # 1
- RECORDING AND AUDIO CONTROL ROOM W/ 12-15 SEATS FOR OBSERVING STUDENTS

Room Name:	**Electronic Media Production Audio Recording Studio**

1. SPACE PROGRAM:

General Space Description	Recording studio
Total New SF Area	1000 NSF
Purpose of Space	Space to accommodate recording and observation
Number of Occupants	12-15
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

Electronic media production video equipment storage, check out room, video edting room, student spaces and communication administration space

3. ARCHITECTURAL CHARACTERISTICS:

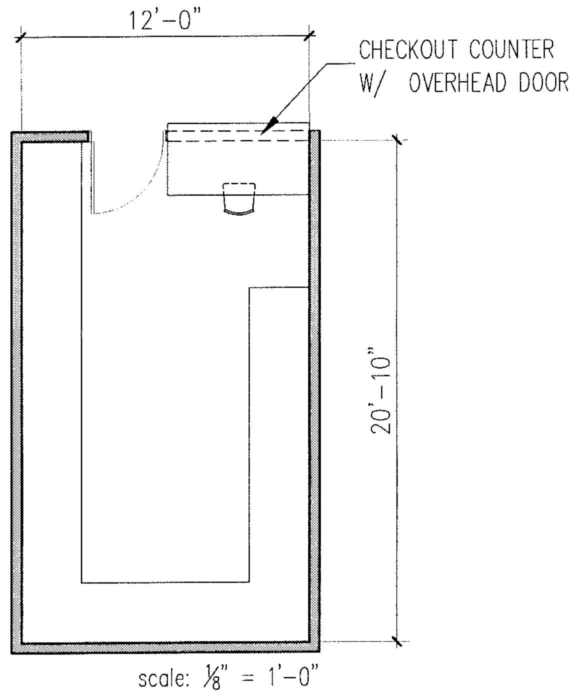
Window	None
Doors	Yes 2, 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	Sound insulation in walls and on the surface of walls
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	Recording equipment - Provide moveable, interior, non-parallel walls for sound control

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable tables and chairs, chairs with fixed work surface



F-2e

ELECTRONIC MEDIA PRODUCTION
VIDEO FIELD EQUIPMENT STORAGE ROOM

1

- 250 NASF
- EQUIPMENT STORAGE AND TEST BENCH FOR MINOR REPAIRS.

Room Name:	**Electronic Media Production Video Field Equipment Storage Check-Out Room**

1. SPACE PROGRAM:

General Space Description	Video equipment storage
Total New SF Area	250 NSF
Purpose of Space	Storage area for media production equipments
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

Electronic media production audio recording studio, video edting room, student spaces and communication administration space

3. ARCHITECTURAL CHARACTERISTICS:

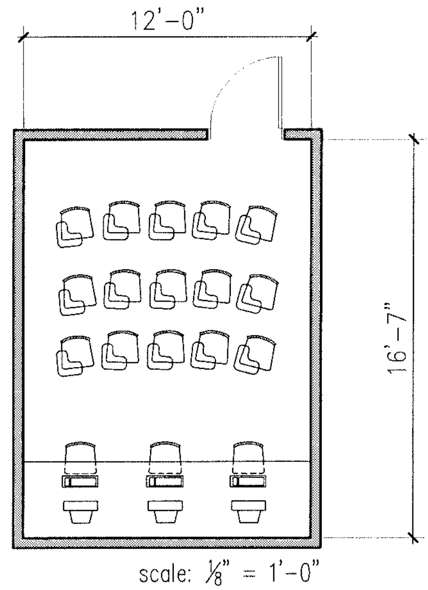
Window	None
Doors	Yes, 3'-0" single leaf
Floor	Vinyl composition tile
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Storage room with check out counter

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Wall outlets
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Fixed wall storage shelves



F-2f

ELECTRONIC MEDIA PRODUCTION
VIDEO EDITING ROOMS

- 200 NASF # 1
- VIDEO EDITING ROOM W/ UP TO 15 SEATS FOR OBSERVING STUDENTS

Room Name:	**Electronic Media Production Video Editing Rooms**

1. SPACE PROGRAM:

General Space Description	Recording studio
Total New SF Area	200 NSF
Purpose of Space	Instruction classroom
Number of Occupants	15
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

Electronic media production video equipment storage, check out room, audio recording studio, student spaces and communication administration space

3. ARCHITECTURAL CHARACTERISTICS:

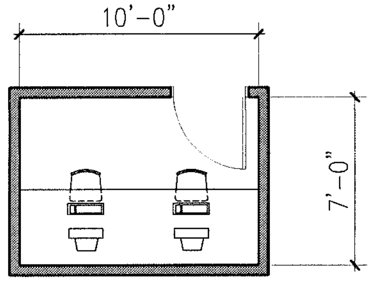
Window	None
Doors	Yes, 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	Recording equipments

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Chairs w/ tablets, built in computer table and chairs



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(F-2g) ELECTRONIC MEDIA PRODUCTION
VIDEO EDITING

- 70 NASF # 2
- VIDEO EDITING ROOMS

Room Name:	**Electronic Media Production Video Editing**

1. SPACE PROGRAM:

General Space Description	Recording studio
Total New SF Area	70 NSF
Purpose of Space	Space to accommodate video editing
Number of Occupants	2
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

Electronic media production video equipment storage, check out room, audio recording studio, student spaces and communication administration space

3. ARCHITECTURAL CHARACTERISTICS:

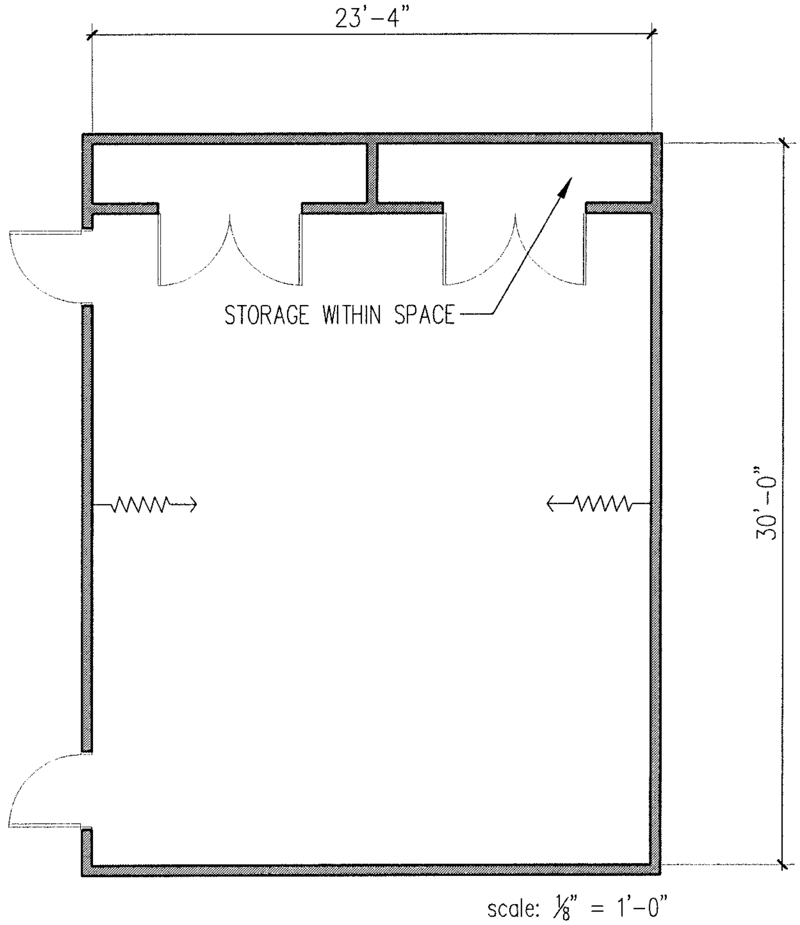
Window	None
Doors	Yes, 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	Sound insulation in walls
General Character of Room	small private studio

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	Video editing equipments

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Fixed table and chairs



F-2h

COMMUNICATION DEBATE LAB

- 700 NASF — # 1
- 12-20 STUDENTS

Room Name:	**Special use Lab** **Communication Debate Lab**

1. SPACE PROGRAM:

General Space Description	Communication Debate Lab
Total New SF Area	700 NSF
Purpose of Space	2 practice rooms and storage w/ dividable wall
Number of Occupants	12-20
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, computer labs, seminar rooms, student spaces and communication administration space
Exterior proximity to service area to allow van loading & unloading

3. ARCHITECTURAL CHARACTERISTICS:

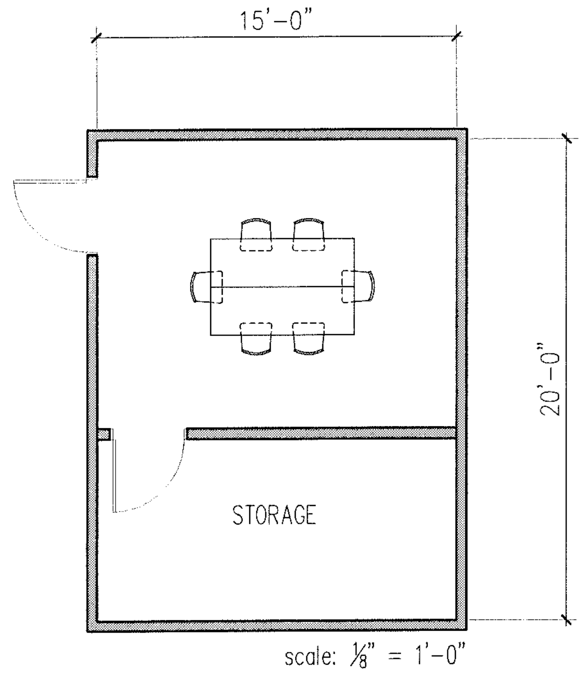
Window	Optional
Doors	Yes 2, 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Card key access, camers
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures, incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	Provide built in storage within room

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Manually operated partion wall, movable tables and chairs



F-2i

TBE AUDIO VISUAL RECORDING ROOM

\# 1

- 300 NASF
- 6 STUDENTS
- 50 SF PER SEAT
- RECORDING ROOM W/ STORAGE FOR AV EQUIPMENT

Room Name:	**TBE Audio Visual Recording Room**

1. SPACE PROGRAM:

General Space Description	Audio visual recording
Total New SF Area	300 NSF
Purpose of Space	Recording room with storage
Number of Occupants	6
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

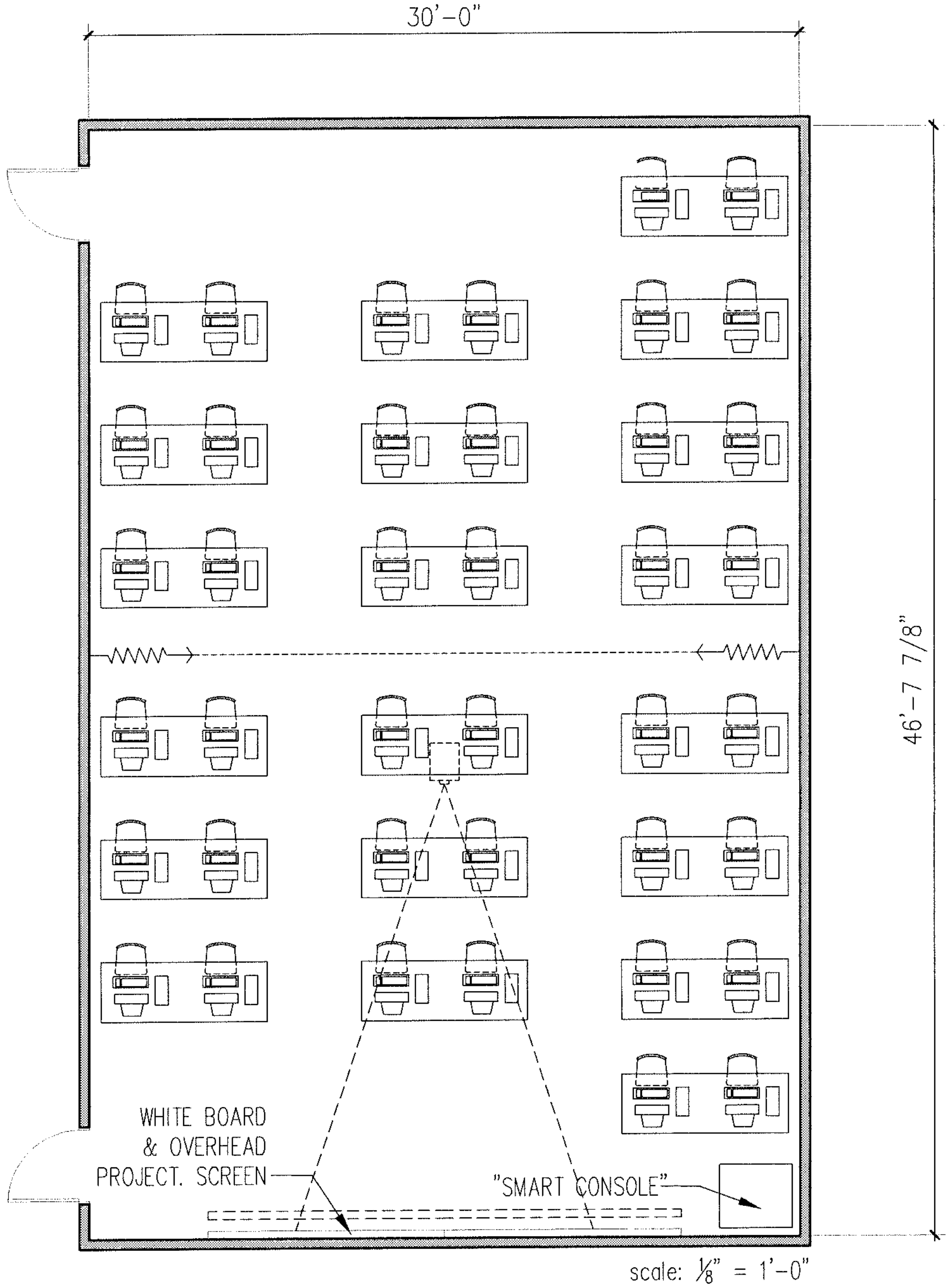
Window	None
Doors	Yes 2, 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	Sound insulation in walls and on the wall surfaces
General Character of Room	Private, quiet

4. ENGINEERING SYSTEM:

Security	None
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescen fixtures and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Blue screen, storage for AV equipment



F-2j

TBE COMPUTER LAB

2

- 1400 NASF
- 40 STUDENTS
- 35 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**TBE** **40 Person Computer Lab**

1. SPACE PROGRAM:

General Space Description	Computer lab
Total New SF Area	1400 NSF
Purpose of Space	Space to accommodate 40 students with 40 computers
Number of Occupants	40
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, labs, seminar rooms and close by student spaces

3. ARCHITECTURAL CHARACTERISTICS:

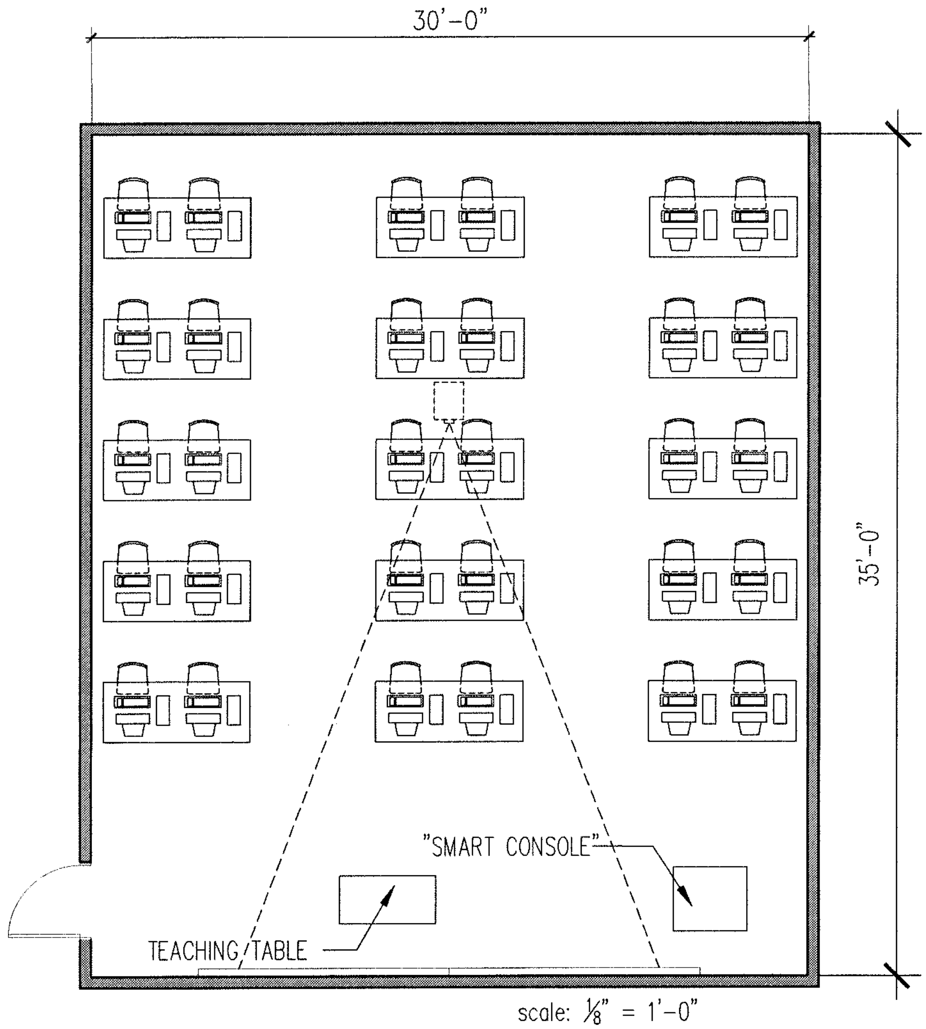
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable computer tables and chairs, overhead projector, projector screen, "smart" console



F-2k

TBE COMPUTER LAB

- 1050 NASF
- 30 STUDENTS
- 35 SF PER SEAT
- MOVEABLE SEATING AND TABLES

1

Room Name:	**TBE** **30 Person Computer Lab**

1. SPACE PROGRAM:

General Space Description	Computer lab
Total New SF Area	1050 NSF
Purpose of Space	Space to accommodate 30 students with 30 computers
Number of Occupants	30
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, labs, seminar rooms and close by student spaces

3. ARCHITECTURAL CHARACTERISTICS:

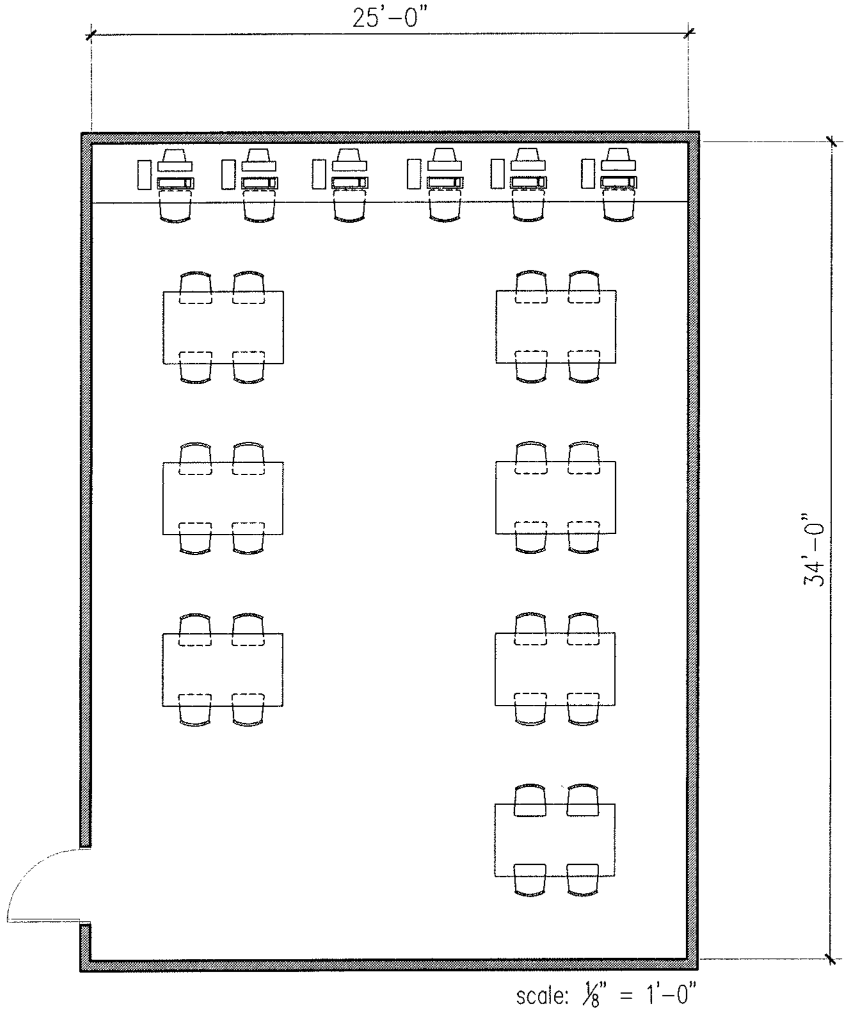
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable computer tables and chairs, overhead projector, projector screen, "smart" console



F-3a WRITING CENTER

- 850 NASF #1
- 7 TUTORS/28 STUDENTS
- 25 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**Writing Center**

1. SPACE PROGRAM:

General Space Description	Classroom/lab
Total New SF Area	850 NSF
Purpose of Space	Tutoring and computer lab
Number of Occupants	34
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

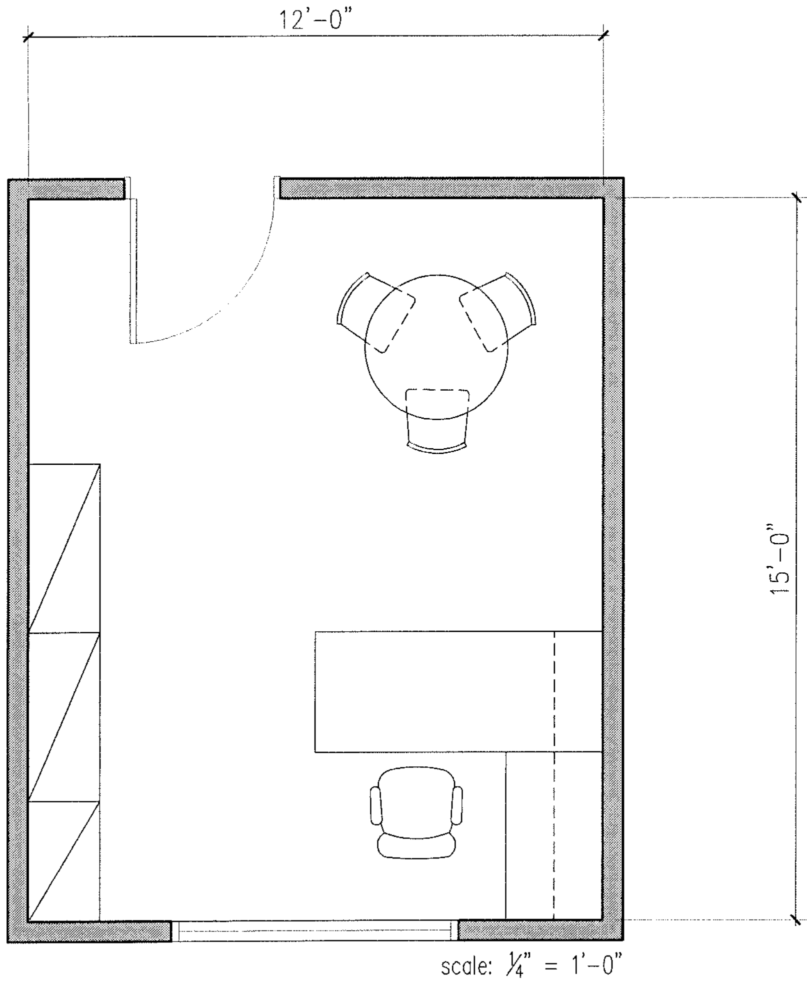
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable tables and chairs, fixed computer stations



F-3b WRITTING CENTER DIRECTOR'S OFFICE

- 180 NASF # 1
- MOVEABLE SEATING AND TABLES

Room Name:	**Writing Center Director's Office**

1. SPACE PROGRAM:

General Space Description	Private office for director of writing
Total New SF Area	180 NSF
Purpose of Space	Office, work area, and meeting for 2-3
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, labs, seminar rooms and student spaces

3. ARCHITECTURAL CHARACTERISTICS:

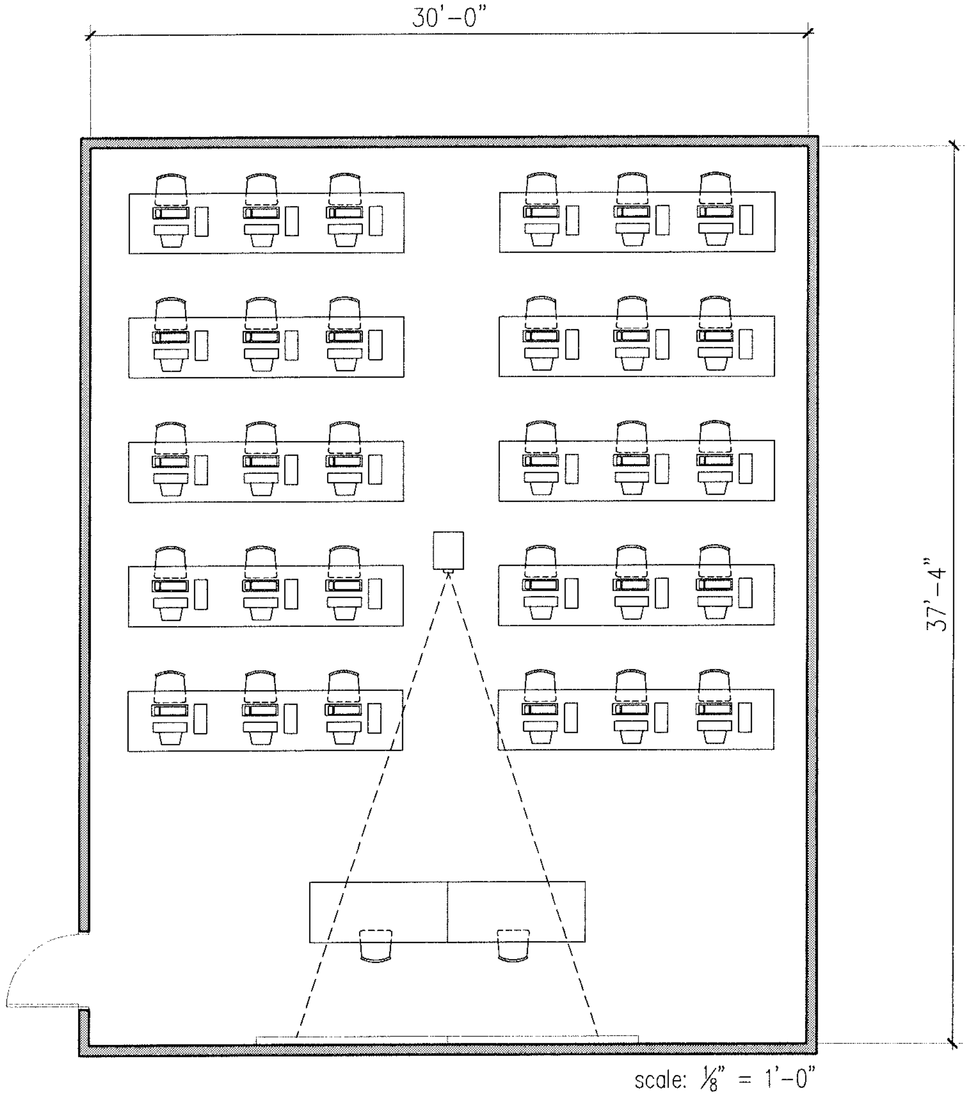
Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Work area and office

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Desk work station with return, file storage, small conference table, marker board, coat hooks, task chair and guest chairs



F-3c OPEN GENERAL COMPUTER LAB/CLASSROOM

1

- 1120 NASF
- 30 STUDENTS/2 LAB AIDES
- 35 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**Open General Computer Lab/Classroom**

1. SPACE PROGRAM:

General Space Description	Open lab
Total New SF Area	1120 NSF
Purpose of Space	Space to accommodate 30 students with 30 computers, two lab aids
Number of Occupants	30
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, labs, seminar rooms and close by student spaces

3. ARCHITECTURAL CHARACTERISTICS:

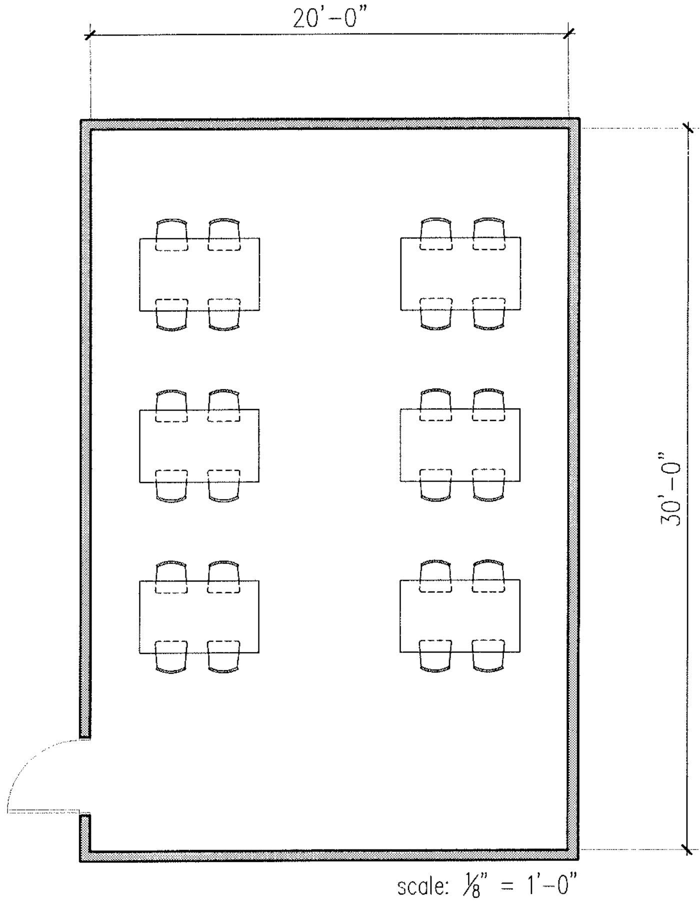
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent and incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable computer tables and chairs, overhead projector, projector screen, "smart" console



F-3d GENERAL TUTORING

- 600 NASF #1
- 6 TUTORS/18 STUDENTS
- 25 SF PER SEAT
- MOVEABLE SEATING AND TABLES

Room Name:	**General Tutoring**

1. SPACE PROGRAM:

General Space Description	Open meeting space
Total New SF Area	600 NSF
Purpose of Space	Tutoring space for communications, foreign languages, etc
Number of Occupants	24
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

All classrooms, labs, seminar rooms and close by student spaces

3. ARCHITECTURAL CHARACTERISTICS:

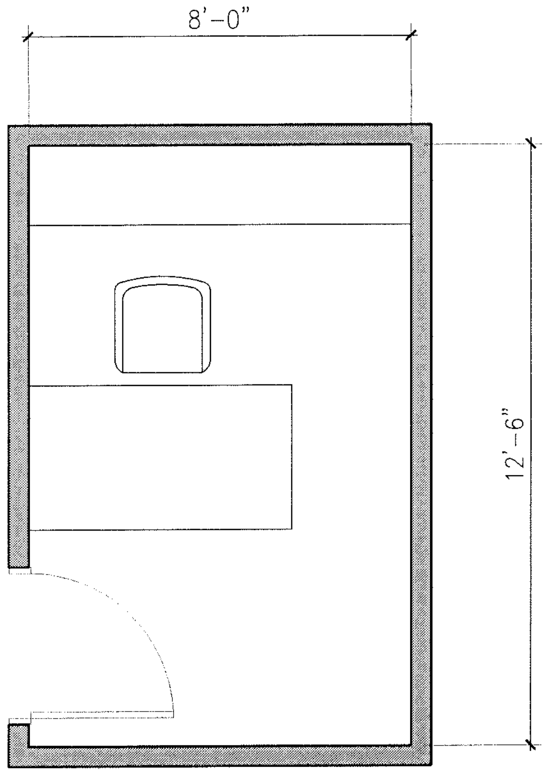
Window	Optional
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Open, flexible floor plan

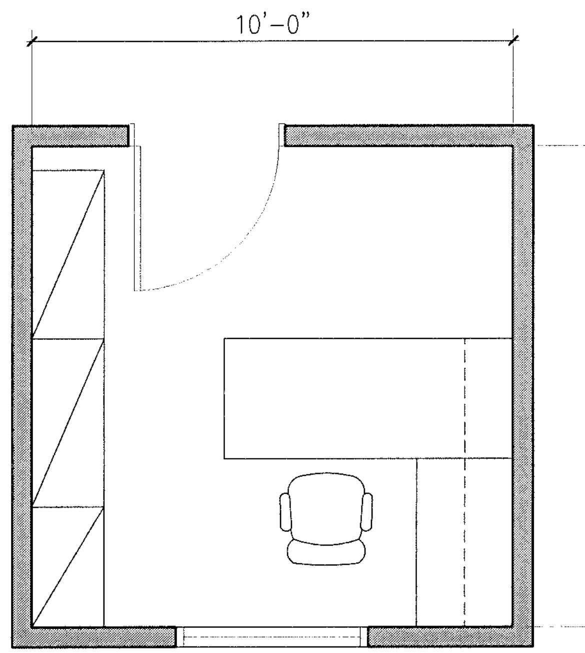
4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Low-glare fluorescent fixtures, incandescent dimmable fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Movable tables and chairs





F-3e OFFICE LAB TECH

- 100 NASF # 1
- MOVEABLE SEATING AND TABLES

Room Name: **Office Lab Tech**

1. SPACE PROGRAM:

General Space Description	Tech Office
Total New SF Area	100 NSF
Purpose of Space	Office
Number of Occupants	1
Hours and Days Used	Needs to accommodate extended hours

2. PROXIMITY AND ACCESS REQUIREMENTS:

Open and general lab/classroom

3. ARCHITECTURAL CHARACTERISTICS:

Window	Yes
Doors	Yes 3'-0" single leaf
Floor	Carpet
Wall	Gypsum board
Ceiling	Acoustical tile ceiling
Ceiling Height	10'-0"
Acoustics	None
General Character of Room	Work area and office

4. ENGINEERING SYSTEM:

Security	Standard
HVAC	Standard air exchange
Electrical	120V power wall outlets
Plumbing	None
Lighting	Fluorescent downlight fixtures
Phone/Data	Wall outlets, along with wireless capability
Special Requirements	None

5. EQUIPMENT, FURNITURE, AND AQCCESSORIES:

Desk work station with return, file storage, coat hooks, task chair

4.4 ADJACENCIES AND RELATIONSHIPS

Public—Private Continuum

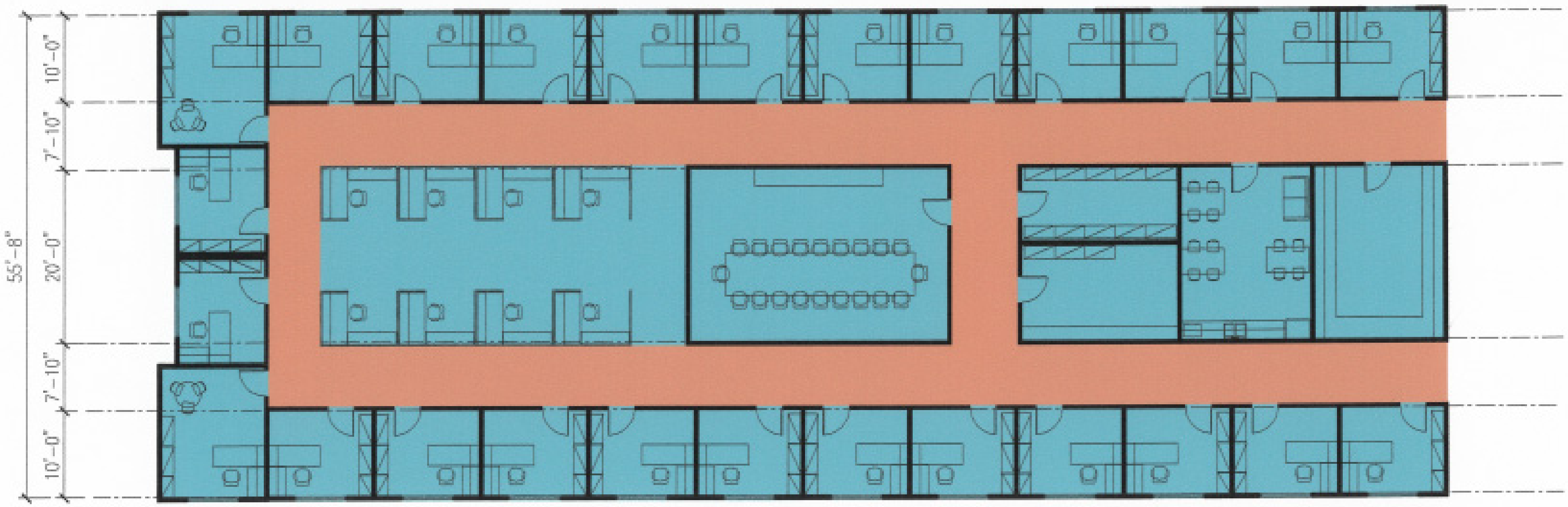
The most public program spaces should be located near entrances, lobbies, on lower floors, etc. More private spaces can be remote, on upper floors with elevator access, etc. In general, those spaces with large population flows, or public functions should be sited low in the building with walk-up access. Vertical circulation systems should support this concept with open, inviting stairs to access the classroom levels and levels with other public programs.

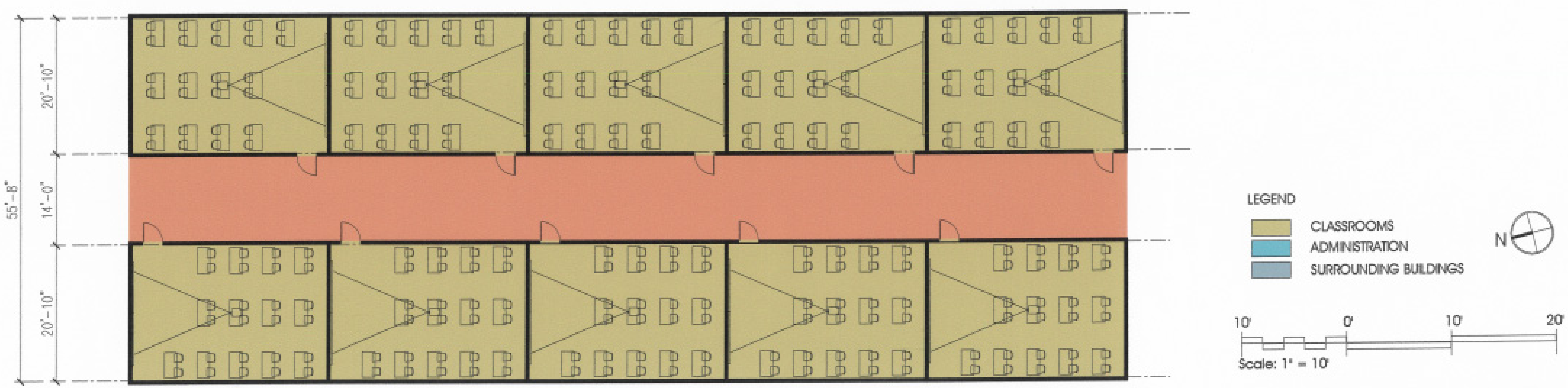
In order of Public (top) to Private (bottom):

Lobby
Classrooms
Seminar Rooms
Small Meeting Rooms and Tutoring Rooms
Student Lounges and Study Areas
Administration Offices and Administration Support Spaces

All adjacencies have been identified on the Program Spreadsheet and Individual Room Sheets.

The following **Conceptual Floor Plan Study** was created to determine appropriate dimensions for the building footprint that allows maximum natural light into interior spaces. It is by no means a floor plan design, and should be utilized by the Design Team as a starting point for the actual floor plan layout during the Schematic Design Stages of the project.





ajc architects

CONCEPTUAL FLOOR PLAN STUDY

Humanities Building

Program Document

5.0 HUMANITIES BUILDING COST SUMMARY

5.1 PROJECT COST SUMMARY

5.2 PROJECT COMPARABLES

5.1 HUMANITIES BUILDING COST SUMMARY

This opinion of probable cost has been prepared to reflect the anticipated cost of the new Humanities Building at Weber State University.

This document is based on the Programmatic Information, including measurement and pricing of quantities wherever information has been provided. Unit rates have been obtained from historical records, along with discussions with contractors. The unit rates provided include labor, material and equipment that reflect current bid costs in the Salt Lake City area. All subcontractor unit rates include the subcontractor's overhead and profit unless otherwise stated.

Exclusions
The following items are excluded:

- Land acquisition costs
- Financing charges and expenses
- Site related environmental abatement measures
- Project phasing costs
- Limited/restricted working hours

Items affecting Opinion of Probable Cost
The following items may change the estimated construction costs, and are not limited to:

- Unforeseen or hidden site utility conditions and capacities
- Modifications to the scope of work represented by this opinion of probable costs
- Phasing of the construction
- Non-competitive bid situations

Assumptions
The following assumptions have been made:

- Construction takes place during normal working hours.
- The CM/GC and subcontractors will have sufficient/temporary site staging and site storage within or adjacent to the vicinity of construction.

Escalation
This opinion of probable costs reflects current costs. Inflation HAS NOT been added to the total costs. An inflation factor will be added by DFCM for the Total Project Cost.

Contingencies
This opinion of probable costs reflects a design contingency of 10%, to allow for items not included in the drawings and Program documentation undefined at this stage.

This opinion of probable costs has been based on a competitive open bid situation with a minimum of 3 bidders for all items of subcontracted work. Please note that Parametrix has no control over the costs of labor, materials, equipment, contractor's methods, or the current competitive bidding market. This represents Parametrix's best judgment as a professional construction consultant. Parametrix does not guarantee the proposals, bids or the overall construction cost will not vary from opinions of probable costs provided within this Program Document.

Construction Costs
The costs provided in this document are for construction costs only. For total project costs, additional soft costs need to be added. Possible soft costs include:

Soft Costs
Hazardous Materials
Pre-Design/Planning
Design
Furnishings and Equipment
Information Technology (Pull Wire)
Technology
Utah Art (1% of Construction Budget)
Testing and Inspection
Construction Contingency
Moving/Occupancy
Builder's Risk Insurance (0.15% of Construction Budget)
Legal Services (0.2% of Construction Budget)
DFCM Management
User Fees
Commissioning
CAD Services (0.07% of Construction Budget)
Miscellaneous Other Costs

The following is summary of the construction costs for the new Humanities Building.

CONSTRUCTION COST ESTIMATE

MASTER SUMMARY

SECTION	AREA	UNIT	COST/SF	COST
CURRENT CONSTRUCTION COST:				
SITE				$1,181,538
BUILDING	85,700	GSF	180.46	$15,465,162
TOTAL (Construction)				$16,646,700

NOTES: Costs are for Construction only.
Costs are based on a Competitive Bid Basis.
Costs are based on Current Costs and Do Not Included Inflation.

CONSTRUCTION COST ESTIMATE

SITE SUMMARY

SECTION		AREA	UNIT	COST/SF	COST
SITE					$960,600
SUB TOTAL					$960,600
GENERAL CONDITIONS	7.0%				$67,242
BONDING	1.0%				$9,606
OVERHEAD & PROFIT	5.0%				$48,030
SUB TOTAL					$1,085,478
DESIGN CONTINGENCY	10.0%				$96,060
TOTAL (Construction)					$1,181,538

NOTES: Costs are for Construction only.
Costs are based on a Competitive Bid Basis.
Costs are based on Current Costs and Do Not Included Inflation.

CONSTRUCTION COST ESTIMATE

BUILDING SUMMARY

SECTION		AREA	UNIT	COST/SF	COST
ARCHITECTURAL		85,700	GSF	58.88	$5,046,115
STRUCTURAL		85,700	GSF	39.70	$3,401,938
MECHANICAL		85,700	GSF	29.82	$2,555,375
ELECTRICAL		85,700	GSF	18.32	$1,569,875
SUB TOTAL		85,700	GSF	146.71	$12,573,303
GENERAL CONDITIONS	7.0%				$880,131
BONDING	1.0%				$125,733
OVERHEAD & PROFIT	5.0%				$628,665
SUB TOTAL		85,700	GSF	165.79	$14,207,832
DESIGN CONTINGENCY	10.0%				$1,257,330
TOTAL (Construction)		85,700	GSF	180.46	$15,465,162

NOTES: Costs are for Construction only.
Costs are based on a Competitive Bid Basis.
Costs are based on Current Costs and Do Not Included Inflation.

The following is a detailed breakdown of the site construction costs for the new Humanities Building.

CONSTRUCTION COST ESTIMATE

SITE DETAIL

SECTION	QUANTITY	UNIT	UNIT COST	COST
SITE				
ON-SITE				
Demolition, Existing Buildings	42,000	SF	6.00	$252,000
Demo, Clear & Grade	102,000	SF	1.50	$153,000
Landscaping & Irrigation	59,000	SF	3.50	$206,500
Concrete Paving	14,700	SF	6.00	$88,200
Concrete Retaining Walls	800	SF	33.00	$26,400
Natural Gas Line	450	LF	20.00	$9,000
Sanitary Sewer Line	600	LF	65.00	$39,000
Storm Sewer Line	750	LF	40.00	$30,000
Fire Line	100	LF	80.00	$8,000
Culinary Water Line	100	LF	35.00	$3,500

CONSTRUCTION COST ESTIMATE

SITE DETAIL

SECTION		QUANTITY	UNIT	UNIT COST	COST
SITE - Continued					
ON-SITE - Continued					
Power Ductbank		200	LF	200.00	$40,000
Telecom Ductbank		200	LF	75.00	$15,000
High Voltage Switch		1	EA	40,000	$40,000
Site Lighting		1	LS	50,000	$50,000
					$960,600
SUB TOTAL					$960,600
GENERAL CONDITIONS	7.0%				$67,242
BONDING	1.0%				$9,606
OVERHEAD & PROFIT	5.0%				$48,030
SUB TOTAL					$1,085,478
DESIGN CONTINGENCY	10.0%				$96,060
TOTAL (Construction)					$1,181,538

NOTES: Costs are for Construction only.
Costs are based on a Competitive Bid Basis
Costs are based on Current Costs and Do Not Included Inflation

The following is a detailed breakdown of the building construction costs for the new Humanities Building.

CONSTRUCTION COST ESTIMATE

BUILDING DETAIL

SECTION	QUANTITY	UNIT	UNIT COST	COST
ARCHITECTURAL				
ROOF				
Membrane Roofing System, Rigid Insulation & Flashings	28,565	SF	9.00	$257,085
Skylight System	1,400	SF	70.00	$98,000
			4.14	**$355,085**
EXTERIOR WALLS				
Foundation Dampproofing w/ Rigid Insulation	5,280	SF	3.00	$15,840
Brick Veneer, Metal Studs, Batt Insulation, Gypsum Bd	26,770	SF	22.00	$588,940
Metal Panels, Metal Studs, Batt Insulation & Gypsum Bd	14,410	SF	38.00	$547,580
			13.45	**$1,152,360**
INTERIOR WALLS				
Metal Studs, Sound Insulation & Gypsum Board	59,500	SF	7.00	$416,500
			4.86	**$416,500**
DOORS AND WINDOWS				
Aluminum Windows / Curtainwall w/ Glass	22,180	SF	50.00	$1,109,000
Sun Shading Devices	2,660	SF	90.00	$239,400
Man Doors w/ Hardware	180	LEAF	1,200	$216,000
			18.25	**$1,564,400**
FINISHES				
Floor Finishes	85,700	SF	5.00	$428,500
Wall Finishes	160,180	SF	1.50	$240,270
Ceiling Finishes	85,700	SF	3.00	$257,100
			10.80	**$925,870**

CONSTRUCTION COST ESTIMATE

BUILDING DETAIL

SECTION	QUANTITY	UNIT	UNIT COST	COST
ARCHITECTURAL - Continued				
SPECIALTIES				
Cabinets & Casework	975	LF	300.00	$292,500
Bath Accessories	9	EA	2,000	$18,000
Misc Specialties	85,700	SF	1.50	$128,550
			5.12	**$439,050**
EQUIPMENT				
Misc Equipment	85,700	SF	0.50	$42,850
			0.50	**$42,850**
CONVEYING SYSTEM				
Elevator, 3 Stop	2	EA	75,000	$150,000
			1.75	**$150,000**

CONSTRUCTION COST ESTIMATE

BUILDING DETAIL

SECTION	QUANTITY	UNIT	UNIT COST	COST
STRUCTURAL				
FOUNDATION				
Concrete Footings w/ Reinf	410	CY	450.00	$184,500
Concrete Foundation Wall w/ Reinf	5,280	SF	22.00	$116,160
Excavation and Backfill, Foundation	3,280	CY	20.00	$65,600
			4.27	$366,260
FLOORS				
Concrete Slab on Grade	28,565	SF	5.50	$157,108
Steel Structure, Decking, Fireproofing & Concrete Slab on Deck	57,135	SF	31.00	$1,771,185
Steel Pan Stairs w/ Railings	12	FLT	15,000	$180,000
			24.60	$2,108,293
COLUMNS				
Steel Columns w/ Fireproofing	85,700	SF	3.50	$299,950
			3.50	$299,950
ROOF				
Steel Structure, Decking & Fireproofing	28,565	SF	19.00	$542,735
			6.33	$542,735
INTERIOR WALLS				
CMU Interior Walls	7,700	SF	11.00	$84,700
			0.99	$84,700

CONSTRUCTION COST ESTIMATE

BUILDING DETAIL

SECTION	QUANTITY	UNIT	UNIT COST	COST
MECHANICAL				
FIRE PROTECTION				
Fire Sprinkler System	85,700	SF	2.25	$192,825
			2.25	$192,825
PLUMBING				
Plumbing Fixtures w/ Piping	162	EA	2,500	$405,000
Plumbing Equipment & Specialties	85,700	SF	1.50	$128,550
			6.23	$533,550
HVAC				
HVAC Ductwork & Insulation	76,500	LB	5.50	$420,750
HVAC Grilles, Registers & Diffusers	980	EA	120.00	$117,600
HVAC Equipment	85,700	SF	8.00	$685,600
HVAC Piping & Specialties	85,700	SF	3.00	$257,100
HVAC Control System	85,700	SF	3.50	$299,950
HVAC Test & Balance	640	HRS	75.00	$48,000
			21.34	$1,829,000

CONSTRUCTION COST ESTIMATE

BUILDING DETAIL

SECTION		QUANTITY	UNIT	UNIT COST	COST
ELECTRICAL					
ELECTRICAL					
Light Fixtures		1,340	EA	250.00	$335,000
Devices (Outlets & Switches)		2,010	EA	75.00	$150,750
Gear (Panels & Transformers)		85,700	SF	2.00	$171,400
Emergency Generator		1	EA	120,000	$120,000
Feeder & Branch Circuitry		85,700	SF	4.50	$385,650
Fire Alarm System		85,700	SF	1.75	$149,975
Phone / Data System		85,700	SF	2.25	$192,825
Electrical Specialties		85,700	SF	0.75	$64,275
Technology System					In Other Budget
				18.32	$1,569,875
SUB TOTAL		85,700	GSF	146.71	$12,573,303
GENERAL CONDITIONS	7.0%				$880,131
BONDING	1.0%				$125,733
OVERHEAD & PROFIT	5.0%				$628,665
SUB TOTAL		85,700	GSF	165.79	$14,207,832
DESIGN CONTINGENCY	10.0%				$1,257,330
TOTAL (Construction)		85,700	GSF	180.46	$15,465,162

NOTES: Costs are for Construction only.
Costs are based on a Competitive Bid Basis.
Costs are based on Current Costs and Do Not Included Inflation

5.2 PROJECT COMPARABLES

As part of the Programming effort, the Programming Team reviewed two similar projects that have completed construction in the past 3 years:

Project #1: Weber State University Davis Campus New Classroom Building

Year Construction Started:	2001
Year Construction Completed:	2003
Size of Building:	160,000 GSF
Total Construction Cost Building/Site:	$17,000,000
Cost Per SF:	$106/SF
Cost Per SF Escalated to 2005 (32%):	$140/SF
Inflation for 2002: 6%	
Inflation for 2003: 6%	
Inflation for 2004: 8%	
Inflation for 2005: 12%	

Project #2: University of Utah Health Sciences Education Building

Year Construction Completed:	2003
Year Construction Completed:	2005
Size of Building:	150,000 GSF
Total Construction Cost Building/Site:	$27,000,000
Cost per SF:	$180/SF
Cost per SF Escalated to 2005 (20%)	$216/SF
Inflation for 2004: 8%	
Inflation for 2005: 12%	

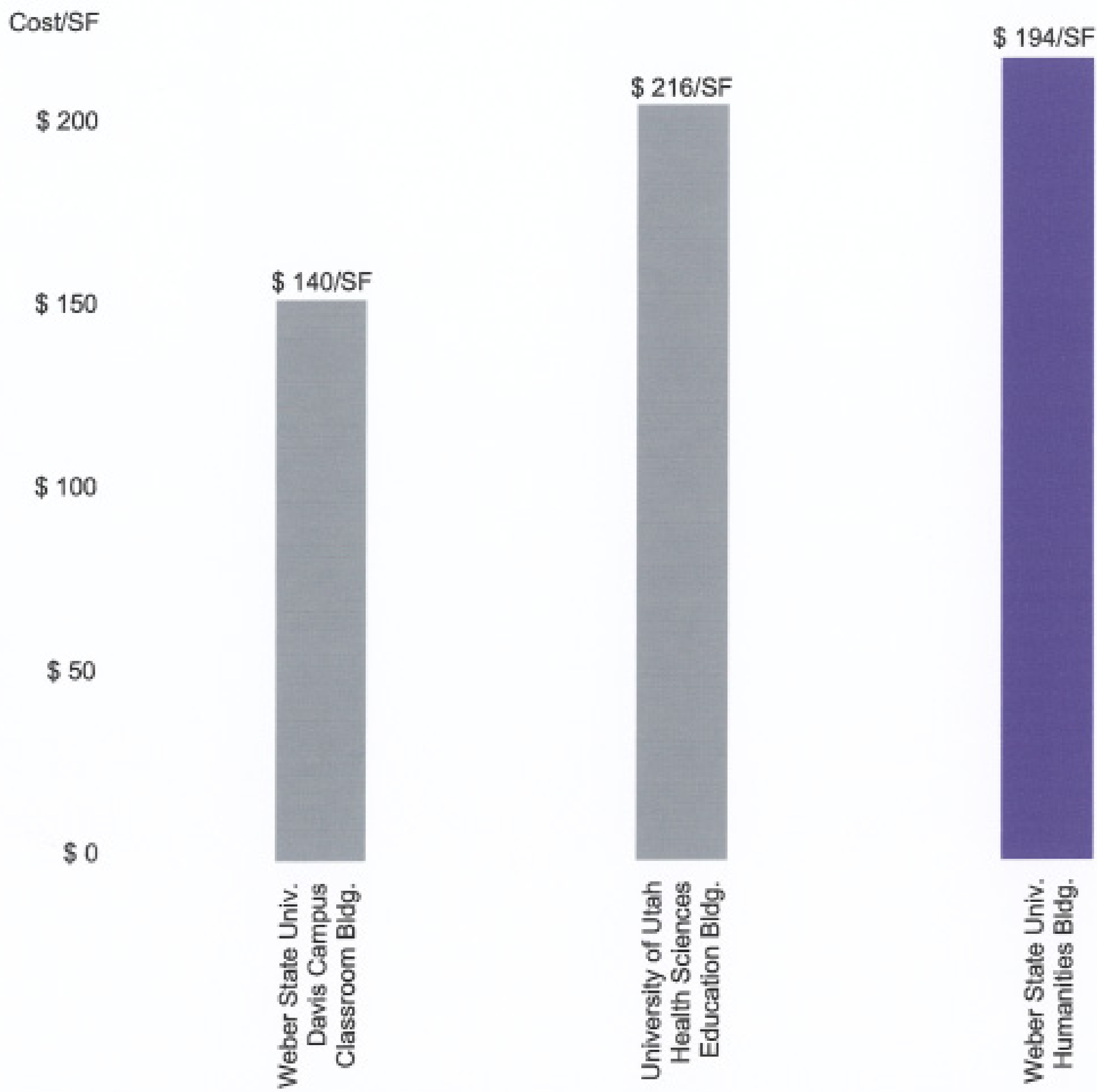
Weber State University New Humanities Building

Size of Building:	85,700 GSF
Construction Budget as of October 2005:	$16,646,700
(Inflation to start of construction not included)	
Cost per SF 2005	**$194.00/SF**

Cost Comparison Graph

Cost Comparison Graph Costs reflect the following:

- Building & Site Construction
- Comparables are inflated to 2005 dollars



6.0 NEW CHILLER

6.1 Introduction

As part of the Programming effort for the new Humanities Building, the programming team was asked to also provide programming services for a new Chiller Building and Plant for Weber State University. A complete Chiller Feasibility Report is included in the Appendix (Section 7) of this Program Document.

This Section will identify the possible site for the new Chiller Building, identify utilities and infrastructure required, provide architectural, structural, mechanical and electrical programmatic requirements, and look at anticipated costs for the construction of this facility.

6.2 Mechanical Executive Summary

Included in Section 7 Appendix of this document is the **Weber State University Central Chilled Water Plant and Distribution System Study.** This study focuses on the existing and proposed chilled water systems for Weber State University. The study identifies existing chilled water distribution conditions, new and existing cooling requirements, and provides recommendations for the construction of a new central chilled water plant. The study will provides recommendations for new upgrades to the existing chilled water distribution systems. Capacities of existing and future buildings were taken from the Weber State University master plan. These capacities and totals can be found in Section 7 Appendix, **Weber State University Central Chilled Water Plant and Distribution System Study,** Sections 2 and 3.

Weber State University originally began as Weber State Academy in 1889. It was made a State Junior College in 1933. Weber State College was updated to University status in 1991. Weber State University has since experienced a steady growth of students and educational facilities. The University is comprised of thirty six (36) main on-campus buildings, and ten (10) auxiliary buildings. Among these buildings, twenty one (21) on-campus buildings are connected to the campus Central Chilled Water Plant. The study focuses on the cooling requirements of the existing buildings, future planned campus buildings, and projected load increases. All discovered and known information has been summarized and the findings incorporated into the design of a new Central Chilled Water Plant.

The following are the main concerns and recommendations for improving the Existing Chilled Water Distribution System and the construction of a new Future Central Chilled Water Plant. (All sections referenced are sections within the document located in Section 7 Appendix):

1. The capacities of the existing three chillers and piping are adequate to handle the existing connected demand. See Section 3.4. However, the existing campus pumping system has reached its' operating limits. Pumps must operate at full capacity to meet current campus needs, without adequate back-up. If a primary pump is lost, the campus capacity is reduced by 50% of one chiller. This could be as much as 625 tons. If a secondary pump is lost, the entire campus cooling capacity will be reduced by 50%.

2. The capacities of the existing three chillers, cooling tower and piping are adequate for the combined existing load and the projected summer 2006 load as long as all three chillers are operating. See Section 3.4. Pumping system will be inadequate as it is currently operating. A higher chilled water Delta T needs to be used to compensate for the lack of pump capacity at future peak demands.

3. The capacities of the existing three chillers, pumps, cooling tower and piping are <u>not</u> adequate for the combined existing connected load, projected summer 2006 load and the future projected load. See Sections 3.3 and 3.4.

4. The new projected central chiller plant should be designed so that a back-up chiller or combination of chillers will always provide the capacity to cover the connected load.

5. Two of the existing chillers are manufactured by The Trane Co, the third chiller by Carrier Corp. The Trane chillers are in good condition and should be relocated to the new

proposed central chiller plant. The Carrier chiller is beyond ASHRAE'S recommended service life and should be removed from service.

6. The different chiller combinations that are evaluated for the new central chiller plant in Section 5.2 are as follows:

Combination A:
1) Chiller #1 – New 1500 Ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1500 Ton with optional VFD
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination B:
1) Chiller #1 – New 2000 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1250 ton
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination C:
1) Chiller #1 – New 1500 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1250 ton with optional VFD
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination D:
1) Chiller #1 – New 2000 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1500 ton
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination E:
1) Chiller #1 – New 2000 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1700 ton
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination F:
1) Chiller #1 – New 1700 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1700 ton with optional VFD
4) Chiller #4 – Existing 650 Ton Trane Unit

7. Modify the campus chilled water loop as recommended in Section 4. This includes the following:
   a. Incorporate a primary chilled water circulation loop for each chiller.
   b. Provide a secondary loop with new pumps and variable frequency drives. Incorporate the campus loop pipe section modifications as part of the secondary loop.

c. Provide a separate "decoupled" chilled water loop for the skybox and its' associated loads. Provide a plate and frame heat exchanger and associated pumps and specialties in the old chiller plant room to serve this loop.

8. Provide a new plate and frame exchanger to provide free cooling by utilizing condenser water from the cooling tower without activating the chillers.

9. Provide all new chilled and condenser water pumps with stand by pumps for the chilled water and condenser water systems.

10. Provide an automated control system to match a sequence of control approved by WSU. An example of a sequence is as follows:
    a. The first stage of cooling when the outdoor temperature is below 60 degrees F, shall be provided by the "Free Cooling" ie. plate and frame exchanger and the cooling tower. This stage of cooling shall be provided until the return water temperature can no longer be maintained. At this point, the "Free Cooling" shall be terminated and the lead chiller shall start.

    b. The lead chiller shall start and maintain operation until the return water temperature continues to rise at which time a return water temperature controller (adjustable) will start the other chillers depending on the combination recommended or approved by WSU.

11. The existing five cell cooling tower is not large enough to handle the combination of the existing connected load, the projected summer 2006 load, and the future projected load.

12. Provide a refrigerant detection, evacuation and personnel safety system. See Section 6.4.

13. Design engineers shall use WSU and DFCM standards to Architects and Engineers defining design criteria, equipment approval, etc. for the new central chiller plant.

14. The new chilled water distribution system and condenser water system within the new central chiller plant should be balanced by an independent testing and balancing agency after the new systems are installed.

15. Based on Sections 3 and 5, we recommend for the new central chilled water plant one of the following chiller combinations with the associated equipment listed below:

    Combination A
    1) Chiller #1 – New 1500 ton with VFD
    2) Chiller #2 – Existing 1250 Ton
    3) Chiller #3 – New 1500 ton with optional VFD
    4) Chiller #4 – Existing 650 Ton

    Combination F
    1) Chiller #1 – New 1700 ton with VFD
    2) Chiller #2 – Existing 1250 Ton
    3) Chiller #3 – New 1700 ton with optional VFD

4) Chiller #4 – Existing 650 Ton

a. Central Air Eliminator – Remove all existing building air eliminators.

b. Central expansion tanks – Remove all existing building expansion tanks.

c. Four inline mounted, constant volume chilled water primary loop circulating pumps for the chillers.

d. Three main campus base mounted secondary distribution pumps with variable frequency drives.

e. Three main condenser water pumps with variable frequency drives.

f. Plate and frame exchanger for free cooling with and automatic change over to mechanical cooling.

g. Cell addition to the existing cooler tower.

h. Automation System.

i. Re-using the existing 24 inch condenser water piping as the new chilled water piping distribution system. See Existing Campus Distribution Map Section 4.2 C.

The recommendations included in this report are based off of WSU master plan information dated September 2005. Because many assumptions have been made concerning future buildings, i.e. future loads, locations, etc. Because of change in the future, as individual building designs are refined, this report shall only be used as a guide and not a finished design for future buildings. WHW Engineering, Inc. assumes no design liability for future modifications to the existing campus plan. Equipment sizing, pipe sizing, loop modifications, field verification of existing conditions, and all other associated recommendations are the responsibility of the future design teams to verify, calculate, and design at the time of the associated future projects.

The following paragraphs are not included in the executive summary of the actual study. These have been added to supplement the programming narrative. This is a summary of information contained in the body of the campus chilled water study, located in Section 7 Appendix of this document.

The following table includes the approximate costs for the two different recommended options. The reason that we recommend either option A or option F is that option A is the most cost effective, while option F provides the most redundancy. The owner should evaluate the options and determine whether redundancy or life cycle costs are a higher priority, and then select the associated chiller combination. A more detailed explanation of these two options can be found in the Appendix of this document, Section 6.1.a of the Chiller Feasibility Study.

WEBER STATE UNIVERSITY
CHILLED WATER STUDY COST ESTIMATE - Preliminary Opinion of Probable Costs
New Campus Chilled Water System Summary

7.4
Combination A

Item Description		Sub-Total		15% O & H		Total
Chiller Plant						
Chiller Plant - Combination A	$	2,797,224.00	$	419,583.60	$	3,216,807.60
Plate & Frame Recommendation						
Plate & Frame Exchanger (Free Cooling)	$	163,220.00	$	24,483.00	$	187,703.00
Campus Piping System For Future Connected Load						
Future Connected Load	$	189,400.00	$	28,410.00	$	217,810.00
	$	3,149,844.00	$	472,476.60	$	3,622,320.60

Sub-Total	$	3,149,844.00
15% O & H	$	472,476.60
Total	**$**	**3,622,320.60**

Combination F

Item Description		Sub-Total		15% O & H		Total
Chiller Plant						
Chiller Plant - Combination F	$	3,000,524.00	$	450,078.60	$	3,450,602.60
Plate & Frame Recommendation						
Plate & Frame Exchanger (Free Cooling)	$	163,220.00	$	24,483.00	$	187,703.00
Campus Piping System For Future Connected Load						
Future Connected Load	$	189,400.00	$	28,410.00	$	217,810.00
	$	3,353,144.00	$	502,971.60	$	3,856,115.60

Sub-Total	$	3,353,144.00
15% O & H	$	502,971.60
Total	**$**	**3,856,115.60**

The above costs are for the equipment associated with the new central chilled water system. This does not include the plumbing and HVAC costs associated with the building itself. The approximate HVAC and plumbing costs for the actual building are as follows:

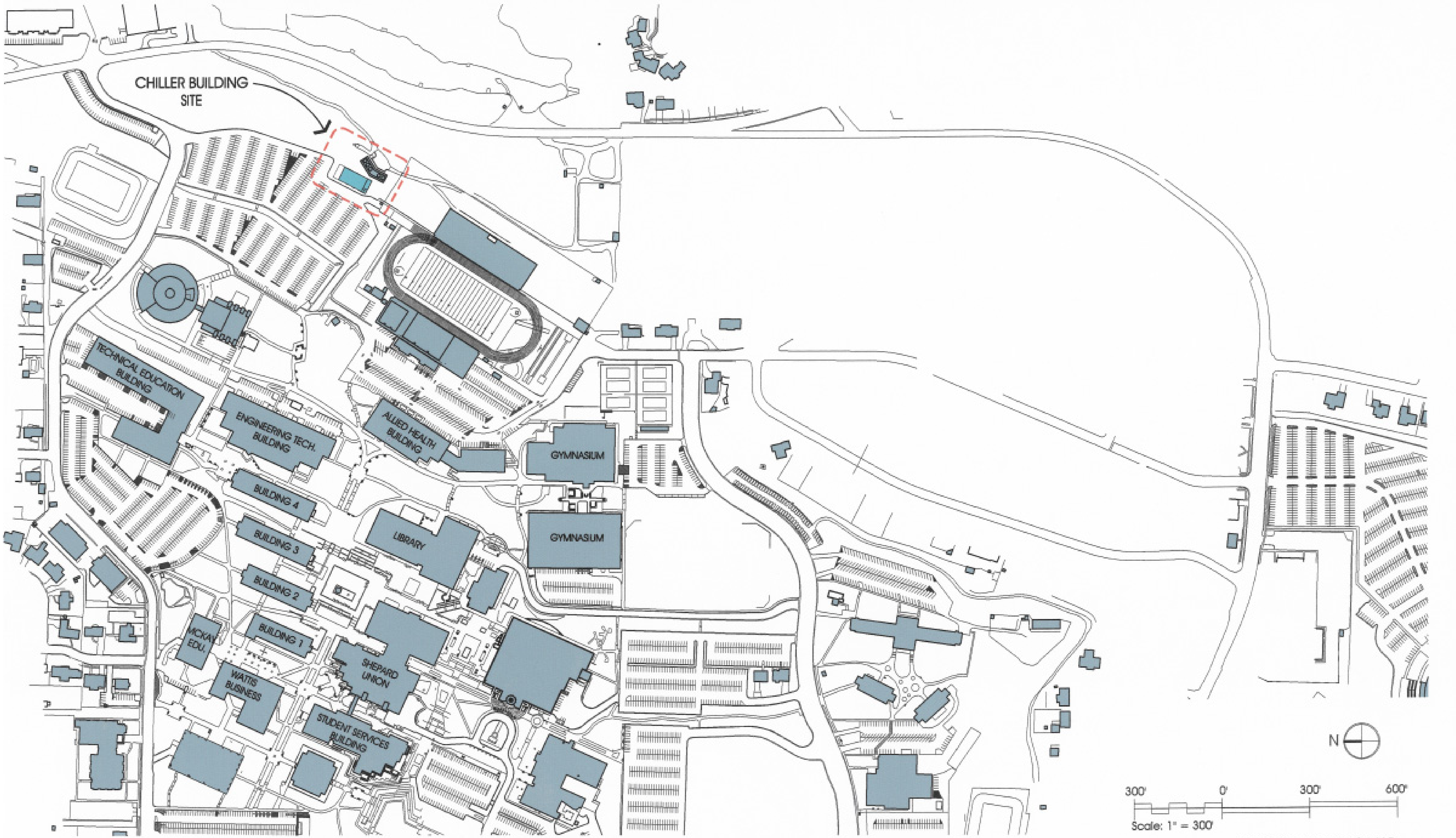
WEBER STATE UNIVERSITY
CHILLED WATER STUDY COST ESTIMATE - Preliminary Opinion of Probable Costs
Chilled Water Plant Building HVAC and Plumbing Costs

Item Description	Sub-Total	15% O & H	Total
Plumbing for new chiller plant (including restroom, drinking fountain, water heater, service sink, compressed air piping, floor drains, etc.)	$25,000.00	$3,750.00	$28,750.00
HVAC for new plant (including fan coil with electric heat, restroom exhaust, etc.)	$45,000.00	$6,750.00	$51,750.00
TOTAL HVAC AND PLUMBING			**$80,500.00**

6.3 PHYSICAL CHARACTERISTICS OF THE SITE

6.3.1 Site Location

The proposed site location for this new facility is located west of the existing cooling tower facility, located adjacent to the stadium parking. See the **Overall Campus Map** for the location of the building on Campus.



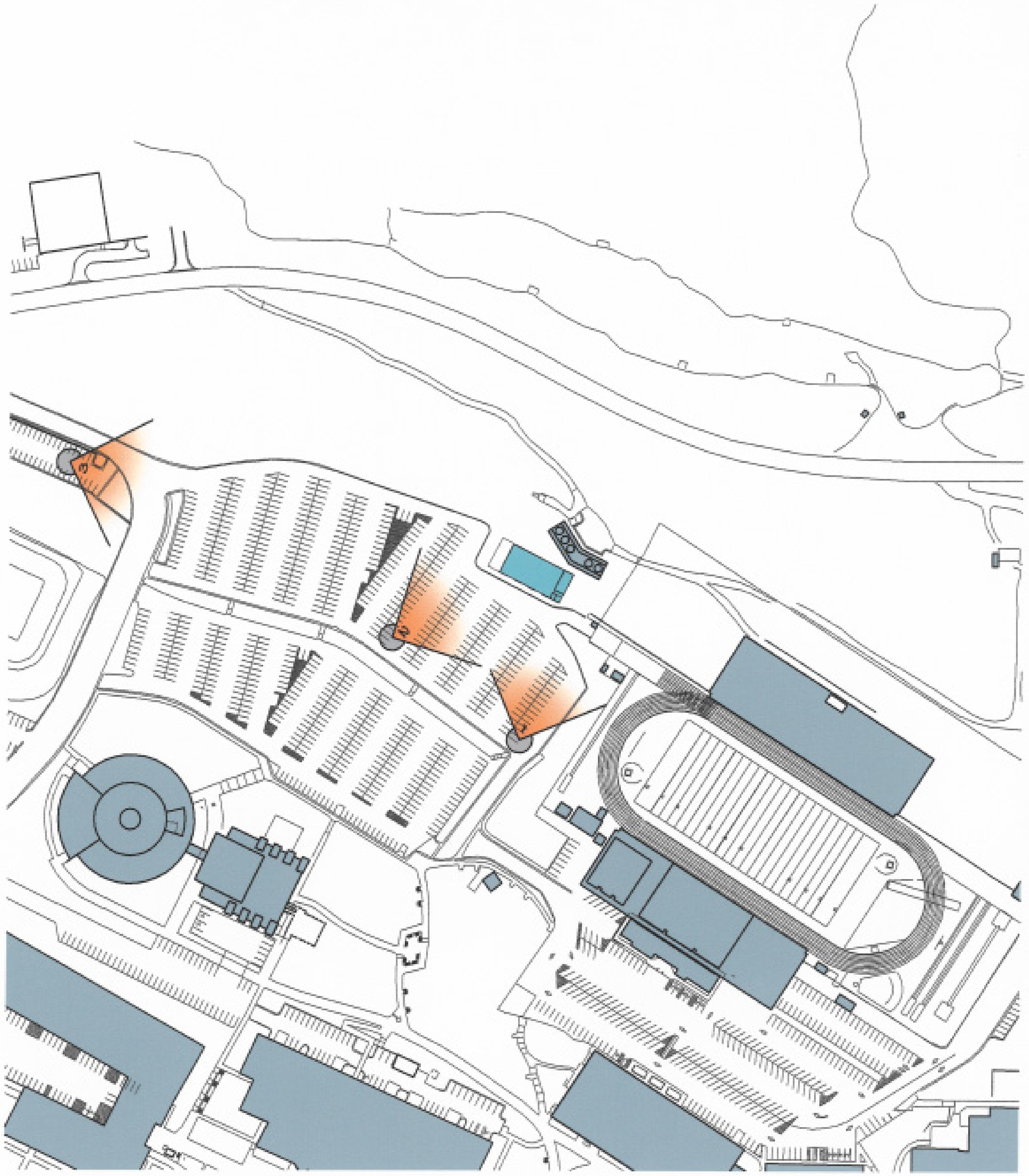
OVERALL CAMPUS MAP
Humanities Building

6.3.2 Photos of the Site

Views of the Site

The proposed site for the new Chiller Building is in the hillside and parking area for the stadium.

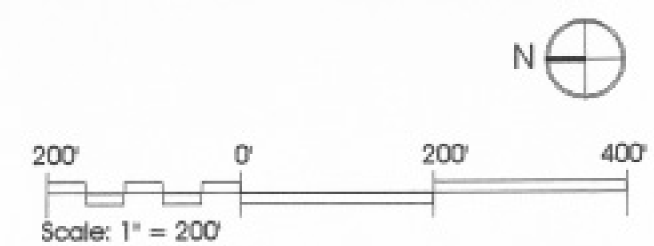
See the following **Views of the Site** photos for views into the site and of the existing Cooling Tower Building.



VIEW #1

VIEW #2

VIEW #3



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VIEWS OF THE SITE
Chiller Building

6.3.3 Geotechnical Investigation Report

A geotechnical report has not been provided during Programming and will need to be completed prior to the Design Phase.

Once the final building size, configuration, structural system, number of levels above and below grade, and column loads have been defined in more detail, the project geotechnical consultant shall provide guidance on the following design criteria as well as any other criteria deemed by the geotechnical consultant to be important.

- Soil bearing capacity
- Structural fill requirements
- Potential differential settlements
- Potential for expansion or collapse of soils due to moisture changes
- Liquefaction potential
- Groundwater characteristics and restrictions
- Seismic considerations, coefficients, fault traces, etc.
- Lateral bearing pressures – active and passive
- Alternate foundation systems
- Pavement sections

6.3.4 Topography and Survey

Prior to the start of design, a topographic survey of this site will be contracted by the State of Utah, Division of Facilities Construction and Management. It is anticipated that this survey will document all existing conditions of the site including surface and subsurface improvements. This survey will be made available for use during the design and construction phases of the project.

Weber State University has provided existing topography for use in the Program document. In general, the site slopes from east (high side) to west (low side), with approximately 16'-18' of fall across the site.

See the following **Existing Topography Plan.** This topography was provided by Weber State University and appears to be the topography of the site prior to the parking lot improvements.

EXISTING TOPOGRAPHY PLAN
Chiller Building

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6.3.5 UTILITIES

The location of the proposed Chiller Building is located west of the existing Cooling Tower Building and north of the Stadium. The site slopes down approximately 16'-18' feet from the existing Cooling Tower Building to the existing parking lot. Site work for the Chiller Building will require demolition of approximately 200-feet of curb and approximately 700 square yards of asphalt pavement. The existing chiller building remainder of the parking lot will be retained and protected during construction.

Existing utilities surround the proposed Chiller Building site to the East, North and South. On the East are overhead power lines; on the north are underground power lines; and on the south are culinary water, chilled water, sanitary sewer and irrigation lines. The existing utility lines should be retained and protect during construction of the new Chiller Building. The new Chiller Building will require culinary water and sanitary sewer services.

Water

Culinary water service for the new Chiller Building will be serviced by connecting to the existing culinary water main located adjacent to the south side of the proposed building location. Domestic water is existing serving the cooling tower. Provide make-up water prv for chilled water make-up. Provide domestic water PRV for restroom and utility sink. Provide backflow preventer for chiller and condenser make-up water to prevent contamination of domestic water.

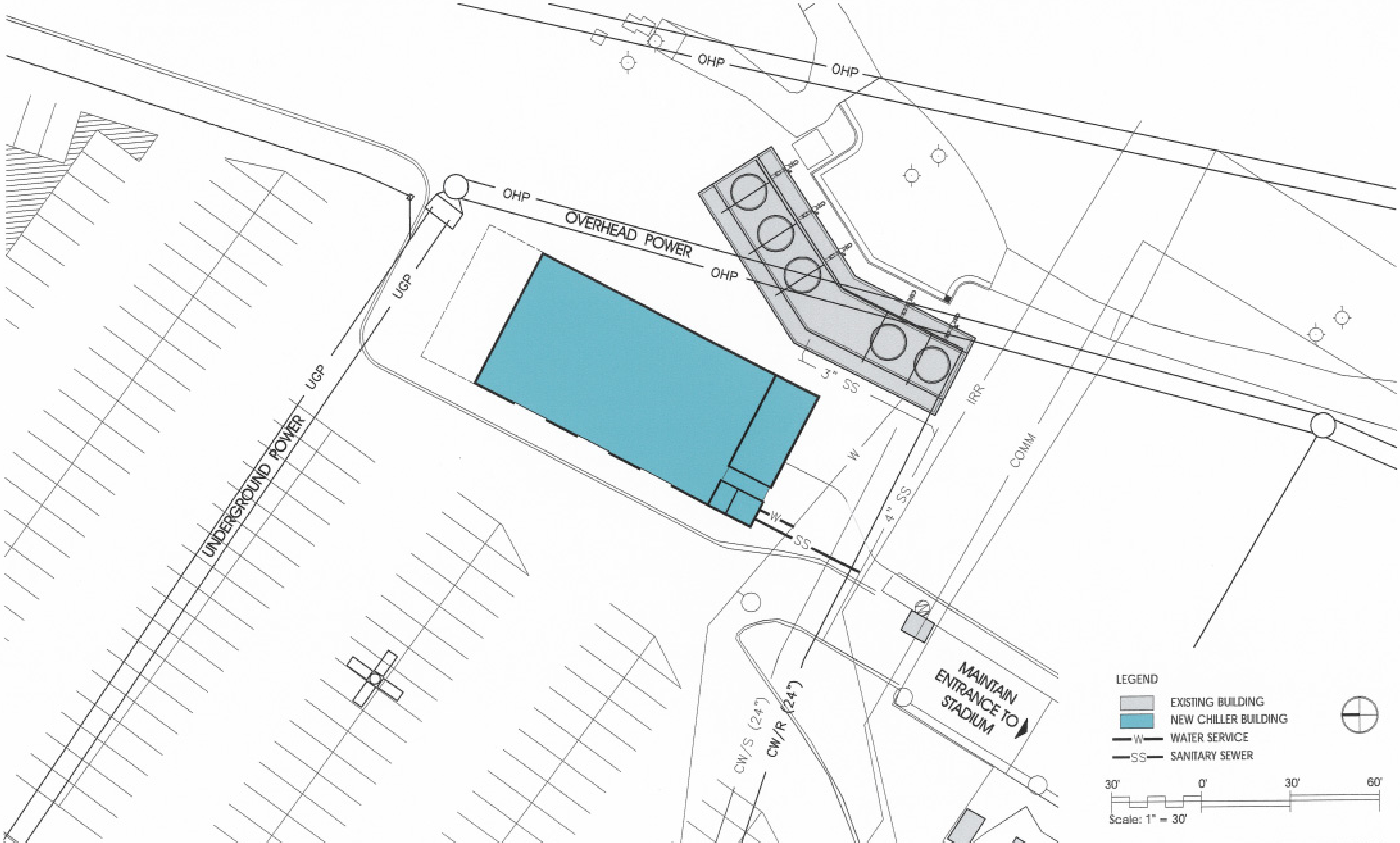
Sewer

The sanitary sewer service will be serviced by connecting to the existing 4-inch sanitary sewer located adjacent to the south side of the proposed building location. All waste piping shall be cast iron bell and spigot per DFCM standards.

Storm Drainage

The nearest storm drain line is approximately 200-feet west of the proposed building. Drainage from the roof could easily surface drain across the existing parking lot surface until the surface flow is intercepted by the existing storm drain system.

Building roof drain piping shall surface drain. Roof drain piping inside the building shall be insulated. Primary and secondary roof drain system shall be provided. Coordinate with Civil.



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PROPOSED UTILITY PLAN
Chiller Building

Program Document

6.4 CHILLER BUILDING

6.4.1 Architectural

The Program of Spaces to be included in the new Chiller Building are as follows:

Equipment Room	90' x 50'	4,500 GSF
Storage and Shop/Electrical	16' x 34'	544 GSF
Unisex Restroom	10' x 6'	60 GSF
Office	10' x 10'	100 GSF
Circulation	6' X 16'	96 GSF
Total Size of New Chiller Building		5,300 GSF

The functions of these spaces are as follows:

Equipment Room	Location for the 4 new Chillers and Associated Equipment. See the Chiller Feasibility Report for the layout of equipment for this space
Storage and Shop/Electrical	The Shop Area will include a work bench, utility sink, compressed air, location for a hot water heater, overhead hoisting system, open storage, small exhaust fan, and refrigerant (hazmat) storage.
Unisex Restroom	As required by code, 1 accessible unisex restroom with: (1) Lavatory (1) Water Closet
Office	Private Office
Circulation	Corridor as required for access to the Unisex Restroom, Office and Storage and Shop/Electrical spaces without having to enter the main Equipment Room.

It is anticipated that the building will be constructed of masonry and concrete. The east wall and portions of north and south walls will be retaining the existing hillside, and would be conducive to concrete retaining walls. The west wall will be fully exposed and can be masonry to tie into the existing masonry structures on the campus. The west wall will also have 3-4 large overhead (doors) openings. This exposure of the building will be highly visible; it is suggested that these overhead openings be "glass" to allow architectural interest in the building. This would provide an opportunity for the public to see into the new Chiller Building, (and require the inside to be kept clean for this "public viewing opportunity".)

Codes, Regulations and Safety

The governing codes for this project are listed below. The Design Team and Architect of Record will need to verify at the beginning of the design phase all required codes and regulations. It is the Design Team and Architect of Record's responsibility to utilize all latest revisions, editions and adopted versions. The following list presents currently applicable code issues and is not a complete list of applicable codes.

International Building Code (IBC) 2003 with Utah Amendments
International Plumbing Code (IPC) 2003
International Mechanical Code (IMC) 2003
International Fire Code (IFC) 2003
Life Safety Code NFPA 101 with Utah Amendments
National Electric Code (NEC) with Utah Amendments 2002
Laws, Rules and Regulations of the Utah State Fire Marshall
The Utah Code for Energy Conservation in New Building Construction (ASHRAE Standard 9.1-1989)
International Energy Conservation Code 2003
ASHREA Indoor Air Quality 62-2001 & Addendum 62n

Planning and Design Criteria to Prevent Architectural Barriers for Aged and Physically Handicapped (Fourth Revision, with lever hardware amendment)
Americans with Disabilities Act Title III, 1991 (ADA) 1998
DFCM Design Criteria for Architects and Engineers
Weber State University Design Standards
ANSI A117-119- 1968 Accessibility Design Standards 1998
American Society of Heating, Refrigeration and Air Conditioning (ASHREA)
Sheet Metal and Air Conditioning Contractor National Association (SMACNA)
Underwriters Laboratory (UL)
American Society of Testing Materials (ASTM)

In addition, the Design Team and Architect of Record will be required to coordinate their efforts with Weber State University Facilities Management and DFCM.

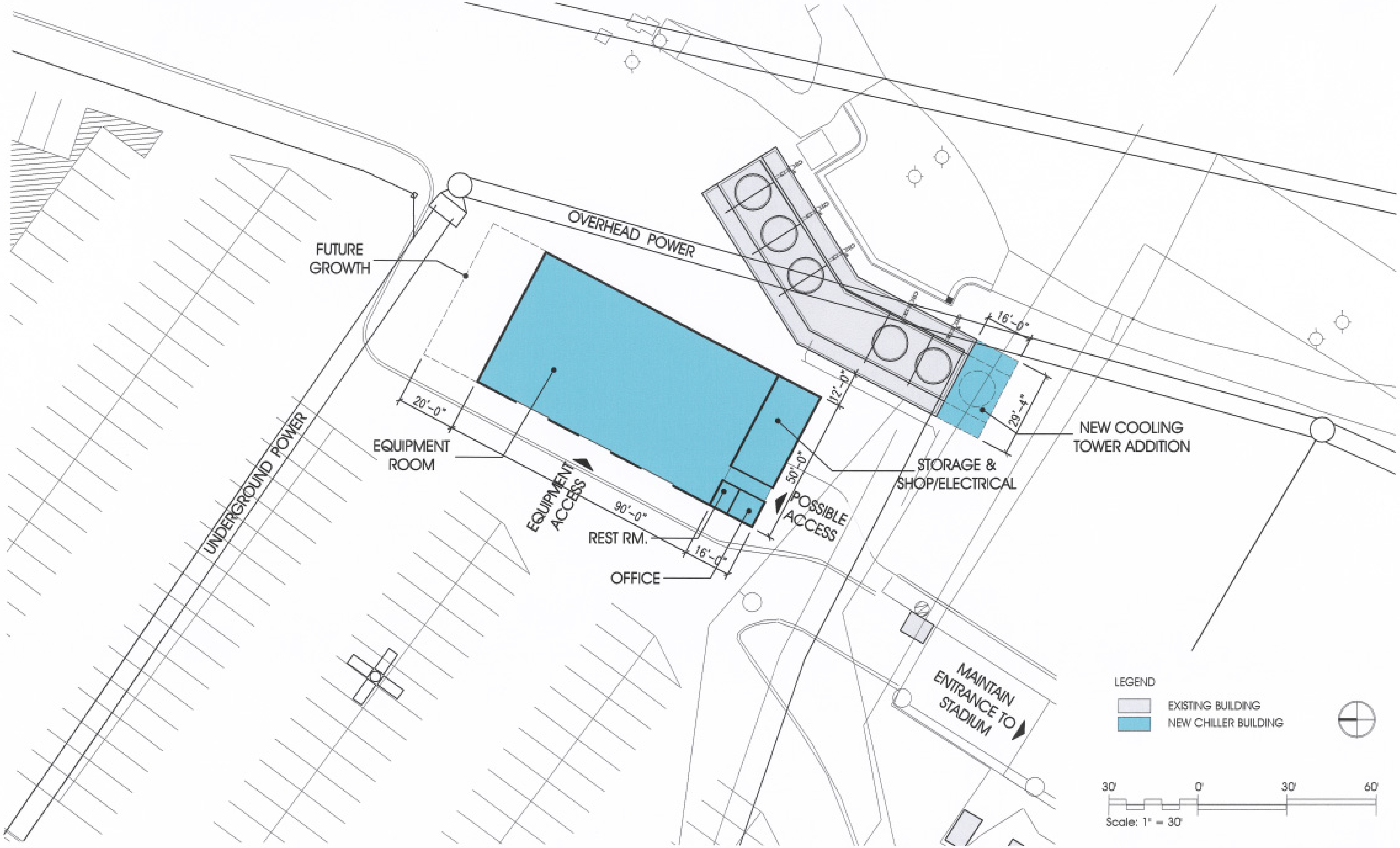
Recommended additional codes, standards and guidelines include:
ANSI/ASHRAE Z9.5
Weber State University Central Quad Master Plan

Occupancy Classification
The occupancy determination must be confirmed by the Architect of Record with the University Fire Marshall and the State Fire Marshall.

Weber State University Facilities Management is the representative of the University with authority over all aspects of the design and construction processes. All contact should be directed through the Project Manager from Weber State University.

Based on the 2003 IBC
Programmed Area: 5,300 gross SF, 1 stories

Item	Value	Section / Notes
Sprinklers	Fully Sprinkled	903
Occupancy	U* See "Other Applicable Codes" below. **Depending on the refrigerant classification the building may need to be an H occupancy.**	312.1 Utility
Construction Type	IIIB	602.2 Building elements are non-combustible.
Allowable Height / Area	U = 2/8500	Table 503
Increase in Height	Not used.	504.2
Area Increase	Not used.	302.3.1 Area increase based on assuming most restrictive occupancy is Group A-3 & applying it to the whole building to achieve "Nonseparated uses." Area increase and height increase not used since programmed area is well under basic allowable area.
Occupancy Separation	Not required.	302.3.1 See area calculations above.
Fire Rating of Building Elements	IIB **Element** **Rating /hr** Structural frame 0 Bearing walls 0 Non-bearing walls 0 Floor 0 Roof 0	Table 601
Stairs	1 hr = 3 stories 2 hr = 4 stories	1019.1
Shafts	1 hr = 3 stories 2 hr = 4 stories	707.2, 707.4
Occupant Load	18	1004.1. Accessory storage areas, mechanical equipment rooms.
Fixture Count	WC= 1/100= 1 Lavatories= 1/100= 1	Table 2902.1 Assuming Storage Occupancy.
*Other Applicable Codes.	Testing, controls & handling ***Classification dependant on type & amount of refrigerant.**	IFC Section 606 IMC Section 11 NFPA 704



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SITE LOCATION OPTION
Chiller Building

Program Document

6.4.2 Structural

Foundation System

A soils report for the project is not yet available. However, it is anticipated that the foundation system will be of conventional spot and continuous footings bearing on suitable, natural, undisturbed soils or on compacted fill extending to suitable, natural, undisturbed soils. The allowable soil bearing pressure will likely range from about 2,000 psf to 3,000 psf. The actual allowable soil bearing pressure will be determined by the Soils Engineer. The frost cover to be provided from final exterior grades to the bottom of exterior footings will be a minimum of 30 inches. Interior footings will likely have a minimum embedment depth of about 18 inches below final interior slab on grade elevations.

The slabs on grade will be a minimum of 6" thick to support the potentially heavy loads from mechanical equipment. Large equipment is to be placed on isolated mat footings. The slabs on grade will be reinforced with at least 0.001 ratio of deformed reinforcing steel in two directions based upon the gross section of concrete. The slab will likely be placed over 4" of free draining granular fill and appropriate moisture barriers. Slabs will be designed and detailed with control and construction joints spaced such that cracking is minimized.

Roof System

The roof system will be 1 ½ inch, 20 gauge, type "B" galvanized steel roof deck over open web steel joists and steel beams. The steel joists will be supported on steel girders. The steel girders and steel beams will be supported on steel columns, or reinforced masonry/reinforced concrete exterior walls. This is a very efficient and economical framing system. The roof will need to be designed to support snow loads, snow drifts and any miscellaneous mechanical loads. The structural roof system is to be designed to support an additional live load of 50 psf to account for the weight of suspended equipment.

Structural/Architectural Exterior Walls

The type of exterior walls to be used has not yet been determined but will likely be of brick veneer over steel studs. These walls are not load bearing and do not provide lateral support for the building. They will need to be detailed to accommodate lateral story drift caused by wind and seismic forces. The design and detailing of these walls will be covered by the architectural drawings.

Lateral Force Resisting System

The lateral force resisting system will be of the steel roof deck acting as a diaphragm. It will distribute the lateral loads to the vertical force resisting system. The vertical force resisting system will be three solid walls of reinforced masonry/reinforced concrete, with a moment resisting steel frame located on the west side where large overhead openings are required. The lateral forces will then be delivered into the foundation system by the vertical force resisting system. The redundancy factor for the project is to less than 1.1. The foundation system will be designed for both overturning and sliding forces.

The building is located approximately ¼ mile from a fault that runs along Skyline Drive.

Codes

The 2003 International Building Code will be used as the minimum code and standard for this project. This includes the current editions of the standards referenced by the 2003 International Building Code. The project will also need to conform to the design standards of the Division of Facilities and Construction Management (DFCM).

Structural Design Criteria and Material Strengths

The final design criteria and material strengths are to be clearly shown on the final structural documents.

Structural Design Criteria and Material Strengths

Listed below are the minimum required structural design criteria and material strengths. The criteria and strengths will continue to be evaluated as the design progresses. The structural design will be according to the 2003 International Building Code (IBC 2003). The building is to be classified as a Category III building per the IBC 2003.

Design Criteria:

1. Roof Snow Load

Snow Ground Load	$P_g = 44$ psf
Snow Importance Factor	$I = 1.10$
Exposure Factor	$C_e = 1.0$
Thermal Factor	$Ct = 1.0$
Flat Roof Snow Loads	$P_f = .7*Pg*I*Ce*Ct$

2. Seismic Loads

Short Period Mapped Acceleration	$S_S = 1.80$
Long Period Mapped Acceleration	$S_1 = 0.78$
Soil Site Class	D
Short Period Site Coefficient	$F_a = 1.50$
Long Period Site Coefficient	$F_v = 1.00$
Design Spectral Response Acceleration	$S_{DS} = 2/3 * F_a * S_S$
Design Spectral Response Acceleration	$S_{D1} = 2/3 * Fv * S1$
Seismic Importance Factor	$I_e = 1.00$
Response Modification Coefficient	$R = 8$
Seismic Response Coefficient	$C_s = .161$
W	Dead Loads of Structure
Building Seismic Design Category	E
Base Shear	$V = C_S * W =$ (Strength Design)

3. Wind Loads:

Basic Wind Velocity (3 Second Gust)	110h
Exposure Type	C
Importance Factor	1.00

Working Stresses for Materials:

1. Concrete (28 day strength):

Footings	3,000 psi
Foundation Walls	4,000 psi
Interior Slabs on Grade	3,500 psi
Exterior Slabs on Grade	4,000 psi

2. Reinforcing Steel ASTM 615 Grade 60 — $F_y = 60$ ksi

3. Structural Steel

Wide Flange Shapes	ASTM A992 (50 ksi)
Other Shapes and Plates	ASTM A36
Steel Tube Columns	ASTM A500 Grade B (46 ksi)

Miscellaneous
Blast loading was not a required design parameter for this project.

The building should be designed for future expansion, as indicated to the north of the building.

6.4.3 Mechanical

General Mechanical
The design and construction of the new chiller plant at Weber State University shall comply with the current Utah State Division of Facilities and Construction Management's updated Design Criteria as well as the current Weber State University Design Standards.

The control system shall be an electronic DDC system tied into the Johnson Metasys central campus control system. The new controls shall be 100% compatible and integrated with the existing campus system.

Provide complete operation and maintenance manuals at the completion of the project as well as a complete set of record drawings and specifications.

All equipment shall be clearly labeled. Equipment, piping and ductwork shall be painted and labeled as required by the Weber State University design guidelines.

Design Conditions
The mechanical system shall be designed to maintain comfort condition in accordance with the Utah State Energy Code, DFCM A/E Design Guide, and WSU Design and Construction Standards.

Elevation: 4350 Ft.

Lat / Long. 41°15' N, 111°57' W

Ambient: (ASHRAE 2-1/2%, 97%)
- Summer: 95°F DB 65°F WB
- Winter: 5°F DB

Indoor Conditions
- Summer: 75°F
- Winter: 72°F

Envelope U-values

Building envelope shall be designed in coordination with mechanical systems in order to achieve energy performance of 20% better than ASHRAE 90.1 – 2001.

Ventilation Rates: ASHRAE 62-1 – 2001, and ASHRAE 15 Safety Code for Mechanical Refrigeration

Internal Heat Gain:
- People: ASHRAE Estimates for Level Activity
- Equipment: Provide adequate cooling to prevent overheating of the equipment (such as chillers and pumps)

Applicable Codes

The mechanical system throughout the building shall be designed and installed in accordance with the most recently adopted of the following codes and standards:

- Life Safety Code
- International Building Code (IBC) including all appendices
- International Mechanical Code (IMC)
- International Plumbing Code (IPC)
- International Energy Conservation Code (IECC)
- National Electrical Code (NEC)
- National Fire Protection Association (NFPA)
- ASHRAE 90.1 - 2001-2003
- ASHRAE Standard for Ventilation 62-1 2001
- ASHRAE 15 Safety Code for Mechanical Refrigeration
- ASHRAE Guides and Standards (ASHRAE)
- State of Utah Boiler and Pressure Vessel Rules and Regulations
- American Society of Mechanical Engineers (ASME)
- American Standards Association (ASA)
- American Society of Testing Materials (ASTM)
- Sheet Metal and Air conditioning Contractors National Association (SMACNA)
- Occupational Safety and Health Administration (OSHA)

- DFCM Indoor Air Quality Criteria
- Utah State Division of Facilities and Construction Management (DFCM) ~ Architect / Engineer Design Guide.
- Weber State University Design Guide

Heating, Ventilating and Air Conditioning
The building shall be heated, cooled, and ventilated with systems suitable for the building function and occupancy in accordance with ASHRAE and DFCM standards. HVAC systems must compare with other mechanical systems designed for workshop and equipment areas. The primary mechanical system for the chiller plant shall be fan coil units and electric unit heaters.

Heating System
Equipment Area:
The chiller equipment room shall be heated by electric unit heaters. Heating for the equipment area shall be adequately sized to prevent freezing by maintaining a minimum 60 degree F space temperature.

All Other Areas:
Provide an electric duct heater in the fan coil unit serving the storage, shop, restroom, office, and circulation areas. Heating in this zone shall be sized for occupant comfort.

Cooling System
Equipment Area:
The chiller equipment room shall be cooled by a fan coil unit with a chilled water coil. Cooling shall be sized to handle equipment heat produced, including the chillers, pumps, variable frequency drives, etc.

All Other Areas:
Provide a fan coil unit with a chilled water coil and electric duct heater for the storage, shop, restroom, office, and circulation areas. Cooling in this zone shall be sized for occupant comfort.

Air systems
Outside Air:
The fan coil units shall introduce outside air into the building per ASHRAE 62 ventilation guidelines. The outside air shall be brought in through wall louvers.

Exhaust Air:
The equipment area and storage area shall be equipped with a refrigerant leak detection system. This shall include the ability to monitor all the different refrigerants being used in the plant, as well as those being stored. The refrigerant leak detection system shall be tied into a refrigerant evacuation exhaust system that complies with ASHRAE Standard 15. The exhaust shall be a roof mounted belt driven fan.

Provide a smaller roof mounted direct drive exhaust fan for the electrical room and restroom. Size per ASHRAE guidelines, and electrical room requirements.

Make-up Air:
Provide a wall mounted automatic damper/louver and interlock with the refrigerant exhaust system. General building exhaust air shall be made up through the fan coil units.

Controls Systems
Provide a DDC controlled building management system. BMS shall be fully integrated with the campus Johnson Metasys system. All HVAC components, including can coils, electric unit heaters, exhaust fans, etc. shall be tied into the DDC system.

Provide a separate DDC system for the new chiller plant, and all equipment associated with the new central plant. See the chiller study for further detail. The chiller plant DDC system shall also be fully integrated into the central campus Johnson Metasys system.

Plumbing Systems
Plumbing systems shall be designed to meet the International Plumbing Code as adopted by the State of Utah, D.F.C.M. Guidelines and Weber State University Design and Construction Standards.

Provide ADA water closet and lavatory in uni-sex restroom. Provide utility sink in shop area. Provide electric tank type storage water heater for building, and locate in the shop area. Domestic water piping shall be type L copper, and waste piping shall be cast iron. Coordinate with civil site utilities to bring waste piping to building.

Provide air compressor and compressed air piping in shop area.

Other Mechanical Systems
Provide all equipment associated with new chilled water plant. See the detailed chilled water study for further information. Chiller plant equipment shall include the following:

- Four water cooled chillers (two existing chillers will be re-located, two chillers will be new, and accommodations shall be made for 1 additional new chiller in the future)
- Chiller circulating pumps (one dedicated pump for each chiller)
- Two campus distribution chilled water pumps with variable frequency drives
- Two main condenser water pumps with variable frequency drives
- Plate and frame heat exchanger with dedicated chilled water circulating pump to serve chilled water loop with condenser water when temperature will allow
- Chiller make-up water and chemical treatment system
- Cooling tower make-up water and chemical treatment system
- Refrigerant Leak detection and evacuation system

- Chilled water piping sized to accommodate future 5^{th} chiller, and tied into existing 24" piping under parking lot. See chiller study.
- Condenser water piping from existing cooling tower to new condenser pumps and new chillers
- Additional cooling tower cell

6.4.4 Electrical

Codes and Standards

Codes, which are applicable to the design of the electrical systems, are listed below. Comply with each of the latest adopted publications:

ADA, Americans with Disabilities Act
ASHRAE 90.1 Energy Code
EIA/TIA, Electronics Industries Association/Telecommunications Industry Association
IBC 2003, International Building Code
IEEE 1100-1999, Recommended Practice for Power and Grounding Electronic Equipment
IESNA, Illuminating Engineering Society of North America
NFPA, National Fire Protection Association (applicable sections including but not limited to):
  NFPA 70, National Electrical Code
  NFPA 72, National Fire Alarm Code
UL, Underwriter's Laboratories
Utah State Fire Marshal Laws, Rules and Regulations
DFCM, Division of Facilities Construction and Management, Design Criteria
Weber State University Design Guidelines

Site Utilities

Medium Voltage Power Distribution System

A new S&C PMH 4-way pad-mounted medium-voltage switch should be provided. The new switch should be tied to the existing S & C switch located to the North of the existing cooling tower building. Medium-voltage conductors between two switches should be installed in conduit and one spare conduit.

The new medium voltage switch should provide power to a new oil-filled, air-cooled, pad-mounted transformer. Primary voltage for new transformer should be 12,470 volt Delta; secondary voltage should be 480/277 volts 3-phase WYE connection.

Telecommunication Distribution

Two (2) 2" conduit should be installed between telephone terminal board in existing cooling tower building and telephone terminal board in new chiller building.

Power Distribution Systems
A new 480/277 volt main distribution switchboard should be provided.

The 480/277 volt main distribution switchboard should be free standing and equipped with Square D. "Powerlogic"- type digital metering and should be tied to the campus central power monitoring system via a data line.

The 480/277 volt main distribution switchboard should be utilized to provide power to branch lighting panelboard, 480 volt mechanical equipment such as chillers, pumps, etc.

The 208/120 volt panelboard should provide power to computer equipment, owner furnished equipment, duplex outlets, small mechanical equipment, etc.

Transient voltage surge suppressors should be provided for 480/277 volt main distribution switchboard and 208/120-volt panelboard.

All conductors should be copper. Conductors for branch circuits should be sized to prevent voltage drop exceeding 3% at the farthest point with 80% of circuit breaker demand load (duplex outlets, equipment, etc.). The total voltage drop on both feeders and branch circuits should not exceed 5%.

All conductors shall be installed in conduit. Minimum size of conduit to be ¾". Type MC cable may be used for light fixtures whip. Provide pull strings in all empty conduit.

A fault current and selective device coordination study should be done to indicate available fault current at all points in the 15 kV and building power distribution system. New switchboards, panelboards, etc., should be adequately rated for the available fault current. Fuses and circuit breakers should be selected to ensure minimum system power outage due to overloads or faults. Circuit breakers with adjustable long time, short time, instantaneous and/or ground fault setting shall be set at levels for optimum system coordination.

Mechanical equipment requiring variable frequency drives (VFDs) should comply with DFCM standards for VFDs included in the "Design criteria for Architects and Engineers" posted on the DFCM website.

Standby Power Distribution System
Provide a standby diesel engine generator with a skid-mounted fuel tank and walk-around sound attenuated enclosure to support new building life safety equipment, mechanical control equipment, outlets by telephone terminal board, and other standby outlets as designated by Weber State University. Standby diesel engine generator should have approximately 20% excess capacity for future growth and flexibility.

New engine generator should be equipped with demand power meters alarm indicating control panel. Dry contacts should be available for remote monitoring of engine and fuel system alarms.

Fuel tank should be sized for 24 hours of engine operation at 100% load. University campus should have the ability to refill the tank during an extended commercial power outage.

Outlets
Locations and number of outlets should be coordinated for each space with Weber State University and comply with their needs and requirements. The following is to be used as general guidance:

Offices: For each workstation, provide two duplex outlets dedicated to computer terminals and one additional normal outlet for every 6' of wall space.

Counter tops (in general): One outlet every 4'; GFI where within 8' of a sink.

Telephone Terminal Board: Provide emergency outlets for equipment and a normal power duplex outlet for general-purpose use.

Restrooms: One GFI outlet near each lavatory counter top.

Storage Room: One duplex outlet.

Building Exterior: One WP/GFI outlet near each entrance.

Grounding: Grounding Conductors

Grounding conductors should be installed with all feeder and branch circuits.

A new isolated copper ground bus bar should be installed by telephone terminal board. Tie the copper bus bar to main ground bus bar in main distribution switchboard.

Lighting-General
Lighting design should comply with illuminance levels and uniformity criteria of IESNA and its recommended practices. Comply with RP1-93 "Office Lighting", RP3-00, and RP-33-99 "Lighting for Exterior Environments". Except for specialized applications, design lighting with a minimum efficacy of 64 lumens per watt. Specify maximum 20% THD electronic ballasts. In addition, design lighting with a CRI exceeding 86, except in storage, mechanical, electrical, and similar non-public applications. Where appropriate, different lamp types should be minimized. Use 4' T-8 lamps with CRI of 86 or greater wherever possible. Lamps should be specified to comply with EPA TCLP requirements.

Comply with ASHRAE 90.1 requirements, except that overall energy target requirements should be exceeded by 15%. Design lighting control to harvest day lighting where practical, to control based upon occupancy, and according to programmable scheduling as applicable to the application.

Only campus standard lighting fixtures should be used for walkways, compatible with the campus surroundings. Exterior lighting should be controlled by combination photocell and time schedule.

Interior Lighting

In general, fluorescent lighting with electronic ballasts should be utilized.

Pendant indirect lighting should be considered for the office.

Occupancy sensors should be used for the appropriate applications. Specify dual technology ceiling mounted directional sensors in private offices and classrooms with manual off-switches. Ultrasonic sensors should be in restrooms.

Provide exit lighting to comply with IBC. Emergency lighting should be designed for means of egress to 1 fc minimum to comply with IBC. Include emergency lighting in restrooms, electrical rooms, communication rooms, etc.

Provide emergency lighting in the exterior of the building by the entrance doors to illuminate path of egress.

Fire Alarm System

Fire alarm system should be designed to comply with Utah State Fire Marshall's "Rules and Regulations" and Weber State University Design Standards. Only Notifier as distributed by Mountain Alarm is allowed on campus. An addressable fire alarm system should be designed capable of networking with the campus system and reporting back to central campus fire alarm system. Design strobes visible from all locations except private offices.

Horn installation should comply with NFPA including for higher ambient noise requirements. Where smoke control systems are required, the integration of the fire alarm with the smoke control systems should be coordinated. Provide duct detectors and fan shutdown where required by NFPA and the IMC. Coordinate location of the building fire alarm control panel with the Campus fire marshal.

Telecommunication System

Telephone terminal board should be installed in location as directed by Weber State University. Two (2) 2 ½ " conduit should be installed between the new telephone terminal board and existing telephone terminal board in the cooling tower building.

J-boxes for all voice/data jacks should be 4" x 4" x 2 ⅜" with single gang mud rings. Two (2) 1" conduit should run from each J-box to telephone terminal board.

Pull box should be provided after total of 180° bend in each conduit run. Maximum conduit distance from each voice/data outlet to cable tray should not exceed 50 feet.

Security System

Boxes and conduit should be provided for card access and security cameras to protect entrance doors.

6.5 CHILLER PROJECT COST SUMMARY

This opinion of probable cost has been prepared to reflect the anticipated cost of the new Humanities Building at Weber State University.

This document is based on the Programmatic Information, including measurement and pricing of quantities wherever information has been provided. Unit rates have been obtained from historical records, along with discussions with contractors. The unit rates provided include labor, material and equipment that reflect current bid costs in the Salt Lake City area. All subcontractor unit rates include the subcontractor's overhead and profit unless otherwise stated.

Exclusions
The following items are excluded:

- Land acquisition costs
- Financing charges and expenses
- Site related environmental abatement measures
- Project phasing costs
- Limited/restricted working hours

Items affecting Opinion of Probable Cost
The following items may change the estimated construction costs, and are not limited to:

- Unforeseen or hidden site utility conditions and capacities
- Modifications to the scope of work represented by this opinion of probable costs
- Phasing of the construction
- Non-competitive bid situations

Assumptions
The following assumptions have been made:

- Construction takes place during normal working hours.
- The CM/GC and subcontractors will have sufficient/temporary site staging and site storage within or adjacent to the vicinity of construction.

Escalation
This opinion of probable costs reflects current costs. Escalation has been included to represent an anticipated start of construction by midpoint 2007, with a second option included for midpoint 2008.

Contingencies
This opinion of probable costs reflects a design contingency of 10%, to allow for items not included in the drawings and Program documentation undefined at this stage.

This opinion of probable costs has been based on a competitive open bid situation with a minimum of 3 bidders for all items of subcontracted work. Please note that Parametrix has no control over the costs of labor, materials, equipment, contractor's methods, or the current competitive bidding market. This represents Parametrix's best judgment as a professional construction consultant. Parametrix does not guarantee the proposals, bids or the overall construction cost will not vary from opinions of probable costs provided within this Program Document.

Construction Costs
The costs provided in this document are for construction costs only. For total project costs, additional soft costs need to be added. Possible soft costs include:

Soft Costs
Hazardous Materials
Pre-Design/Planning
Design
Furnishings and Equipment
Information Technology (Pull Wire)
Technology
Utah Art (1% of Construction Budget)
Testing and Inspection
Construction Contingency
Moving/Occupancy
Builder's Risk Insurance (0.15% of Construction Budget)
Legal Services (0.2% of Construction Budget)
DFCM Management
User Fees
Commissioning
CAD Services (0.07% of Construction Budget)
Miscellaneous Other Costs

The following is a detailed breakdown of the construction costs for the new Chiller.

CONSTRUCTION COST ESTIMATE

CHILLER BUILDING, COOLING TOWER AND SITE

SECTION	AREA UNIT	COST/SF	COST
CIVIL			
SITE DEMOLITION			
Remove and Dispose of Curb Wall	200 LF	$10.00	$2,000.00
Remove and Dispose of Asphalt Paving	700 SY	$4.00	$2,800.00
Clear and Grub	1 LS	$5,000.00	$5,000.00
Curb Wall	250 LF	$25.00	$6,250.00
Asphalt Repair	1 LS	$500.00	$500.00
Site Excavation	1 LS	$6,000.00	$6,000.00
UTILITY CONNECTION			
New Water Service	1 LS	$5,000.00	$5,000.00
New Sanitary Sewer	1 LS	$5,000.00	$5,000.00
ARCHITECTURAL			
ROOF			
Membrane Roofing System, Rigid Insulation and Flashings	5,300 SF	$9.00	$47,700.00
EXTERIOR WALLS			
Foundation, Dampproofing w/ Rigid Insulation	5,300 SF	$9.00	$47,700.00
Brick Veneer, Metal Studs, Batt Insulation, Gypsum Bd	3,600 SF	$22.00	$79,200.00
INTERIOR WALLS			
Metal Studs, Sound Insulation and Gypsum Board	1,500 SF	$7.00	$10,500.00
DOORS AND WINDOWS			
Overhead Doors	4 EA	$6,500.00	$26,000.00
Man Doors w/ Hardware	6 EA	$1,200.00	$7,200.00

FINISHES				
Floor Finishes		5,300 SF	$4.00	$21,200.00
Wall Finishes		2,300 SF	$1.50	$3,450.00
Ceiling Finishes		800 SF	$3.00	$2,400.00
SPECIALTIES				
Cabinets and Casework		50 LF	$300.00	$15,000.00
Bath Accessories		1 EA	$2,000.00	$2,000.00
Misc. Specialties		5,300 SF	$1.50	$7,950.00
STRUCTURAL				
Concrete		1 LS	$85,000.00	$85,000.00
Metals		1 LS	$67,114.00	$67,114.00
MECHANICAL				
Mechanical Cooling Tower and Chiller (Option A)		1 LS	$3,662,320.00	$3,662,320.00
Mechanical HVAC and Plumbing		1 LS	$80,500.00	$80,500.00
ELECTRICAL				
4 Chillers at 1250 ton each with 4160 volt power and associated pumps at 480 volts		1 LS	$324,500.00	$324,500.00
Electrical at Cooling Tower Addition		1 LS	$15,000.00	$15,000.00
SUB TOTAL				$4,537,284.00
GENERAL CONDITIONS	7%			$317,609.88
BONDING	1%			$45,372.84
OVERHEAD AND PROFIT	5%			$226,864.20
SUB TOTAL				$5,127,130.92
DESIGN CONTINGENCY	10%			$512,713.09
TOTAL (Construction) As of October 2005				$5,639,844.01

Notes: Costs are for Construction Only
Costs are based on a Competitive Bid Basis
Costs DO NOT include Inflation to Start of Construction
Mechanical costs for additional cooling tower includes masonry/concrete structure

7.0 APPENDIX

7.1 SITE OPTIONS 1a, 1b, 2 and 3

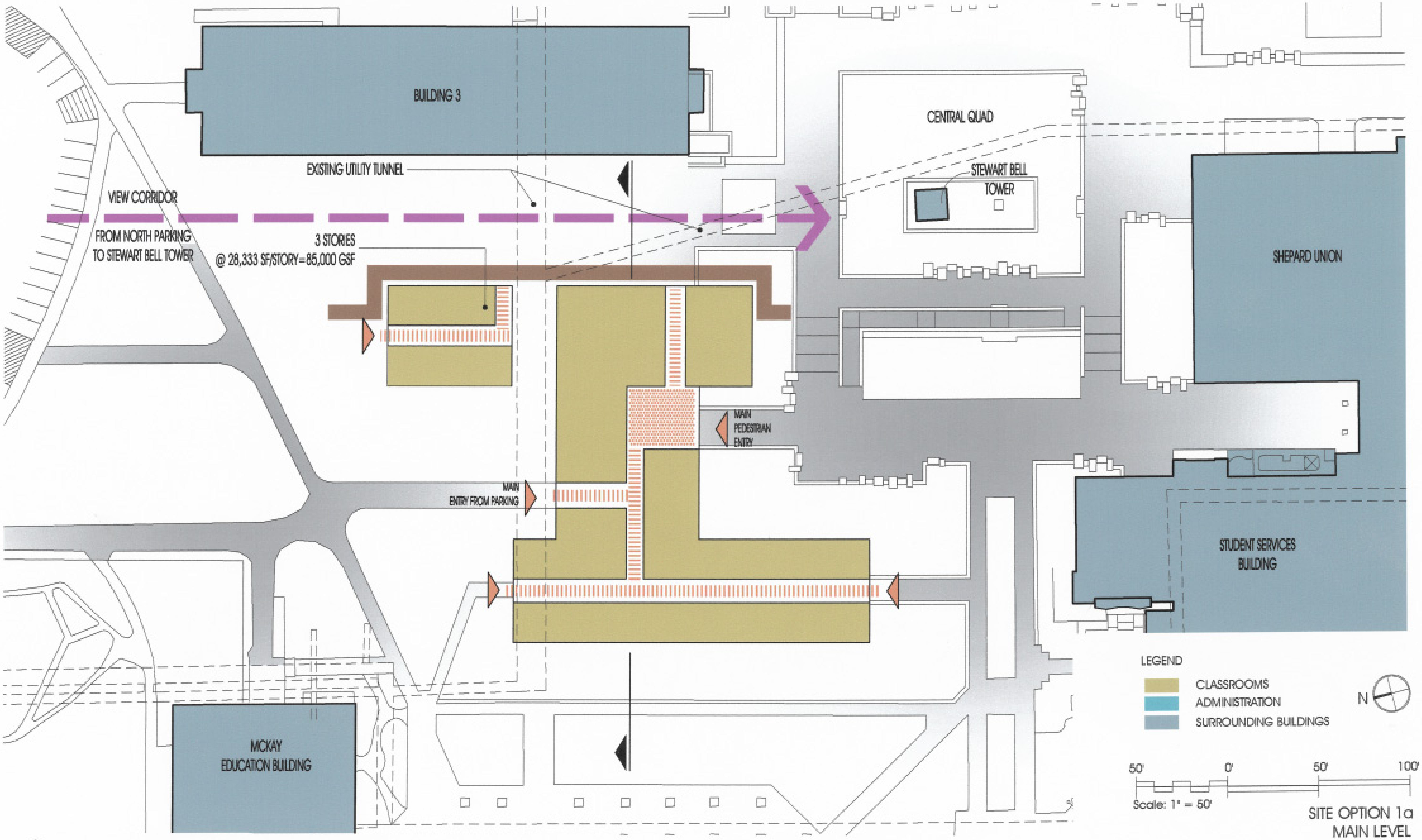
7.2 COSTS TO RELOCATE THE UTILITY TUNNEL

7.3 CHILLER FEASIBILITY STUDY

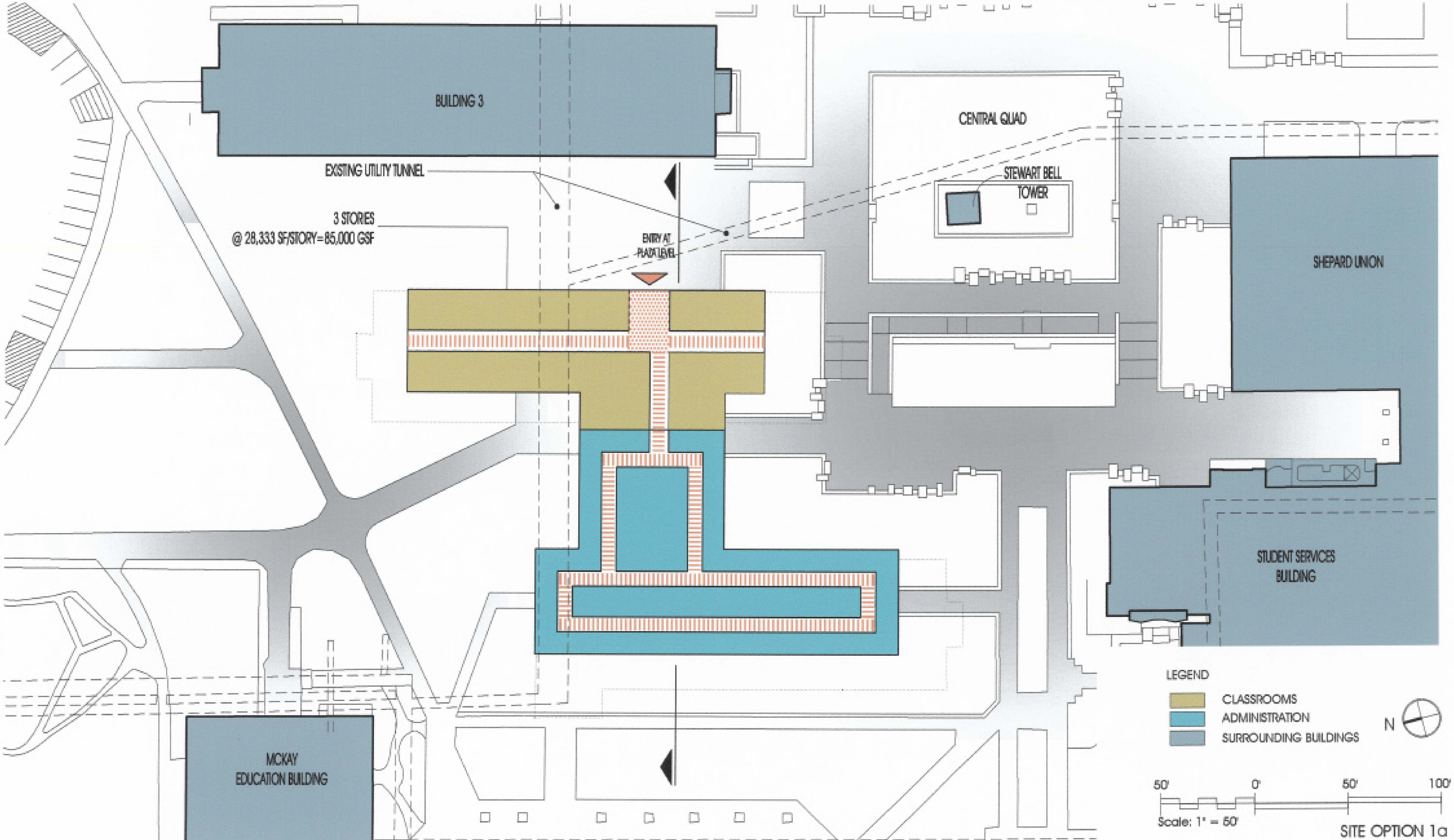
7.1 SITE OPTIONS 1a, 1b, 2 AND 3

The following are additional Site Options 1a, 1b, 2 and 3 that were reviewed by the Programming Steering Committee and determined not to be the preferred Site Option for the placement of the building. These are provided for reference only as to what was explored during the Program Phase.

These Options all included relocation of the existing Utility Tunnel.



SITE OPTION 1a
MAIN LEVEL

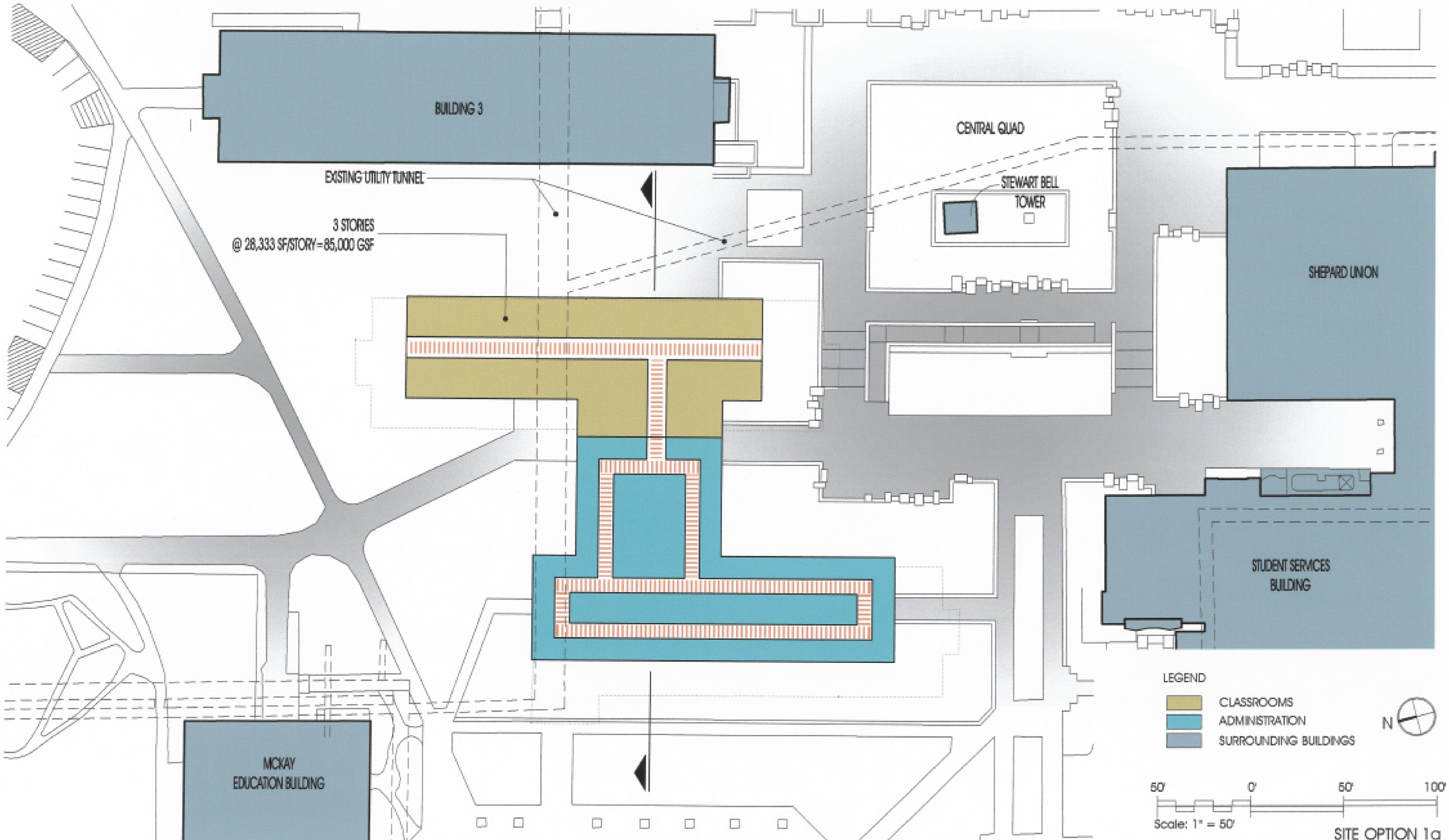


SITE OPTION 1a
SECOND LEVEL

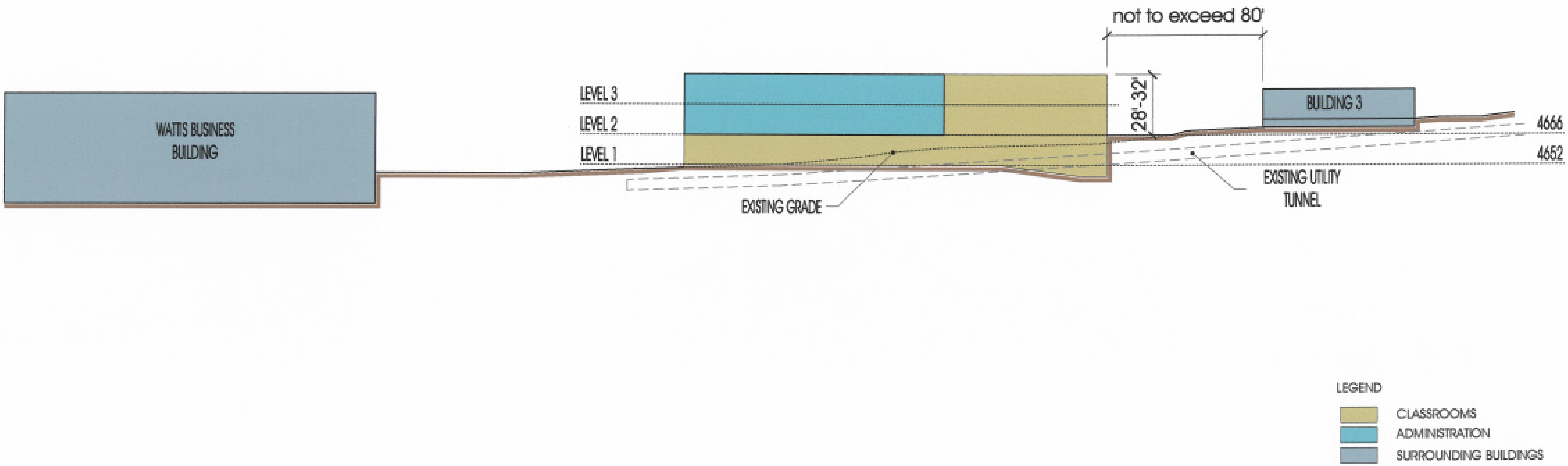
ajc architects

Humanities Building

Program Document

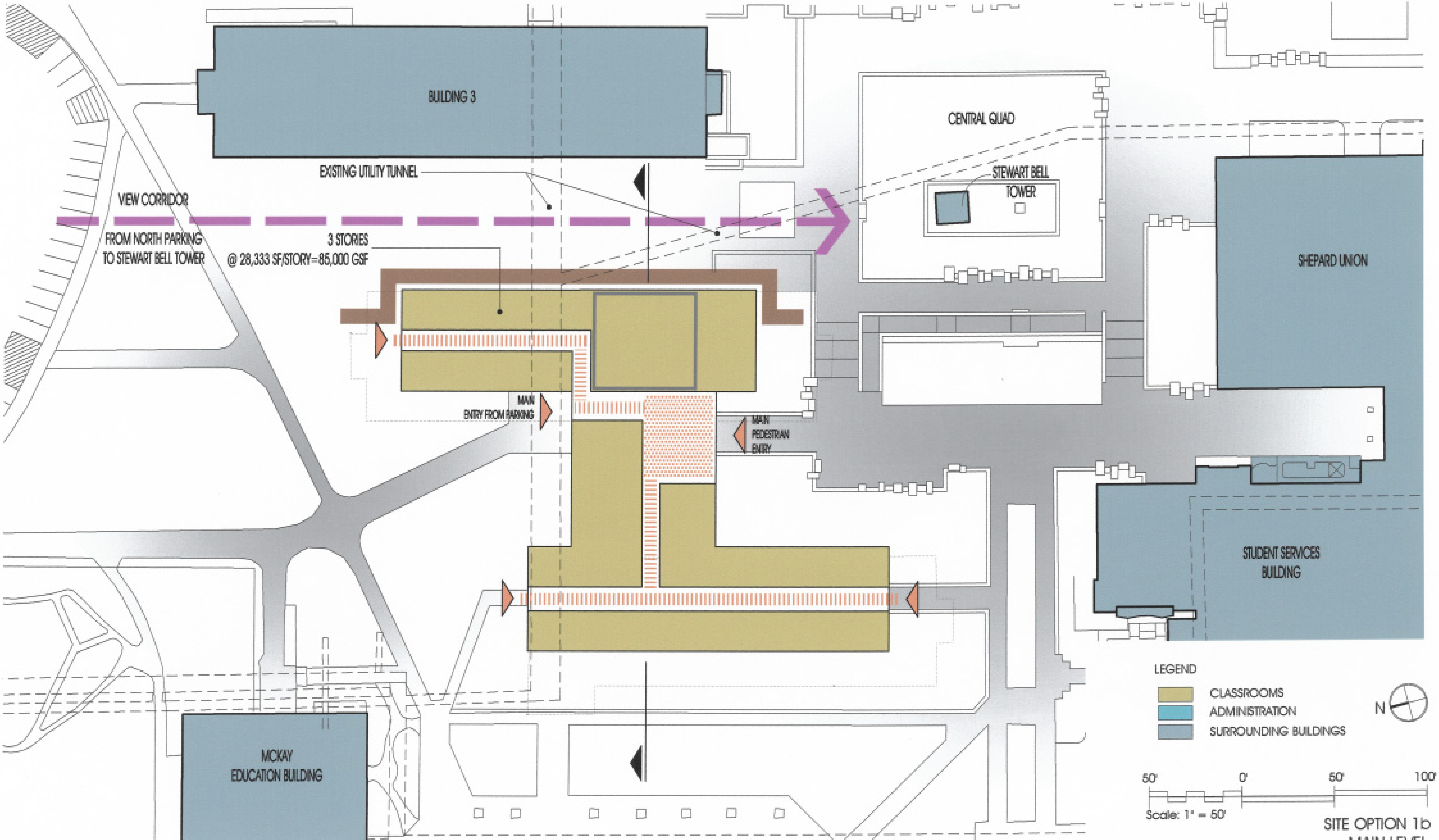


SITE OPTION 1a
THIRD LEVEL

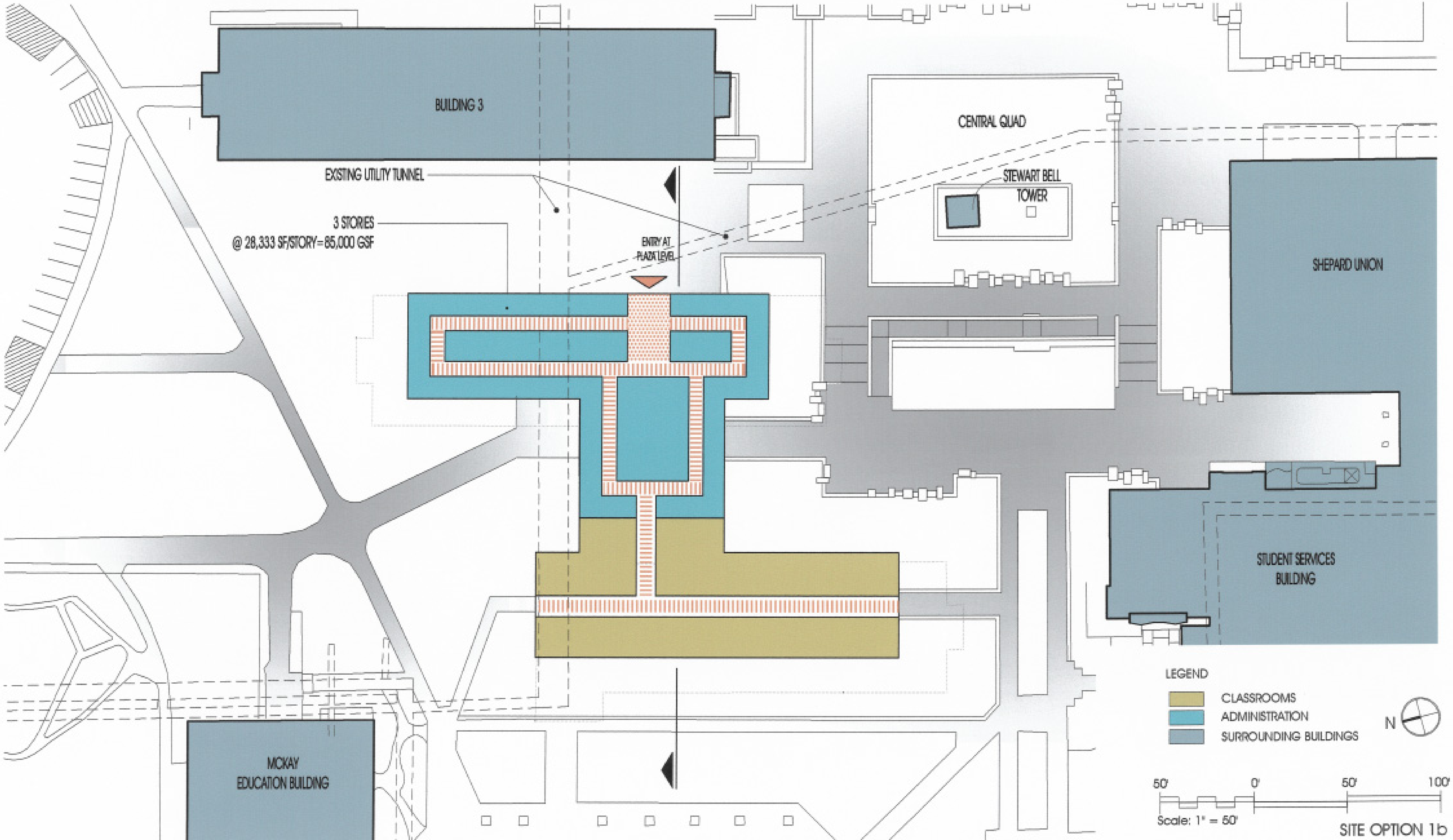


ajc architects

BUILDING SECTION
OPTION 1a
Humanities Building

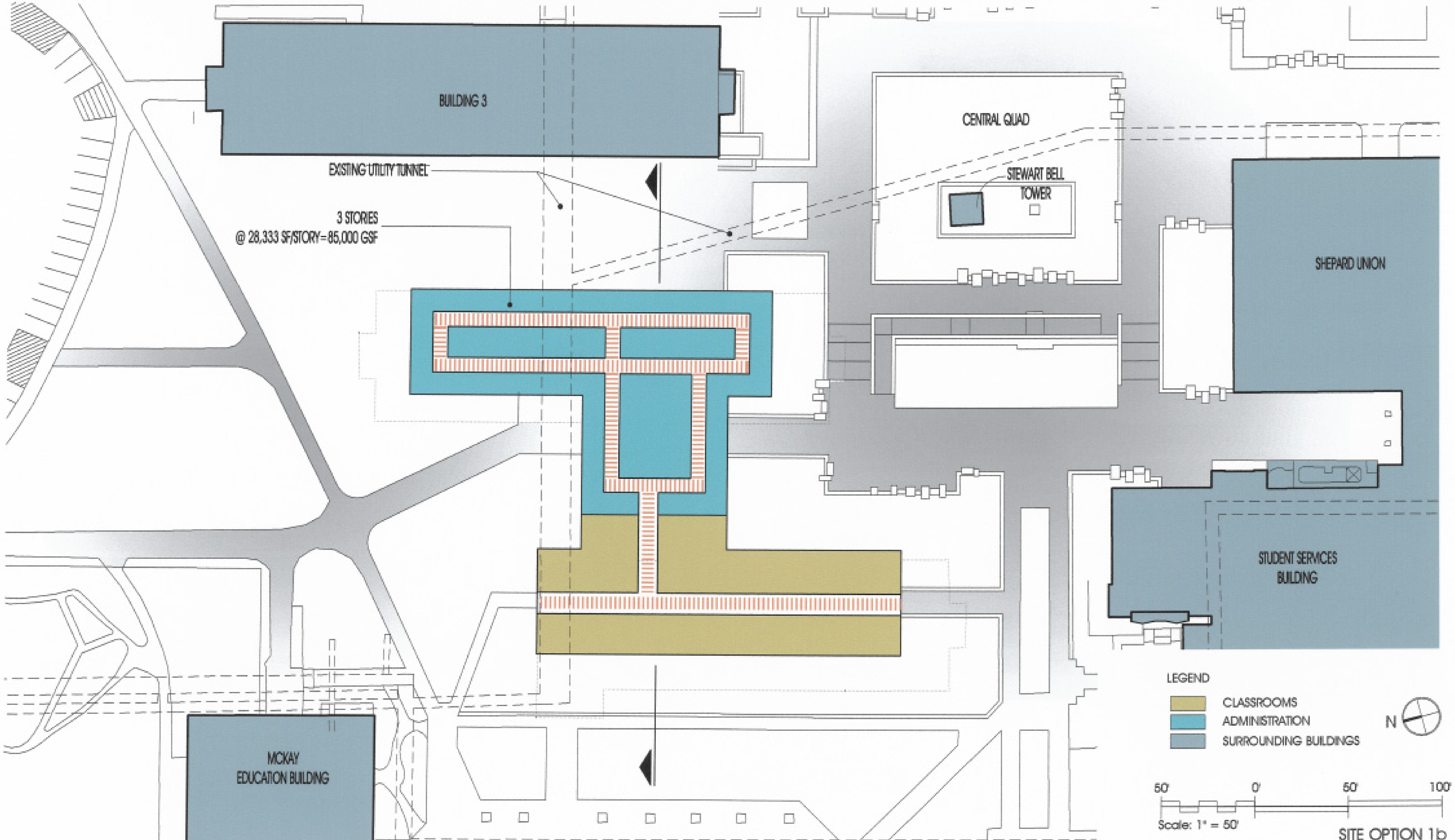


SITE OPTION 1b
MAIN LEVEL



SITE OPTION 1b
SECOND LEVEL

ajc architects



SITE OPTION 1b
THIRD LEVEL

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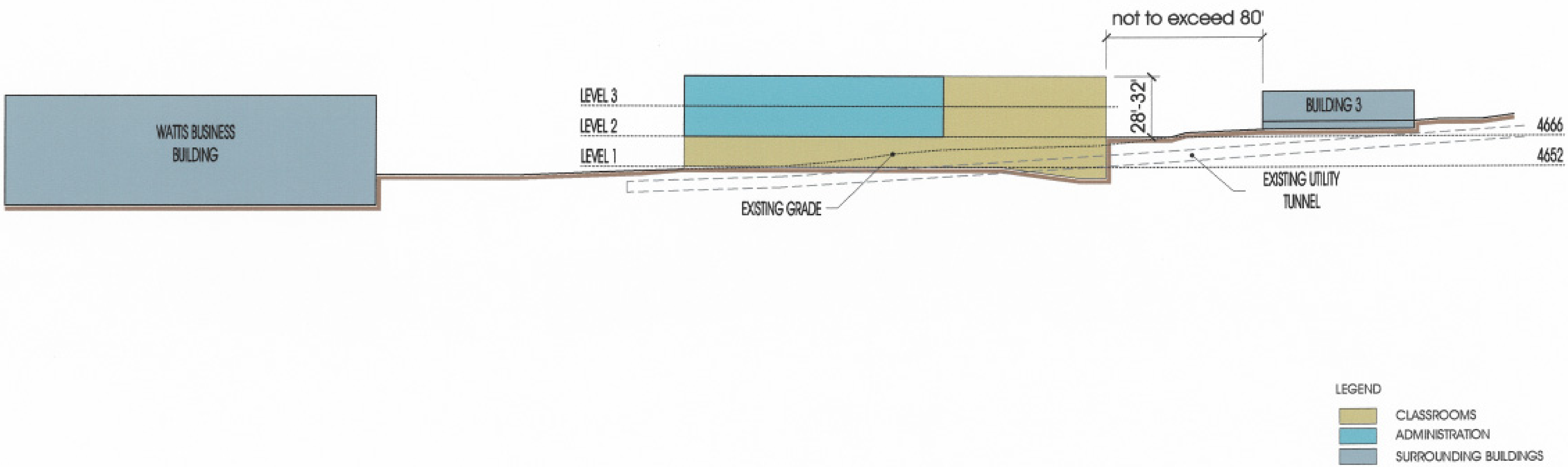
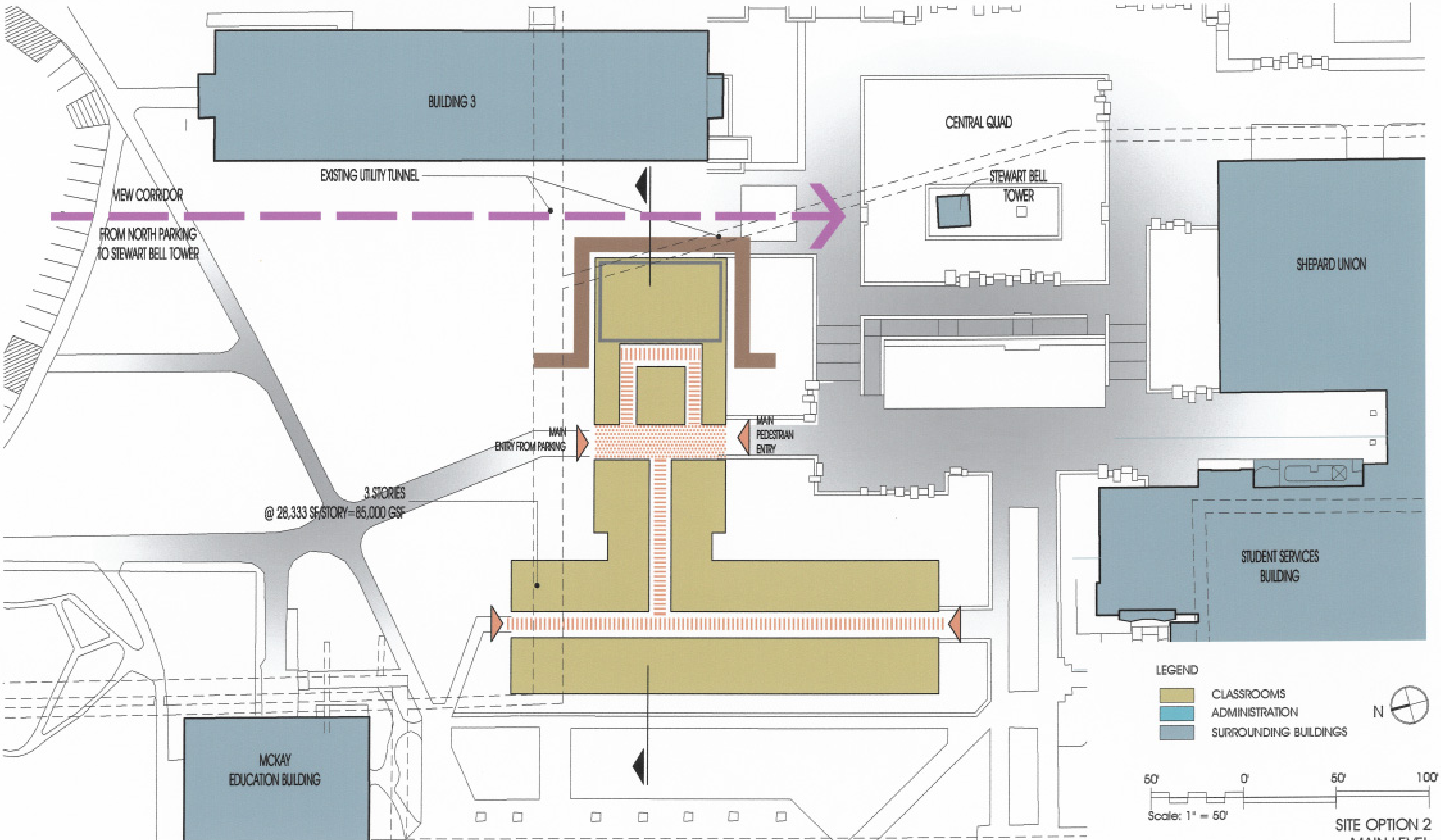
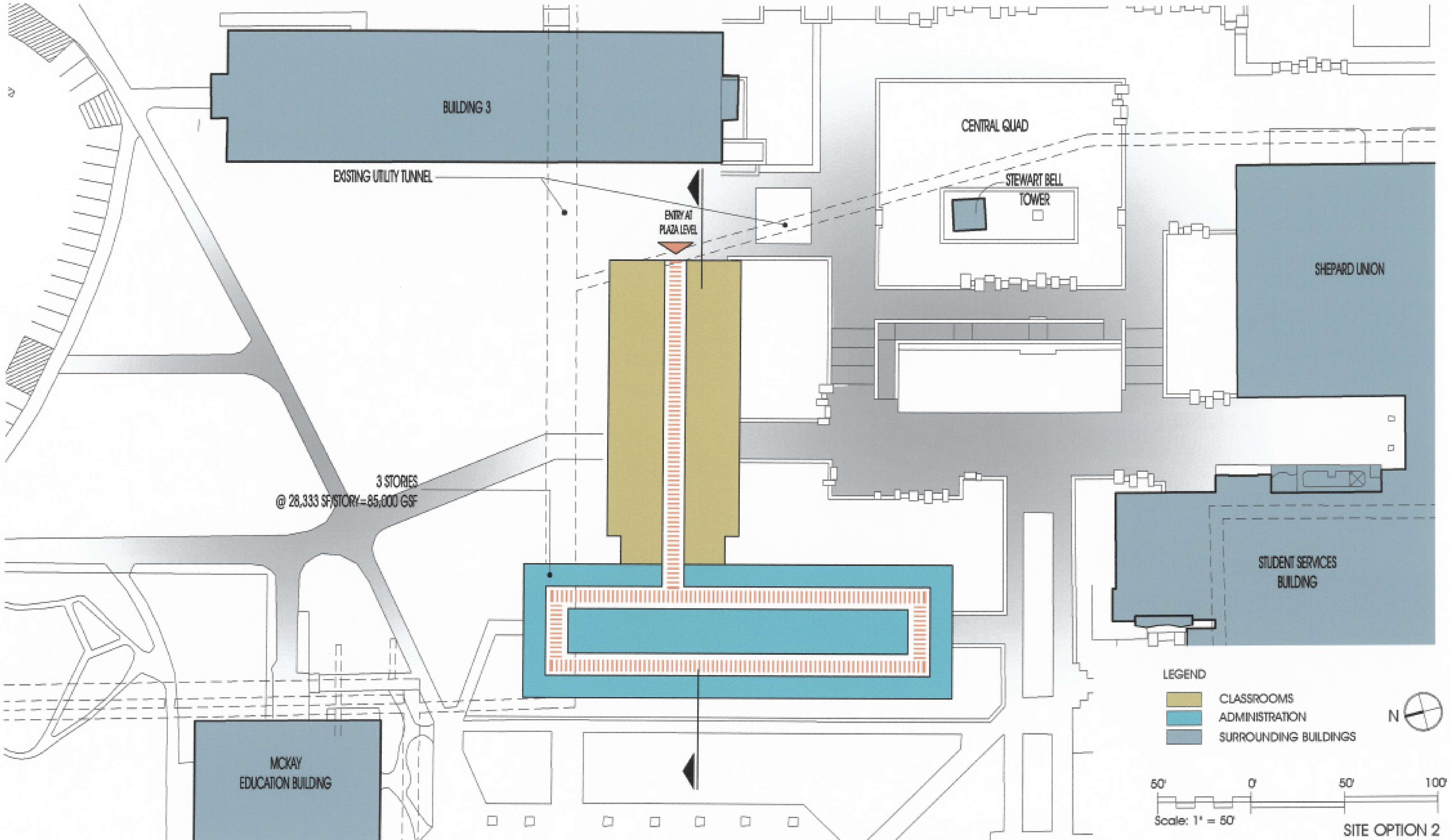


ajc architects

BUILDING SECTION
OPTION 1b
Humanities Building

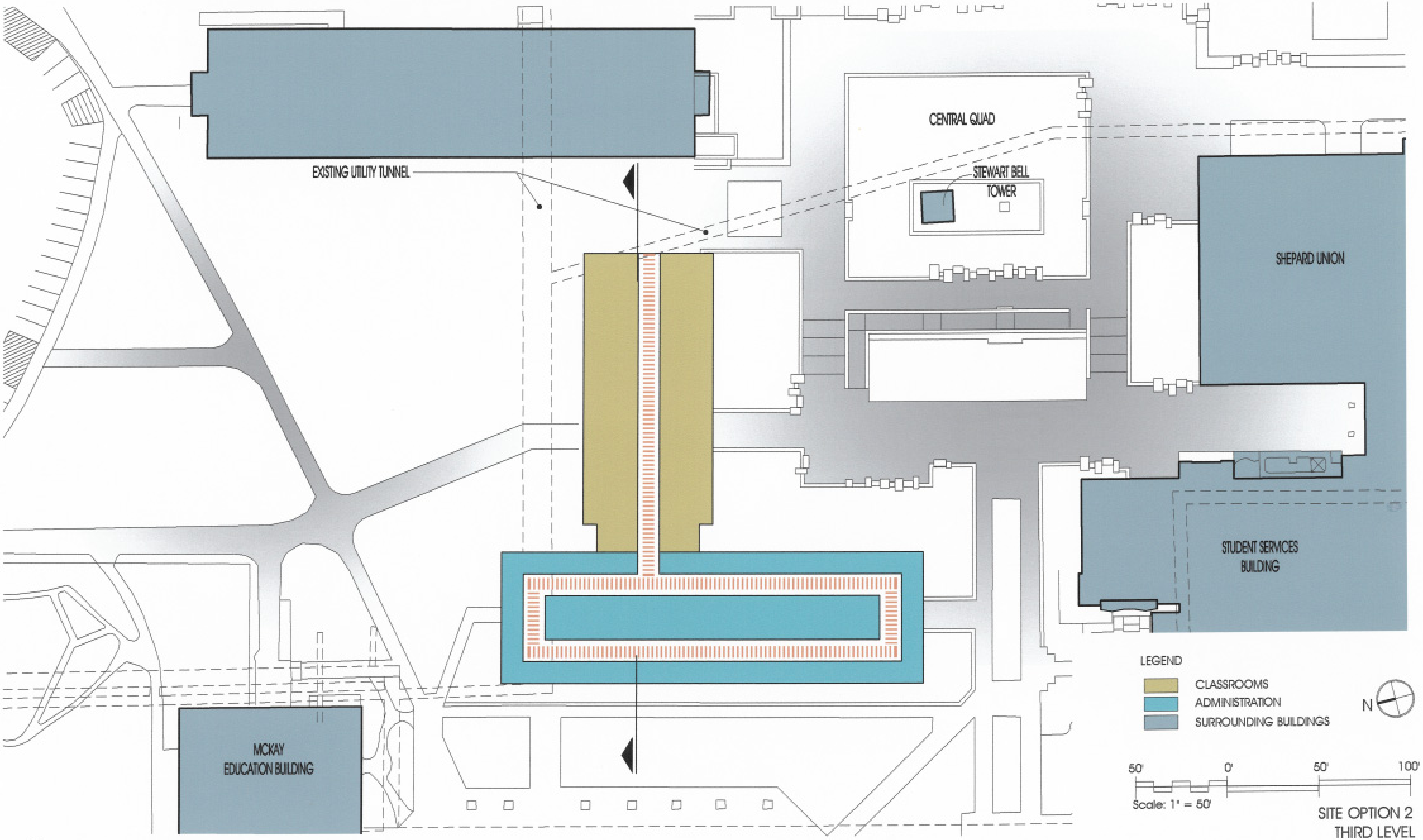


SITE OPTION 2
MAIN LEVEL



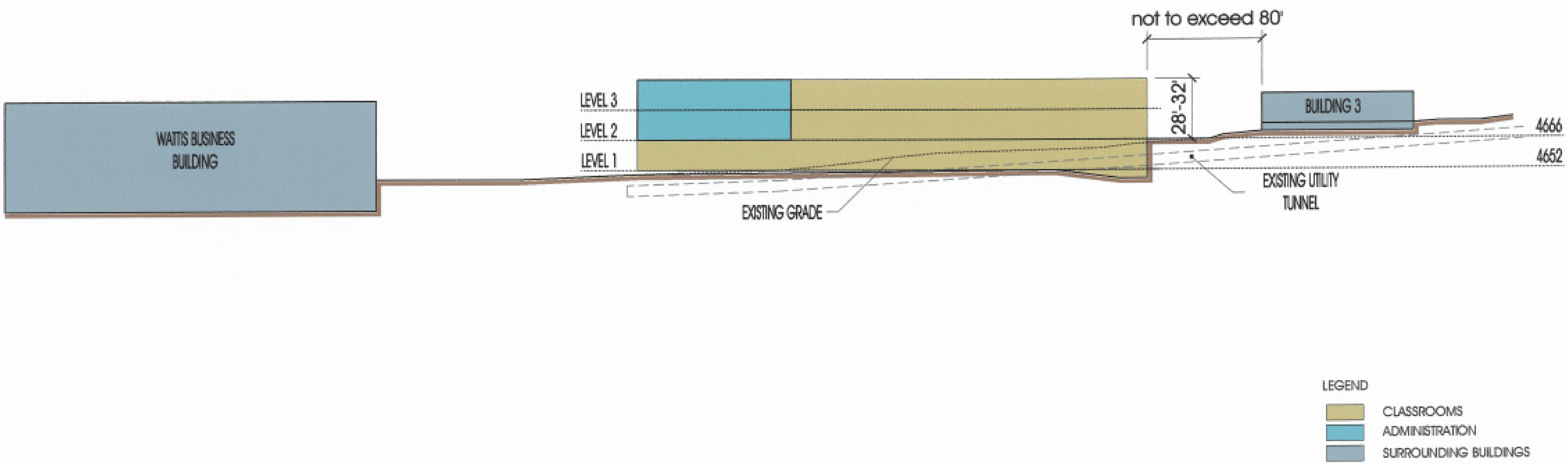
SITE OPTION 2
SECOND LEVEL

ajc architects



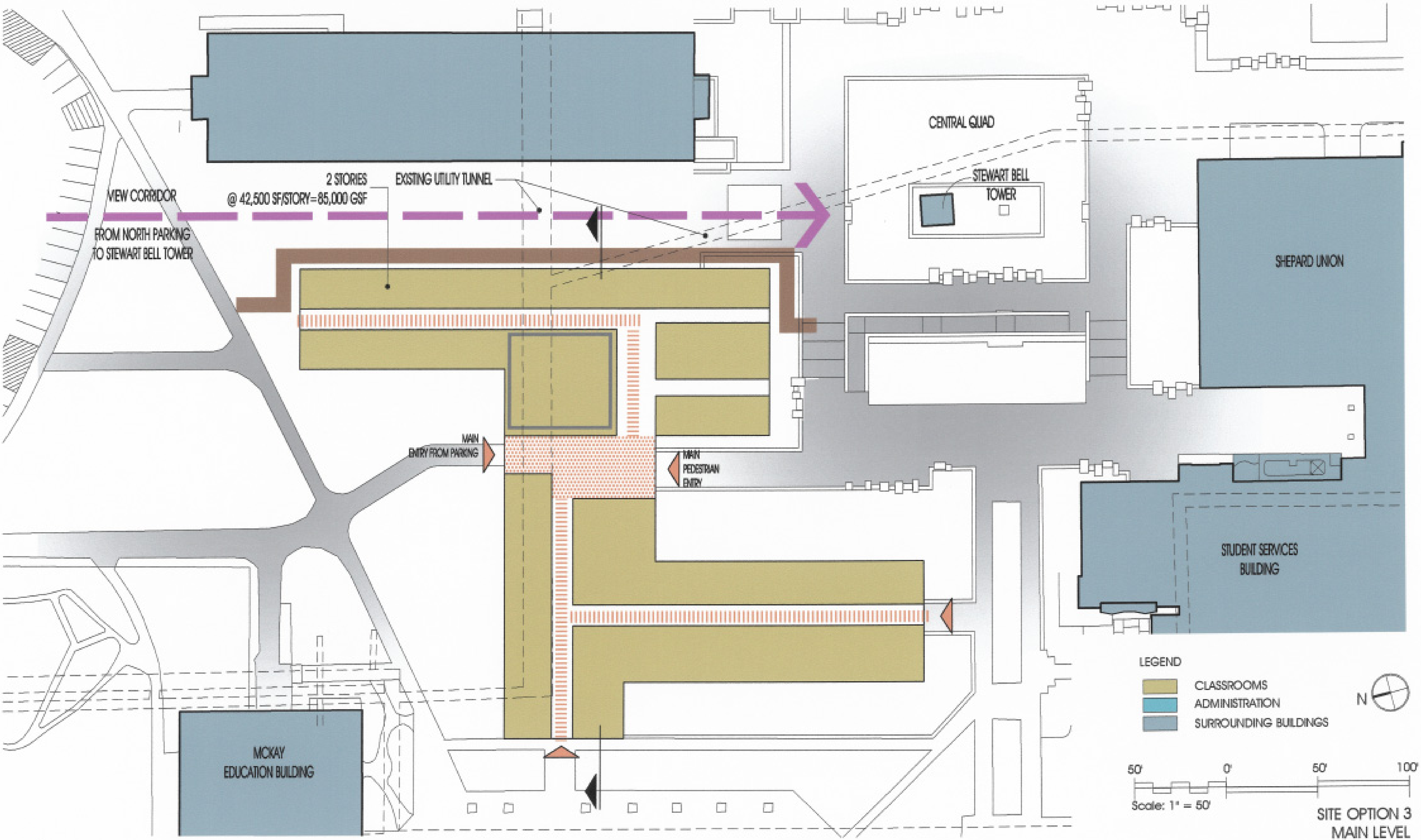
SITE OPTION 2
THIRD LEVEL

ajc architects



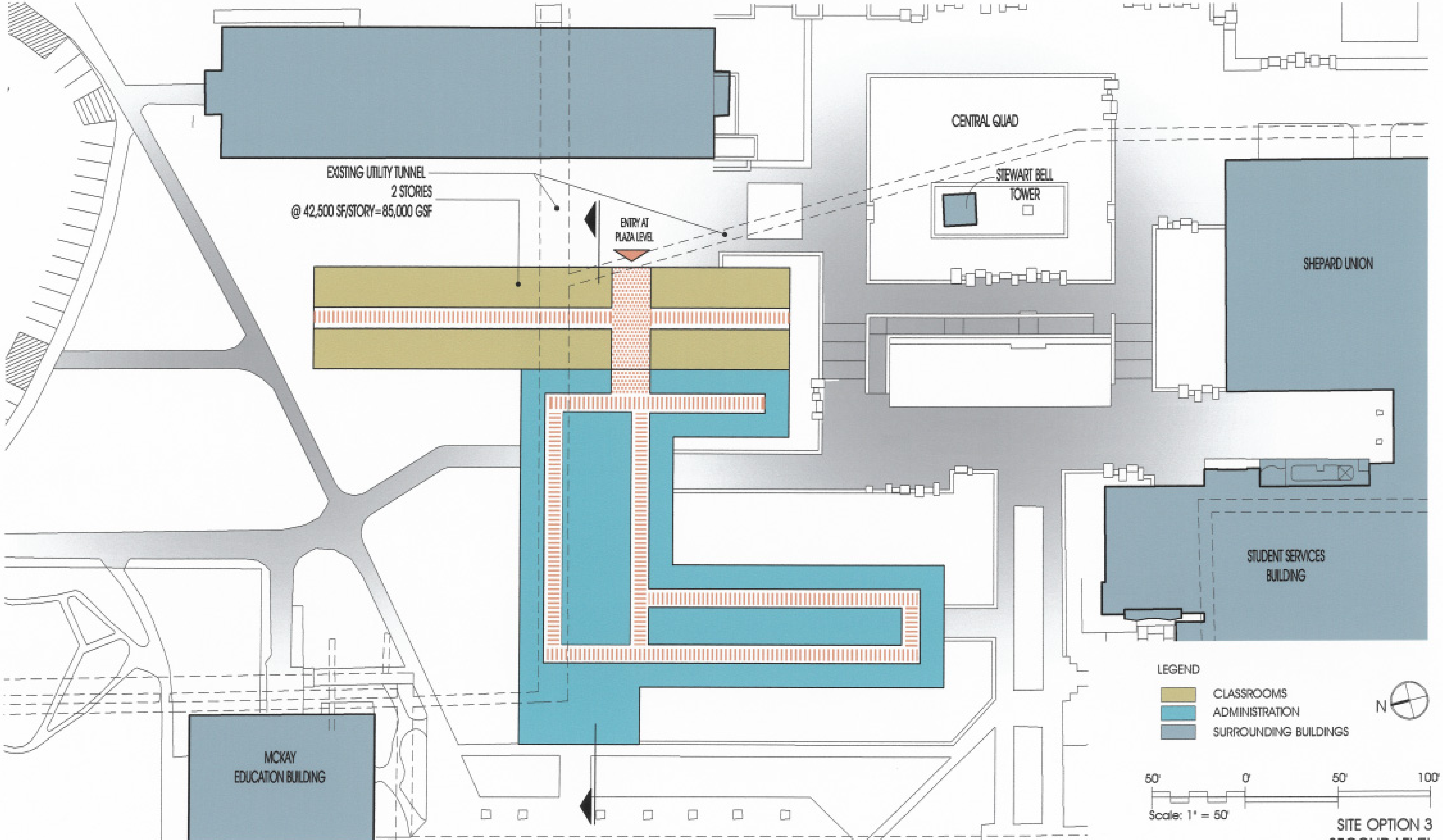
BUILDING SECTION
OPTION 2
Humanities Building

ajc architects

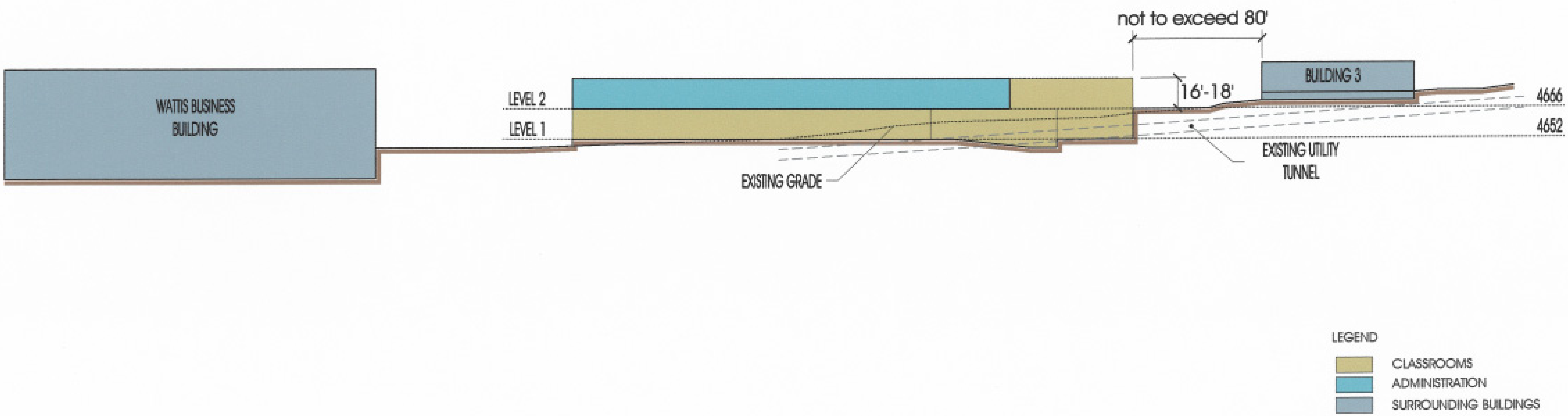


SITE OPTION 3
MAIN LEVEL

ajc architects



SITE OPTION 3
SECOND LEVEL



BUILDING SECTION
OPTION 3
Humanities Building

7.2 COSTS TO RELOCATE THE EXISTING UTILITY TUNNEL

The following is the Cost Estimate for relocating the existing utility tunnel.

CONSTRUCTION COST ESTIMATE

MASTER SUMMARY

SECTION	AREA	UNIT	COST/SF	COST
CURRENT CONSTRUCTION COST:				
UTILITY TUNNEL RELOCATION				$735,540
TOTAL (Construction)				$735,540

NOTES: Costs are for Construction only.
Costs are based on a Competitive Bid Basis.
Costs are based on Current Costs and Do Not Included Inflation.

CONSTRUCTION COST ESTIMATE

SITE SUMMARY

SECTION		AREA	UNIT	COST/SF	COST
UTILITY TUNNEL RELOCATION					$598,000
SUB TOTAL					$598,000
GENERAL CONDITIONS	7.0%				$41,860
BONDING	1.0%				$5,980
OVERHEAD & PROFIT	5.0%				$29,900
SUB TOTAL					$675,740
DESIGN CONTINGENCY	10.0%				$59,800
TOTAL (Construction)					$735,540

NOTES: Costs are for Construction only.
Costs are based on a Competitive Bid Basis.
Costs are based on Current Costs and Do Not Included Inflation.

CONSTRUCTION COST ESTIMATE

SITE DETAIL

SECTION		QUANTITY	UNIT	UNIT COST	COST
UTILITY TUNNEL RELOCATION					
Concrete Utility Tunnel (New)		460	LF	800.00	$368,000
Chilled Water Line		460	LF	100.00	$46,000
High Temp Water Line		460	LF	250.00	$115,000
Condensate Line		920	LF	75.00	$69,000
					$598,000
SUB TOTAL					$598,000
GENERAL CONDITIONS	7.0%				$41,860
BONDING	1.0%				$5,980
OVERHEAD & PROFIT	5.0%				$29,900
SUB TOTAL					$675,740
DESIGN CONTINGENCY	10.0%				$59,800
TOTAL (Construction)					$735,540

NOTES: Costs are for Construction only.
Costs are based on a Competitive Bid Basis.
Costs are based on Current Costs and Do Not Included Inflation

7.3 CHILLER FEASIBILITY STUDY

The following is the complete Chiller Feasibility Study by WHW Engineers.

WEBER STATE UNIVERSITY
CENTRAL CHILLED WATER PLANT AND DISTRIBUTION SYSTEM STUDY



WEBER STATE UNIVERSITY
DIVISION OF FACILITIES CONSTRUCTION MANAGEMENT

October, 2005

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excellence@whw-engineering.com

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A.3 Potential New Chiller Computer Run Performance Data
A.4 Plate and Frame Heat Exchanger Information
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A.7 ASHRAE Recommended Equipment Service Life

SECTION 1 – EXECUTIVE SUMMARY

1.1 Executive Summary

A. This study focuses on the existing and proposed chilled water systems for Weber State University. This study will identify existing chilled water distribution conditions, new and existing cooling requirements, and provide recommendations for the construction of a new central chilled water plant. The study will provide recommendations for new upgrades to the existing chilled water distribution systems. Capacities of existing and future buildings were taken from the Weber State University master plan. These capacities and totals can be found in Sections 2 and 3.

B. Weber State University originally began as Weber State Academy in 1889. It was made a State Junior College in 1933. Weber State College was updated to University status in 1991. Weber State University has since experienced a steady growth of students and educational facilities. The University is comprised of Thirty Six (36) main on-campus buildings, and Ten (10) auxiliary buildings. Among these buildings, Twenty One (21) on-campus buildings are connected to the campus Central Chilled Water Plant. This study will focus on the cooling requirements of the existing buildings, future planned campus buildings, and projected load increases. All discovered and known information will be summarized and the findings incorporated into the design of a new Central Chilled Water Plant.

C. The following are the main concerns, and recommendations for improving the Existing Chilled Water Distribution System and the construction of a new Future Central Chilled Water Plant:

1. The capacities of the existing three chillers and piping are adequate to handle the existing connected demand. See Section 3.4. However, the existing campus pumping system has reached its' operating limits. Pumps must operate at full capacity to meet current campus needs, without adequate back-up. If a primary pump is lost, the campus capacity is reduced by 50% of one chiller. This could be as much as 625 tons. If a secondary pump is lost, the entire campus cooling capacity will be reduced by 50%.
2. The capacities of the existing three chillers, cooling tower and piping are adequate for the combined existing load and the projected summer 2006 load as long as all three chillers are operating. See Section 3.4. Pumping system will be inadequate as it is currently operating. A higher chilled water Delta T needs to be used to compensate for the lack of pump capacity at future peak demands.
3. The capacities of the existing three chillers, pumps, cooling tower and piping are **not** adequate for the combined existing connected load, projected summer 2006 load and the future projected load. See Sections 3.3 and 3.4.

4. The new projected central chiller plant should be designed so that a back-up chiller or combination of chillers will always provide the capacity to cover the connected load.
5. Two of the existing chillers are manufactured by The Trane Co, the third chiller by Carrier Corp. The Trane chillers are in good condition and should be relocated to the new proposed central chiller plant. The Carrier chiller is beyond ASHRAE'S recommended service life and should be removed from service.
6. The different chiller combinations that are evaluated for the new central chiller plant in Section 5.2 are as follows:

Combination A:

1) Chiller #1 – New 1500 Ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1500 Ton with optional VFD
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination B:

1) Chiller #1 – New 2000 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1250 ton
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination C:

1) Chiller #1 – New 1500 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1250 ton with optional VFD
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination D:

1) Chiller #1 – New 2000 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1500 ton
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination E:

1) Chiller #1 – New 2000 ton with VFD
2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1700 ton
4) Chiller #4 – Existing 650 Ton Trane Unit

Combination F:

1) Chiller #1 – New 1700 ton with VFD

2) Chiller #2 – Existing 1250 Ton Trane Unit
3) Chiller #3 – New 1700 ton with optional VFD
4) Chiller #4 – Existing 650 Ton Trane Unit

7. Modify the campus chilled water loop as recommended in Section 4. This includes the following:
   a. Incorporate a primary chilled water circulation loop for each chiller.
   b. Provide a secondary loop with new pumps and variable frequency drives. Incorporate the campus loop pipe section modifications as part of the secondary loop.
   c. Provide a separate "decoupled" chilled water loop for the skybox and its' associated loads. Provide a plate and frame heat exchanger and associated pumps and specialties in the old chiller plant room to serve this loop.
8. Provide a new plate and frame heat exchanger to provide free cooling by utilizing condenser water from the cooling tower without activating the chillers.
9. Provide all new chilled and condenser water pumps with stand by pumps for the chilled water and condenser water systems.
10. Provide an automated control system to match a sequence of control approved by WSU. An example of a sequence is as follows:
    a. The first stage of cooling when the outdoor temperature is below 60 degrees F, shall be provided by the "Free Cooling" ie. plate and frame exchanger and the cooling tower. This stage of cooling shall be provided until the return water temperature can no longer be maintained. At this point, the "Free Cooling" shall be terminated and the lead chiller shall start.
    b. The lead chiller shall start and maintain operation until the return water temperature continues to rise at which time a return water temperature controller (adjustable) will start the other chillers depending on the combination recommended or approved by WSU.
11. The existing five cell cooling tower is not large enough to handle the combination of the existing connected load, the projected summer 2006 load, and the future projected load.
12. Provide a refrigerant detection, evacuation and personnel safety system. See Section 6.4.
13. Design engineers shall use WSU and DFCM standards to Architects and Engineers defining design criteria, equipment approval, etc. for the new central chiller plant.
14. The new chilled water distribution system and condenser water system within the new central chiller plant should be balanced by an independent testing and balancing agency after the new systems are installed.

15. Based on Sections 3 and 5, we recommend for the new central chilled water plant one of the following chiller combinations with the associated equipment listed below:

    a. Combination A

        1) Chiller #1 – New 1500 ton with VFD
        2) Chiller #2 – Existing 1250 Ton
        3) Chiller #3 – New 1500 ton with optional VFD
        4) Chiller #4 – Existing 650 Ton

    b. Combination F

        1) Chiller #1 – New 1700 ton with VFD
        2) Chiller #2 – Existing 1250 Ton
        3) Chiller #3 – New 1700 ton with optional VFD
        4) Chiller #4 – Existing 650 Ton

    c. Central Air Eliminator – Remove all existing building air eliminators.
    d. Central expansion tanks – Remove all existing building expansion tanks.
    e. Four inline mounted, constant volume chilled water primary loop circulating pumps for the chillers.
    f. Three main campus base mounted secondary distribution pumps with variable frequency drives.
    g. Three main condenser water pumps with variable frequency drives.
    h. Plate and frame heat exchanger for free cooling with an automatic change over to mechanical cooling.
    i. Cell addition to the existing cooling tower.
    j. Automation System.
    k. Re-using the existing 24 inch condenser water piping as the new chilled water piping distribution system. See Existing Campus Distribution Map Section 4.2 C.

D. The recommendations included in this report are based off of the WSU master plan information dated September 2005. Because many assumptions have been made concerning future buildings, i.e. future loads, locations, etc., and because of future individual building design changes, this report shall only be used as a guide and not a finished design for future buildings. WHW Engineering, Inc. assumes no design liability for future modifications to the existing campus plan. Equipment sizing, pipe sizing, loop modifications, field verification of existing conditions, and all other associated recommendations are the responsibility of the future design teams to verify, calculate, and design at the time of the associated future projects.

SECTION 2 – HISTORY OF EXISTING CHILLED WATER SYSTEM

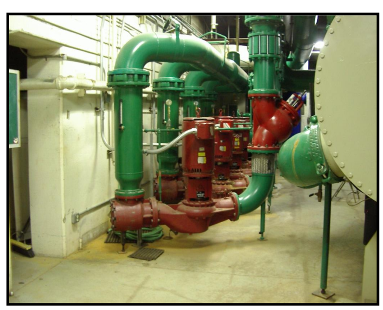
2.1 Central Chiller Plant Description

A. Plant Use and Identification

1. The central chiller plant, located in the lower floor of the Science Lab Building, is used to house the central chilled water plant that distributes chilled water to 21 campus buildings. The equipment space is divided into two complete separate rooms.

2. The existing central chilled water plant, located in the basement of the Science Lab Building, was brought on line in 1969 with the first of two 650 ton lithium-bromide absorption chillers. In 1977 a 1250 ton (Carrier) centrifugal chiller was installed in a separate under floor mechanical room located on the south side of the Science Lab; however this chiller was not completely operational until 1988 at which time it became the primary campus chiller. The absorption chillers were taken out of service and later scrapped to make way for the installation of new future centrifugal chillers.

3. In 1994 a Trane model CVHE 650 Ton, R123 centrifugal chiller was installed in the east basement of the Science Lab to work in tandem with the existing 1250 ton (Carrier) chiller. The campus continued to expand and all the antiquated “stand alone” chiller systems were scrapped creating the need for a new chiller in the central chilled water plant. A new 1250 Ton R123 Trane chiller was purchased and installed in 2001. Due to the additional condenser water demand placed on the existing cooling tower, along with the deteriorated state of the existing towers, a new five cell cooling tower was installed. The new tower is located east of the existing central chiller plant in an area north of the stadium and east of the parking lot.



B. Cooling Equipment – Northeast Chiller Room

1. The equipment installed in the Northeast chiller room consists of the following:

Item 1: East side Chiller CH-2 – Trane Model CVHF-128, 1250 Ton, R-123 Refrigerant.

Item 2: West side Chiller CH-1 – Trane model CVHE 8890-123, 650 Ton, R-123 Refrigerant.

Item 3: Expansion Tank – None

Item 4: Air Eliminator – None

Item 5: Chilled Water Pump P-11; Vertical Inline – Armstrong 8x8x10; 1300 GPM @ 44 ft. Hd., 20 HP, 230/460 Volts, 1800 rpm.

Item 6: Chilled Water Pump P-12; Vertical Inline – Armstrong 8x8x10; 1300 GPM @ 44 ft. Hd., 20 HP, 230/460 Volts; 1800 rpm.

Item 7: Chilled Water Pump P-13; Vertical Inline – Armstrong 8x8x10; 1300 GPM @ 44 ft. Hd., 20 HP, 230/460 Volts; 1800 rpm.

Item 8: Chilled Water Pump P-14; Vertical Inline – Armstrong 8x8x10; 1300 GPM @ 44 ft. Hd., 20 HP, 230/460 Volts; 1800 rpm.

Item 9: Condenser Water Pump. P-7 – Armstrong Vertical Inline 8x8x11.5, 1950 GPM @ 89 ft. Hd.; 60 HP; 230/460 Volts; 1770 rpm.

Item 10: Condenser Water Pump. P-8 – Armstrong Vertical Inline 8x8x11.5, 1950 GPM @ 89 ft. Hd.; 60 HP; 230/460 Volts; 1770 rpm.

Item 11: Condenser Water Pump. P-9 – Armstrong Vertical Inline 8x8x11.5, 1950 GPM @ 89 ft. Hd.; 60 HP; 230/460 Volts; 1770 rpm.

Item 12: Condenser Water Pump. P-10 – Armstrong Vertical Inline 8x8x11.5, 1950 GPM @ 89 ft. Hd.; 60 HP; 230/460 Volts; 1770 rpm.

C. Cooling Equipment – Southwest Chiller Room

1. The equipment installed in the Southwest chiller room consists of the following:

Item 1: Chiller CH-3 – Carrier model 19FA, 1250 Tons–R-500 Refrigerant.

Item 2: Chilled Water Pump P-1 – Bell & Gossett, Model VSCS, 3000 GPM @ 120 ft. Hd., 125 HP, 460 Volt., 3 phase.

Item 3: Chilled Water Pump P-2 – Bell & Gossett, Model VSCS; 3000 GPM @ 120 ft. Hd., 125 HP, 460 Volt., 3 phase.

Item 4: Chilled Water Pump P-3 – Bell & Gossett, Model VSCS, 2733 GPM @ 45 ft. Hd., 60 HP, 230/460 Volt., 3 phase.

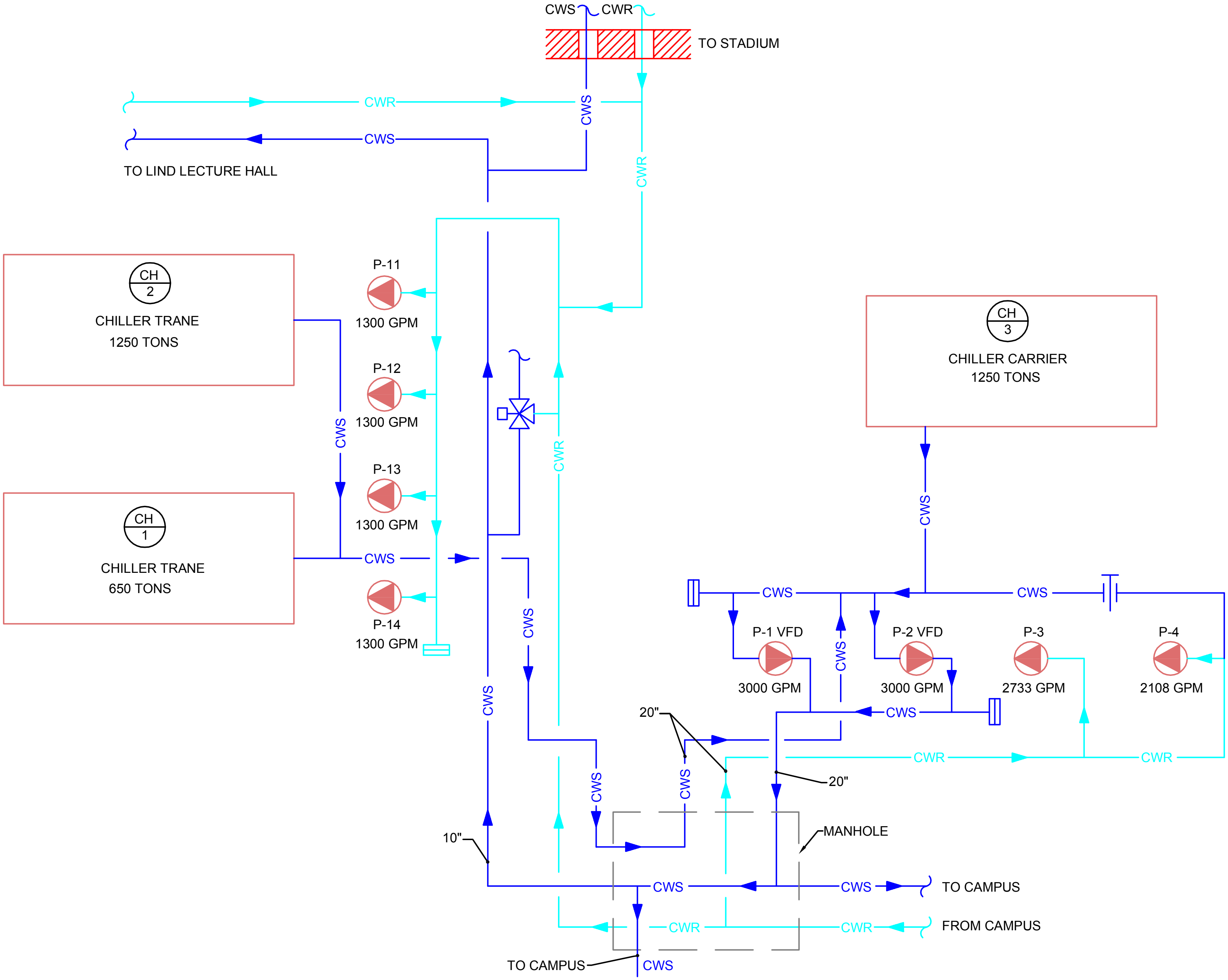
Item 5: Chilled Water Pump P-4 – Bell & Gossett, Model VSCS, 2108 GPM @ 75 ft. Hd., 60 HP, 230/460 Volts.

Item 6: Condenser Water Pump P-5 – Bell & Gossett VSCS, 2108 GPM, 75 ft. Hd., 60 HP, 230/460 Volt., 3 phase.

Item 7: Condenser Water Pump P-6 – Bell & Gossett VSCS, 2108 GPM, 75 ft. Hd., 60 HP, 230/460 Volt. 3 phase.

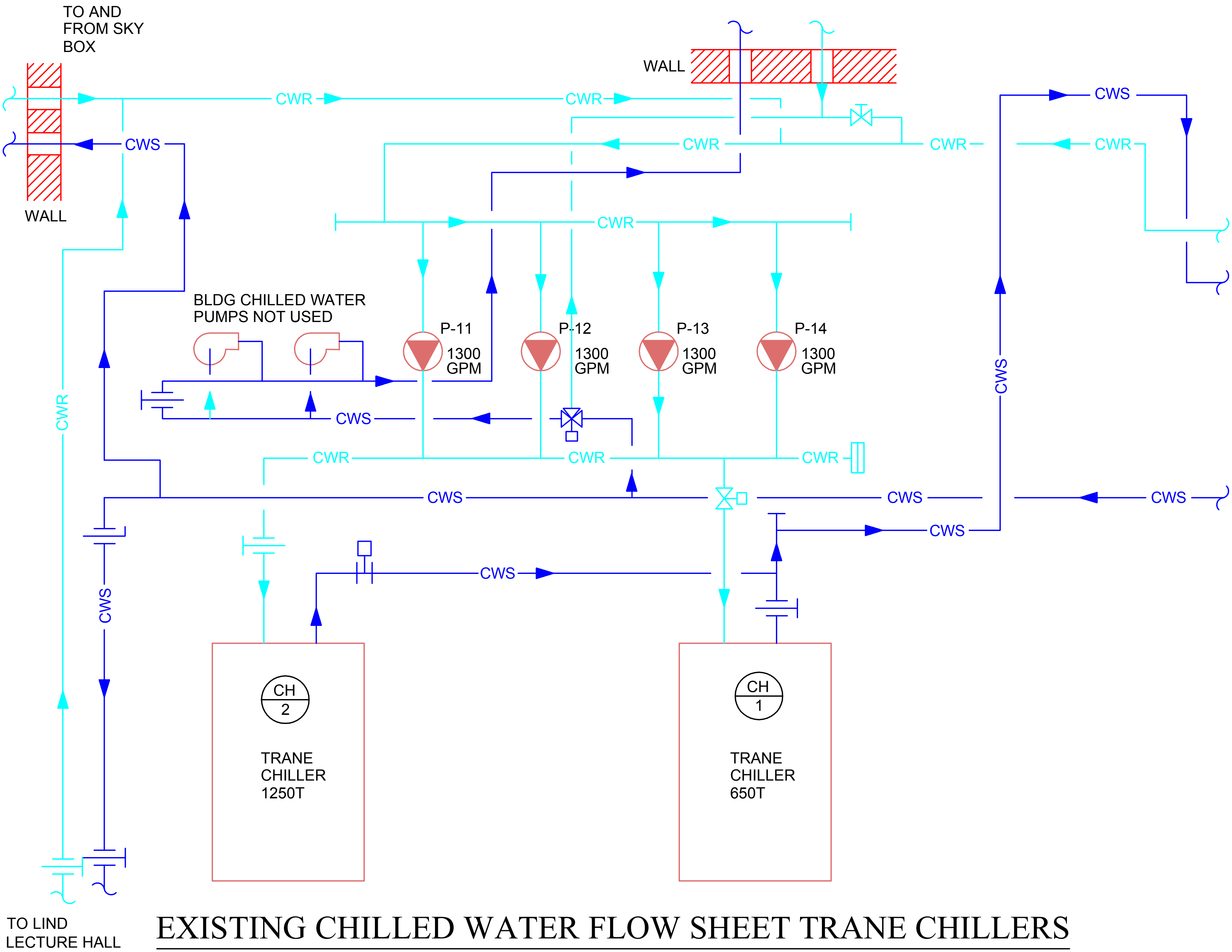
Item 8: Expansion Tank: Amtrol 1988, Vertical, size 1200-L; Model 116557, 12 PSI; two provided.

Item 9: VFD Drives for chilled water pumps, P-1 and P-2.



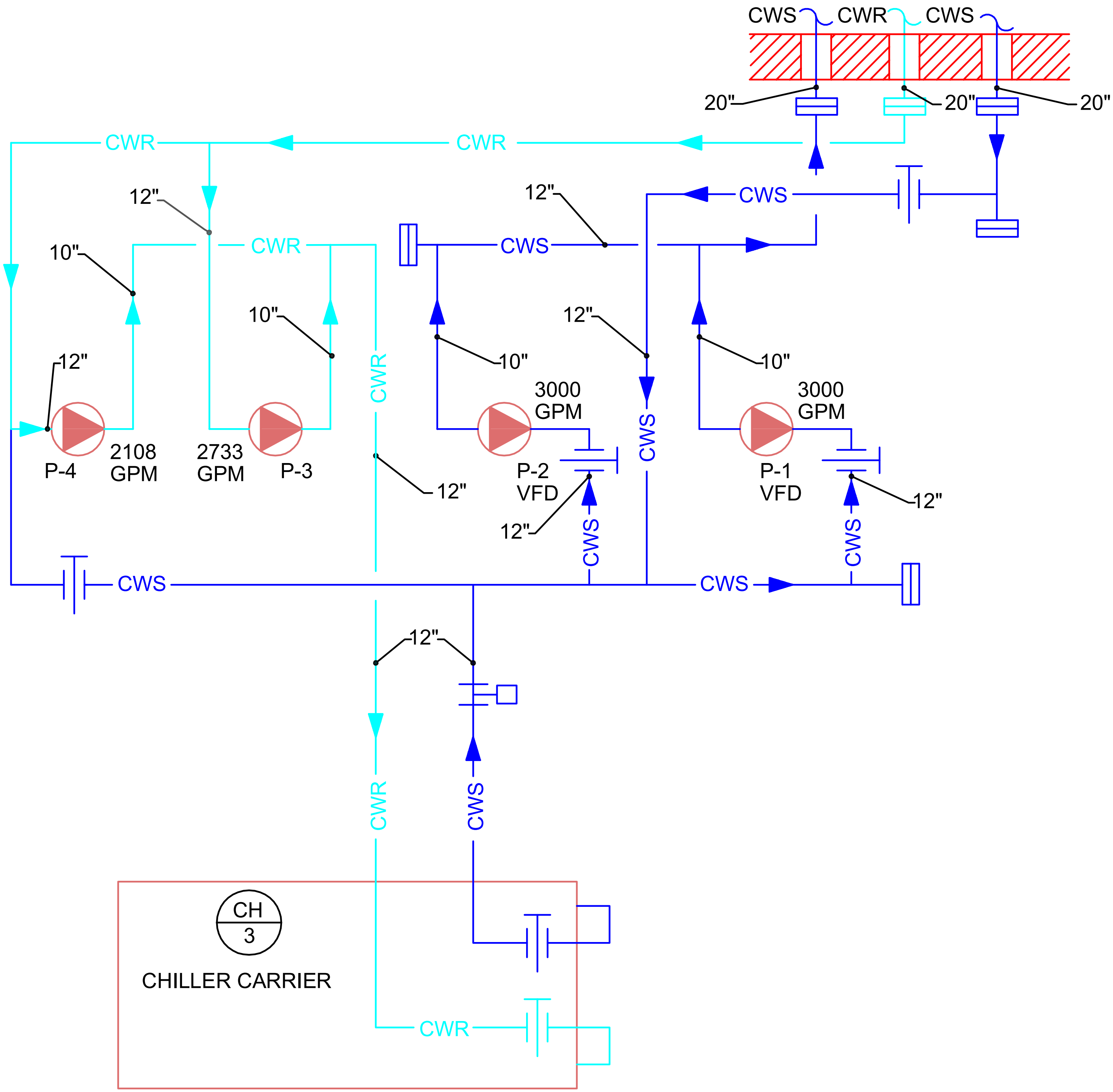
OVERALL CHILLED WATER PIPING FLOW SHEET

NOT TO SCALE



EXISTING CHILLED WATER FLOW SHEET TRANE CHILLERS

NOT TO SCALE



EXISTING CHILLED WATER FLOW SHEET CARRIER CHILLER

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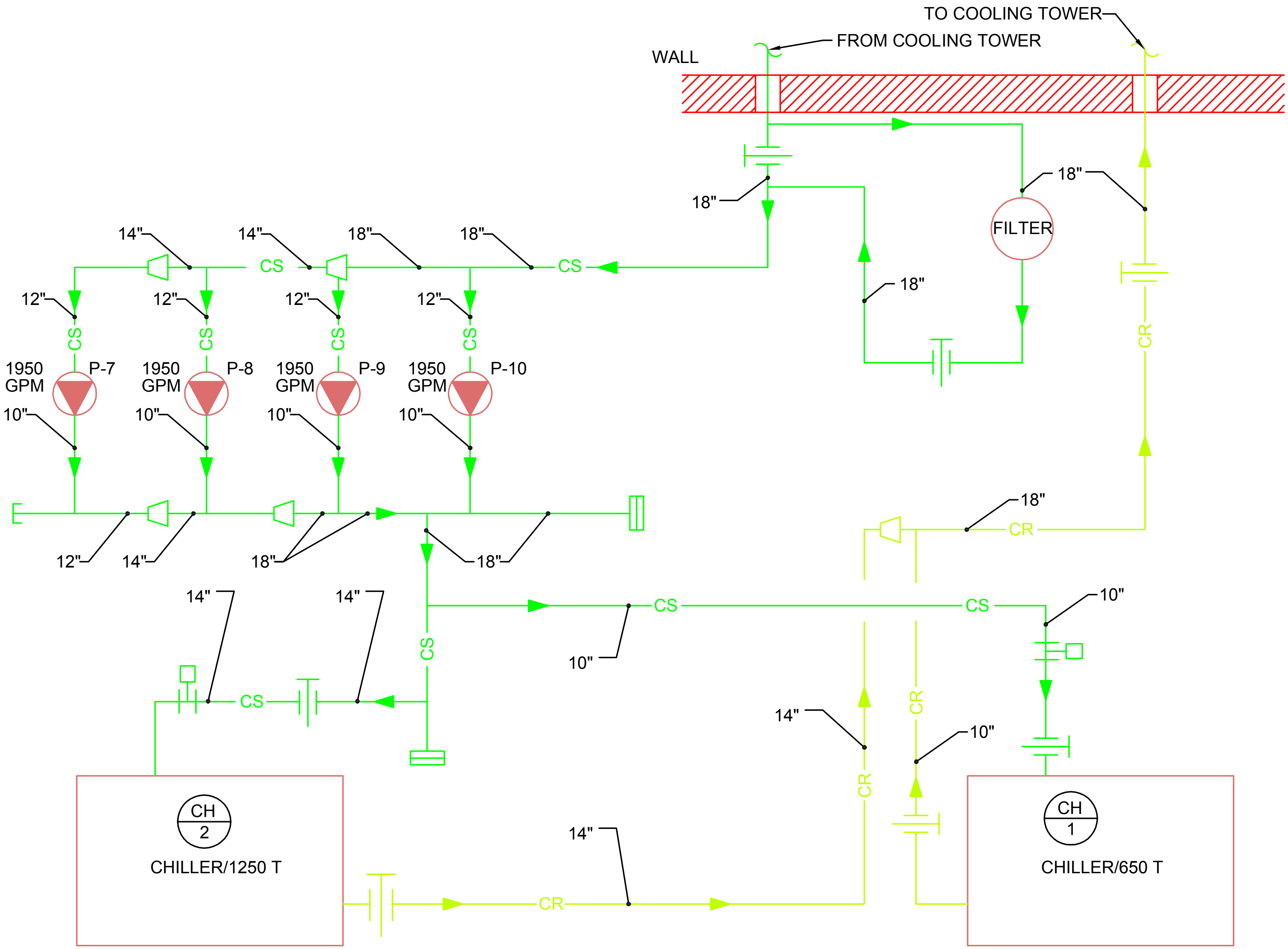

EXISTING CONDENSER WATER FLOW SHEET TRANE CHILLERS

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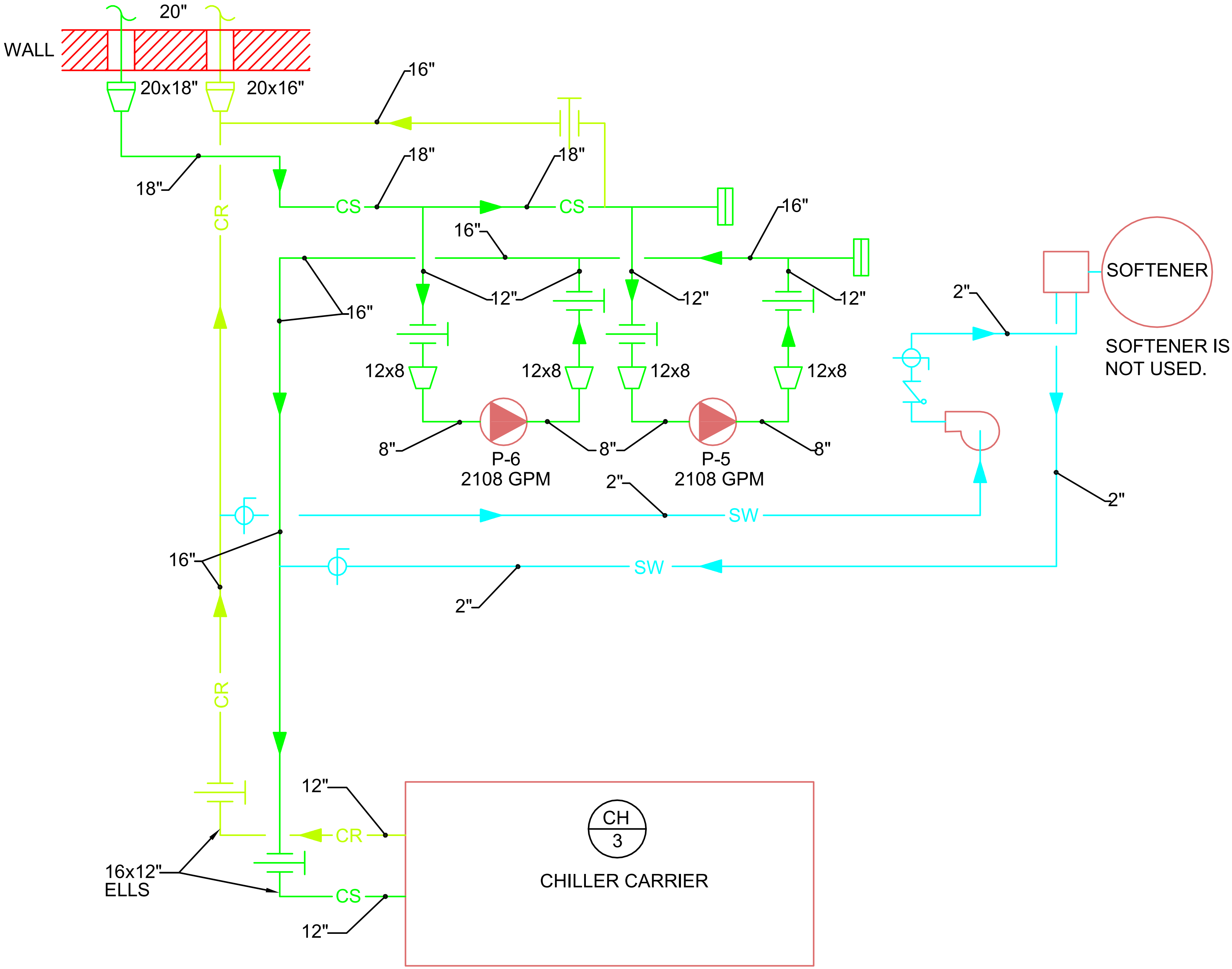


EXISTING CONDENSER WATER FLOW SHEET CARRIER CHILLER

NOT TO SCALE

2.3 EXISTING CAMPUS BUILDINGS LOAD SUMMARY

Building Name	Gross Sq. Feet	Connected to Central Cooling Plant	Gross Cooling Tons	GPM	Future Planning
Building # 1		No	0	0	Demolish / Future New Bldg. 320 Tons
Building # 2		No	0	0	Demolish
Building # 3		No	0	0	Demolish
Building # 4	39897	Yes	119	286	Demolish / Future New Bldg. 320 Tons
Science Lab	112650	Yes	285	684	Future Additional 285 Tons
Lind Lecture	48200	Yes	133	320	None
Miller Administration	45147	Yes	179	430	None
Social Science	106327	Yes	346	830	None
Wattis Business	52269	Yes	118	284	None
McKay Education Building	67785	Yes	312	749	None
Heating Plant	6206	Yes	18	43	None
Technical Education	18163	Yes	54	130	Future Additional 271 Tons
Engineering Technology	72910	Yes	141	339	Future Additional 32 Tons
Allied Health Ph. 1	61198	Yes	132	316	None
Allied Health Ph. 2	27058	Yes	99	238	None
Student Services	82700	Yes	123	296	None
Shepherd Union	172231	Yes	513	1232	S-06 Additional 40 Tons
Stewart Library	159276	Yes	389	933	S-06 Additional 15 Tons
Browning Center	160143	Yes	472	1133	None
Lampros Hall	18361	Yes	68	163	None
Kimball Visual Arts	70872	Yes	201	482	None
Stadium Offices	21247	Yes	93	223	None
HPEC	78846	Yes	208	499	None
Stadium Sky Box	39507	Yes	109	261	None
Campus Services		No			Future Additional 40 Tons
Swenson Gym		No			S-06 Additional 280 Tons
Track Locker Room		Yes	15	36	None

SECTION 3 – CENTRAL CHILLED WATER PLANT CONDITIONS

3.1 Introduction

A. The Existing Central Chiller Plant is located under the Science Lab Building #6 and consists of three centrifugal chillers. Two chillers are manufactured by Trane Co., with capacities of 1250 and 650 Tons respectively. The third chiller is manufactured by Carrier Corp., having a capacity of 1250 Tons.

The 650 Ton Trane chiller was installed in 1992, the 1250 Ton Trane unit in 2001. Trane chillers are in good condition. The Carrier chiller was installed in 1975 and is in fair to poor condition.

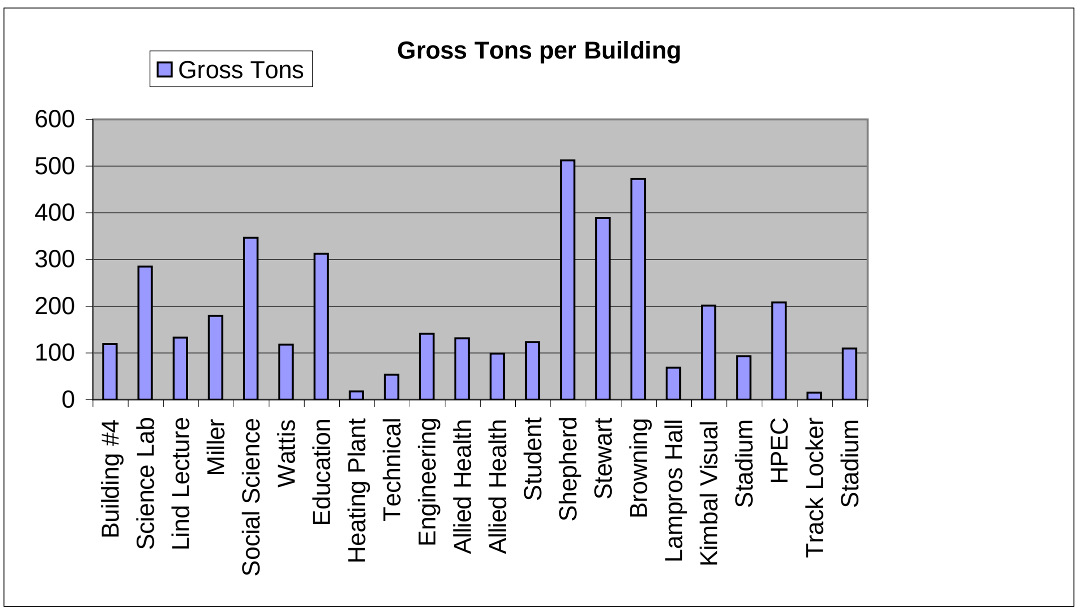
B. The following campus loads are indicated in both a numeric and graph format.

1. These loads include the existing campus load, the projected load for summer 2006, and the projected overall future load. The total of these are shown, as well as conclusions to the capacities required for both the new and existing chilled water plants.
2. The loads include approximations for a campus central system diversity factor. The campus currently sees around a 60% diversity factor. This means that the central plant peak operation is approximately 60% of the sum of the individual building peak loads. Because this is the current campus diversity factor, it has been applied to the existing loads as well as the summer of 2006 cooling loads; however, a 65% diversity factor is being used for the **entire** campus after 2006. This is done to add a safety factor and give some future flexibility. As the University continues to grow and develop, building schedules may change, new buildings may have different load profiles, and the campus diversity factor may change. When planning for a central chiller plant that is intended to serve the campus needs for the unforeseeable future, we feel it prudent to use a slightly higher diversity factor to account for some future flexibility.

3.2 CENTRAL PLANT LOAD REQUIREMENTS

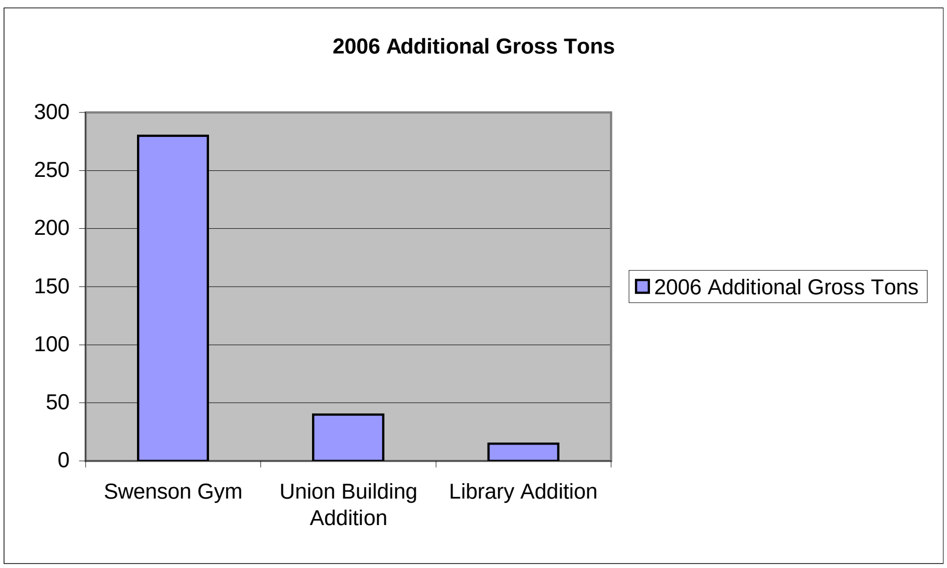
A. EXISTING BUILDING CONNECTED LOADS

Building No.	Building Name	Area Sq. FT.	MBH	Gross Tons	10ΔT GPM	Diversity Factor	Net Tons	Net GPM
4	Building #4	39,897	1,430	119	286	60%	71.4	172
6	Science Lab	142,650	3,420	285	684	60%	171	410
7	Lind Lecture	48,200	1,600	133	319	60%	79.8	191
10	Miller Administration	45,147	2,152	179	430	60%	107.4	258
14	Social Science	106,327	4,150	346	830	60%	207.6	498
15	Wattis Business	52,269	1,420	118	283	60%	70.8	170
16	Education Building	67,785	3,744	312	749	60%	187.2	449
18	Heating Plant	6,206	216	18	43	60%	10.8	26
22	Technical Education	18,163	650	54	130	60%	32.4	78
23	Engineering Tech.	72,910	1,694	141	338	60%	84.6	203
34a	Allied Health PH.1	61,198	1,580	132	317	60%	79.2	190
34b	Allied Health PH.II	27,058	1,192	99	238	60%	59.4	143
35	Student services	82,700	1,480	123	295	60%	73.8	177
36	Shepherd Union	172,231	6,158	513	1231	60%	307.8	739
37	Stewart Library	159,276	4,667	389	934	60%	233.4	560
37	Browning Center	160,143	5,664	472	1133	60%	283.2	680
39	Lampros Hall	18,361	816	68	163	60%	40.8	98
40	Kimbal Visual Arts	70,872	2,409	201	482	60%	120.6	289
52	Stadium Offices	21,247	1,116	93	223	60%	55.8	134
51	HPEC	78,846	2,493	208	499	60%	124.8	299
	Track Locker Rooms		180	15	36	60%	9	22
55	Stadium Skybox	39,507	1,305	109	262	60%	65.4	157
	Sub-Total	**1,490,993**	**49,536**	**4,127**	**9,905**	**60%**	**2,476**	**5,943**



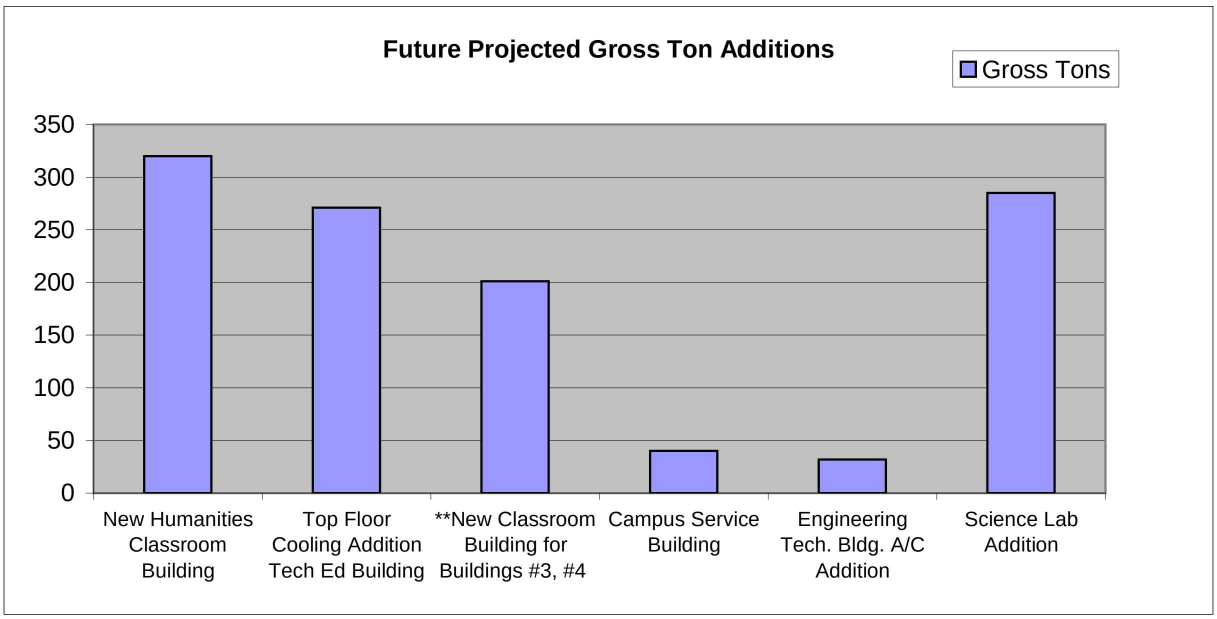
B. PROJECTED SUMMER 2006 LOADS

Building No.	Building Name	Area Sq. FT.	MBH	Gross Tons	10ΔT GPM	Diversity Factor	Net Tons	Net GPM
50	Swenson Gym	85,000	3,120	280	672	60%	168	403.2
36	Union Building Addition	14,000	480	40	96	60%	24	57.6
37	Library Addition	5,000	180	15	36	60%	9	21.6
	Sub-Total	**104,000**	**3,780**	**335**	**804**	**60%**	**201**	**482**



C. PROJECTED FUTURE LOADS

Building No.	Building Name	Area Sq. FT.	MBH	Gross Tons	10ΔT GPM	Diversity Factor	Net Tons	Net GPM
	New Humanities Classroom Building	120,000	3,840	320	768	65%	208	499
22	Top Floor Cooling Addition Tech Ed Building	69,813	3,252	271	650	65%	176.15	423
	**New Classroom Building for Buildings #3, #4	120,000	2,412	201	482	65%	130.65	314
	Campus Service Building	8,040	480	40	96	65%	26	62
	Engineering Tech. Bldg. A/C Addition	10,503	384	32	77	65%	21	50
6	Science Lab Addition	113,000	3,420	285	684	65%	185.25	445
	Sub-Total	**441,356**	**13,788**	**1,149**	**2,758**	65%	**747**	**1792**

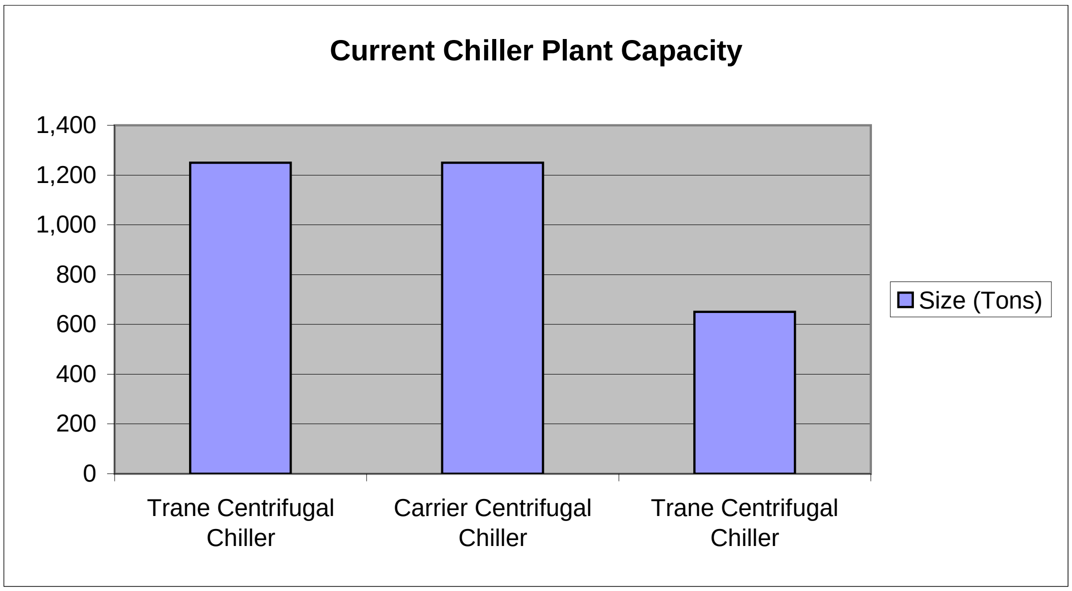


**Additional load required for the replacement of Bldg #4 with the new Humanities Building.

3.3 CHILLER PLANT CAPACITY REQUIREMENT SUMMARY

A. EXISTING CENTRAL CHILLED WATER PLANT CAPACITY

Chiller Manufacturer/Type	Size (Tons)	Line Loss Factor	Total Tons
Trane Centrifugal Chiller	1,250	95%	1,188
Carrier Centrifugal Chiller	1,250	95%	1,188
Trane Centrifugal Chiller	650	95%	618
		Total Existing Central Plant Capacity:	**2993**

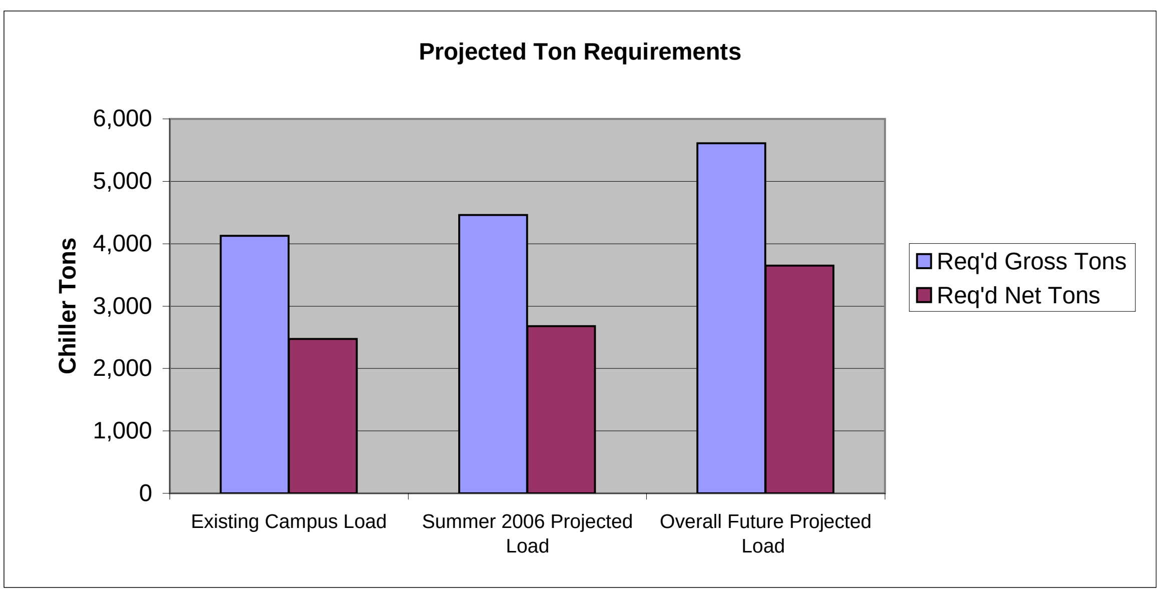


B. NEW REQUIRED CHILLED WATER PLANT CAPACITY

Connected Loads	Area Sq. FT.	MBH	Gross Tons	10ΔT GPM	Diversity	Net Tons	Net GPM
Existing Campus Load	1,490,993	49,536	4,127	9,905	60%	2,476	5,943
Summer 2006 Projected Load	104,000	3,780	335	804	60%	201	482
Future Projected Load For Future Buildings	441,356	13,788	1,149	2,758	65%	747	1792.44
Gross Totals	**2,036,349**	**67,104**	**5,611**	**13,467**		**3,424**	**8,218**

Overall Future Plant Capacity Requirements	Area Sq. FT.	MBH	Gross Tons	10ΔT GPM	Diversity	Net Tons	Net GPM
Overall Future Loads with New Diversity	**2,036,349**	**67,104**	**5,611**	**13,467**	**65%**	**3,647**	**8,753**

PROJECTED LOAD INCREASE			
Projected Gross Ton Requirements	**Req'd Gross Tons**	**Req'd Net Tons**	**Load Increase From Existing**
Existing Campus Load	4,127	2,476	0%
Summer 2006 Projected Load	4,462	2,677	8%
Overall Future Projected Load	5,611	3,647	47%



3.4 Conclusion

1. The existing chiller capacity is capable of serving the needs of the existing connected load:

    - Existing connected load: 2,476 Tons
    - Existing chiller plant capacity: 2,993 Tons
    - Excess capacity: 517 Tons

2. The existing chiller capacity is capable* of serving the needs of the existing connected load and the additional loads projected for the summer of 2006:

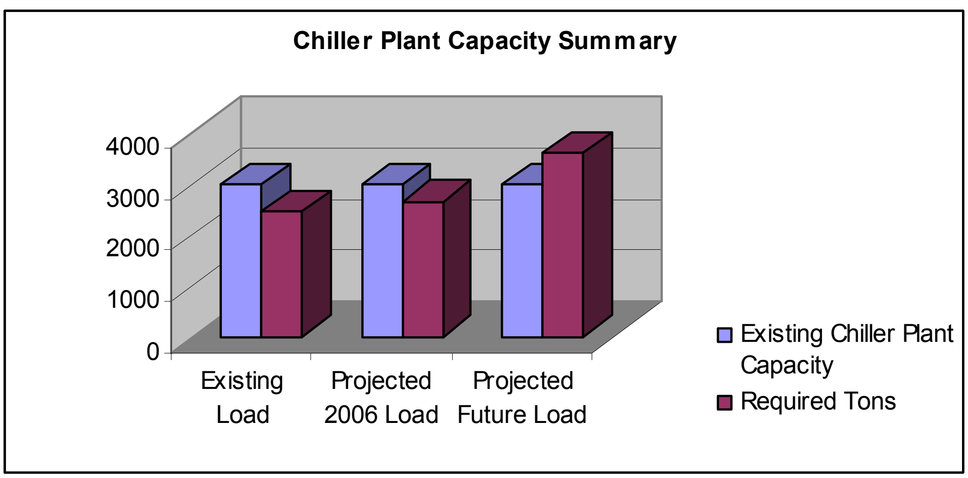
    - Existing connected load & 2006 addition: 2,677 Tons
    - Existing chiller plant capacity: 2,993 Tons
    - Excess capacity: 316 Tons

    *In order to meet this demand, all three chillers must be in operation and functioning to capacity. In an event that any one of the three chillers fail, the result would be a higher water temperature distribution system with significantly less cooling at each individual building.

    Note: Pumping system will be inadequate as it is currently operating. A higher chilled water Delta T will need to be used in attempt to compensate for lack of pumping capacity at peak loads.

3. The existing chiller capacity is **not** capable of serving the needs of the existing connected load, the additional projected summer load of 2006, and the additional future load.

    - Total projected future load: 3,647 Tons
    - Existing chiller plant capacity: 2,993 Tons
    - Capacity insufficiency: 654 Tons



SECTION 4 – CHILLED WATER CAMPUS DISTRIBUTION SYSTEM

4.1 Introduction

A. This section will describe the existing and future chilled water piping distribution systems. This description includes maps, flow sheets, piping analysis sheets, comparison sheets between existing and future piping capacities, pipe sizing and recommendations.

B. The existing campus chilled water piping distribution system is a two pipe direct return system. Each building is equipped with two way valves or 3-way valves operating as two way valves. Piping is routed both in tunnels and directly buried.

C. The piping distribution system begins at the existing central chilled water plant located under the Science lab building. The piping is routed west where it separates into one branch going north and one going south. Both branches turn and head west. (See campus distribution map.) Chilled water piping is also distributed east to the stadium. The east side of campus is the high point and the west the low point of the system.

D. See the central chilled water flow sheets this section for existing piping arrangements. Pipe flow analysis sheets, indicate existing and future conditions. Pipe section nodes show pipe size, GPM, and required tons for that section of piping. Supply and return chilled water piping is shown on the map as one.

Tunnel to Kimball Arts

Tunnel to Student Services

4.2 CAMPUS PIPING AND PUMPING SYSTEMS

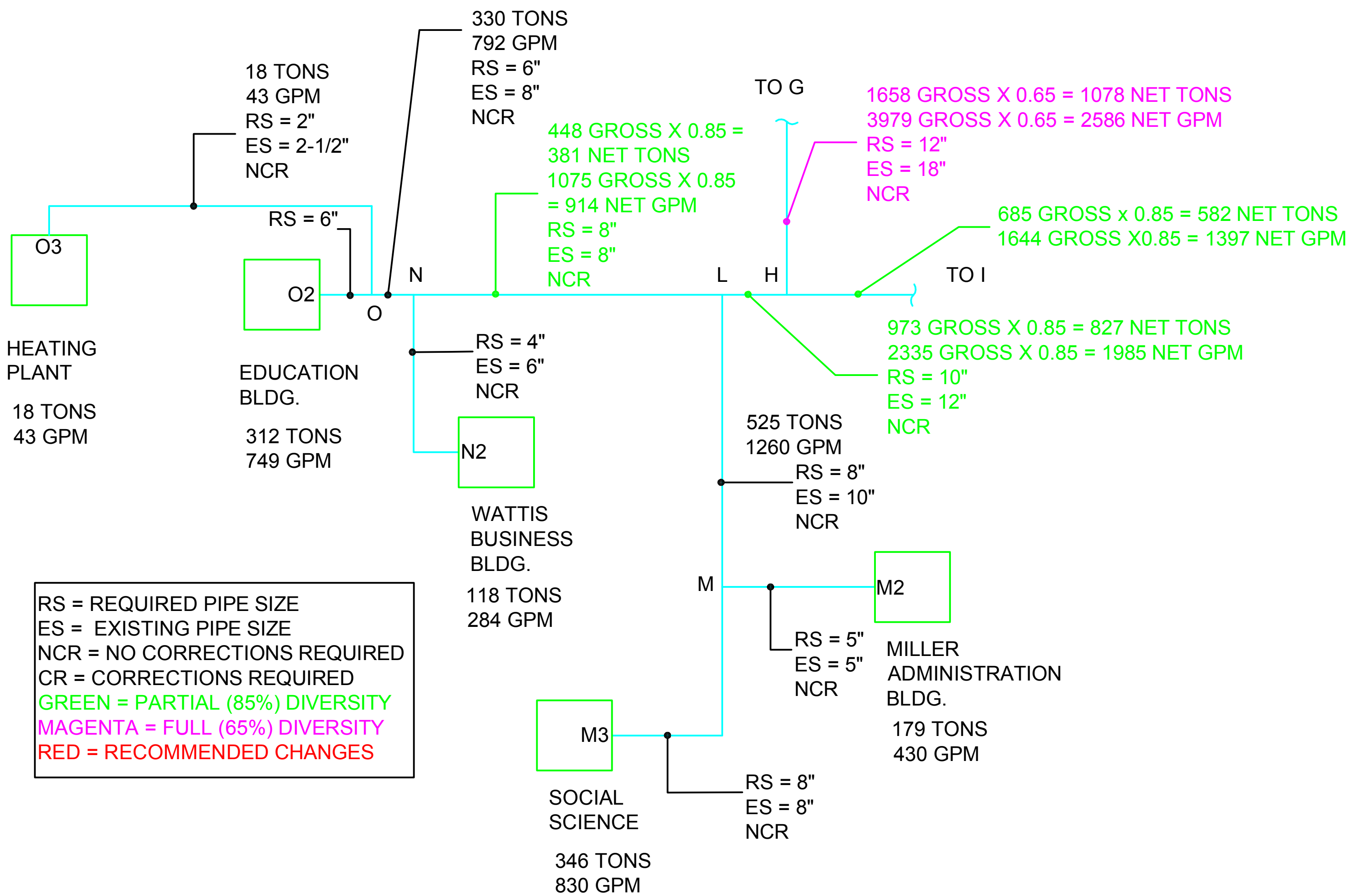
A. CHILLED WATER PIPE SECTION SUMMARY (see individual flow sheets and campus map for further detail)

Chilled Water Pipe Section Summary										
		Existing Gross CHW Load		Existing Net CHW Load**		Anticipated Future Gross CHW Load***		Anticipated Future Net CHW Load**		
Pipe Section	Existing Size	Tons	GPM	Tons	GPM	Tons	GPM	Tons	GPM	Recommended Minimum Future Size*
A-A.2	24" condenser	Existing pipe re-configured in future				5611	13466	3647	8753	24"
B-B.1	6"	285	684	285	684	285	684	285	684	6"
B-B.2	4"	133	319	133	319	133	319	133	319	4"
B-S	6"	217	521	217	521	217	521	217	521	6"
S-S.2	6"	217	521	217	521	217	521	217	521	6"
S.3-S.4	4"	93	223	93	223	93	223	93	223	4"
S.2-S.3	4"	108	259	108	259	108	259	108	259	4"
S.2-S.5	4"	109	262	109	262	109	262	109	262	4"
S.3-S.6	2"	15	36	15	36	15	36	15	36	2"
A.2-T	-	-	-	-	-	5611	13466	3647	8753	24"
T-T.1	-	-	-	-	-	285	684	285	684	6"
T-T.2	-	-	-	-	-	5326	12782	3462	8309	24"
T.2-C	20"	Existing pipe re-configured in future				1133	2719	1133	2719	10"
BC	20"	3492	8381	2270	5448	-	-	-	-	abandon/remove
CB****	10"	635	1524	635	1524	635	1524	635	1524	8"
CR	8"	195	468	195	468	498	1195	498	1195	8"
R-R.2	6"	141	338	141	338	173	415	173	415	5"
R-R.3	4"	54	130	54	130	325	780	325	780	6"
CD	20"	3297	7913	2143	5143	New configuration. Becomes T.2-D and T.2-C				
T.2-D	20"	Existing pipe re-configured in future				4193	10063	2725	6541	18"
D-D.1	20"	3297	7913	2143	5143	4193	10063	2725	6541	18"
D.1-D.2	6"	132	317	132	317	132	317	132	317	5"
D.1-E	20"	3165	7596	2057	4937	4061	9746	2640	6335	18"
EQ	10"	696	1670	592	1420	991	2378	842	2022	10"
Q-Q.1	10"	389	934	389	934	404	970	404	970	8"
Q-Q.2	10"	307	737	307	737	587	1409	587	1409	8"
Q.2-Q.3	4"	99	238	99	238	99	238	99	238	4"
Q.2-Q.4		208	499	208	499	488	1171	488	1171	8"
Q.4-Q.5	5"	208	499	208	499	208	499	208	499	5"
Q.4-Q.6	(5" stub)	-	-	-	-	280	672	280	672	6"
EF	20"	2469	5926	1605	3852	3070	7368	1996	4789	18"
F-F.2	5"	119	286	119	286	320	768	320	768	6"
FG	18"	2350	5640	1528	3666	2750	6600	1788	4290	16"
GH	18"	1658	3979	1078	2586	2058	4939	1338	3210	12"
GP	8"	692	1661	588	1412	692	1661	588	1412	8"
P-P.2	5"	152	365	152	365	152	365	152	365	5"
P-P.3	8"	472	1133	472	1133	472	1133	472	1133	8"
P-P.4	4"	68	163	68	163	68	163	68	163	4"
HI	12"	685	1644	582	1397	725	1740	616	1479	8"
I-I.2	8"	361	866	361	866	401	962	401	962	8"
I.2-I.3	-	-	-	-	-	40	96	40	96	3"
IJ	12"	324	778	324	778	324	778	324	778	8"
J-J.2	5"	123	295	123	295	123	295	123	295	5"
JK	10"	201	482	201	482	201	482	201	482	6"
K-K.2	3"	51	122	51	122	51	122	51	122	3"
K-K.3	6"	150	360	150	360	150	360	150	360	5"
HL	12"	973	2335	827	1985	1333	3199	1133	2719	12"
LM	10"	525	1260	525	1260	525	1260	525	1260	8"
M-M.2	5"	179	430	179	430	179	430	179	430	5"
M-M.3	8"	346	830	346	830	346	830	346	830	8"
LN	8"	448	1075	381	914	808	1939	687	1648	8"
N-N.2	6"	118	283	118	283	118	283	118	283	4"
NO	8"	330	792	330	792	690	1656	690	1656	8"
O-O.2	8"	312	749	312	749	312	749	312	749	6"
O-O.2.5	2.5"	18	43	18	43	378	907	378	907	8"
O2.5-O.3	2.5"	18	43	18	43	58	139	58	139	3"
O.3-O.3.5	2.5"	18	43	18	43	18	43	18	43	2"
O2.5-O.5	-	-	-	-	-	320	768	320	768	6"
O.3-O.4	-	-	-	-	-	40	96	40	96	3"

* Based on anticipated future <u>net</u> load, using the 2005 campus master plan. Pipe size recommendations are made using a maximum pressure drop of 5.0'/100 ft and maximum velocity of 8.0'/sec. The sizes and sections shown in red indicate either new sections of piping, or sections where the future recommended line size is larger than the existing line size. These recommendations only apply to the current anticipated development. If changes are made to the campus master plan, then recommended line sizes should be re-evaluated.

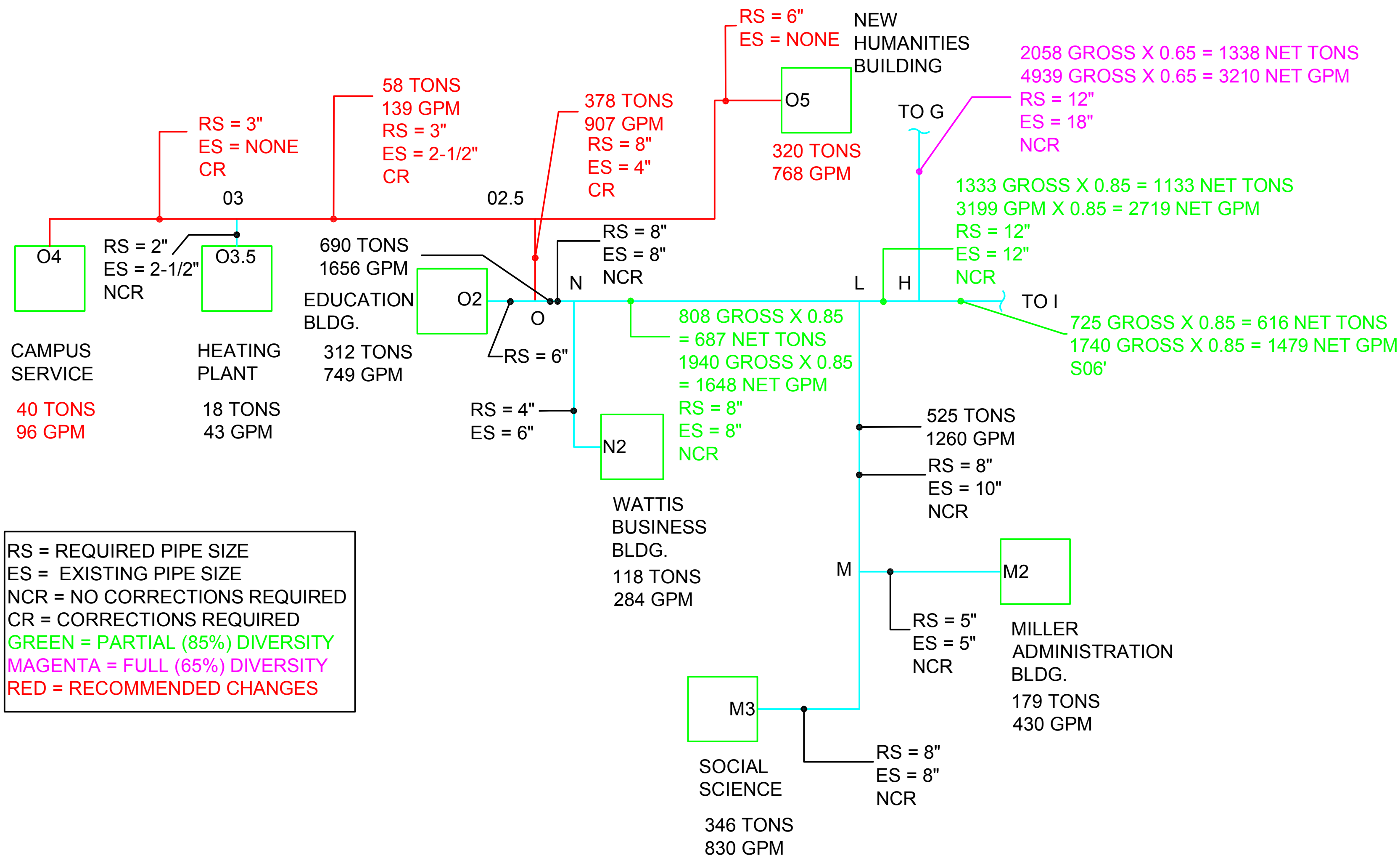
** The net chilled water load for the pipe sections is based on approximate diversity factors at the different sections. The individual building branch loads do not use a diversity factor. The existing building loads are shown in blue. The sub-mains that serve relatively few buildings do not use a diversity factor, and are shown in regular **black**. The diversity factor for the main chilled water lines is approximated at 65%. This is the same diversity as the central plant. These loads are shown in magenta. The diversity factor for the sub-mains serving large groups of buildings is approximated at 85%. These loads are shown in green.

*** Where section loads increase as a result of anticipated development, these new loads are shown in *italics*.
**** A 20" pipe runs from B to C, and a 10" pipe runs back from C to B, so both sections are listed.



BRANCH #1 & #2 EXISTING

NOT TO SCALE



BRANCH #1 & #2A FUTURE

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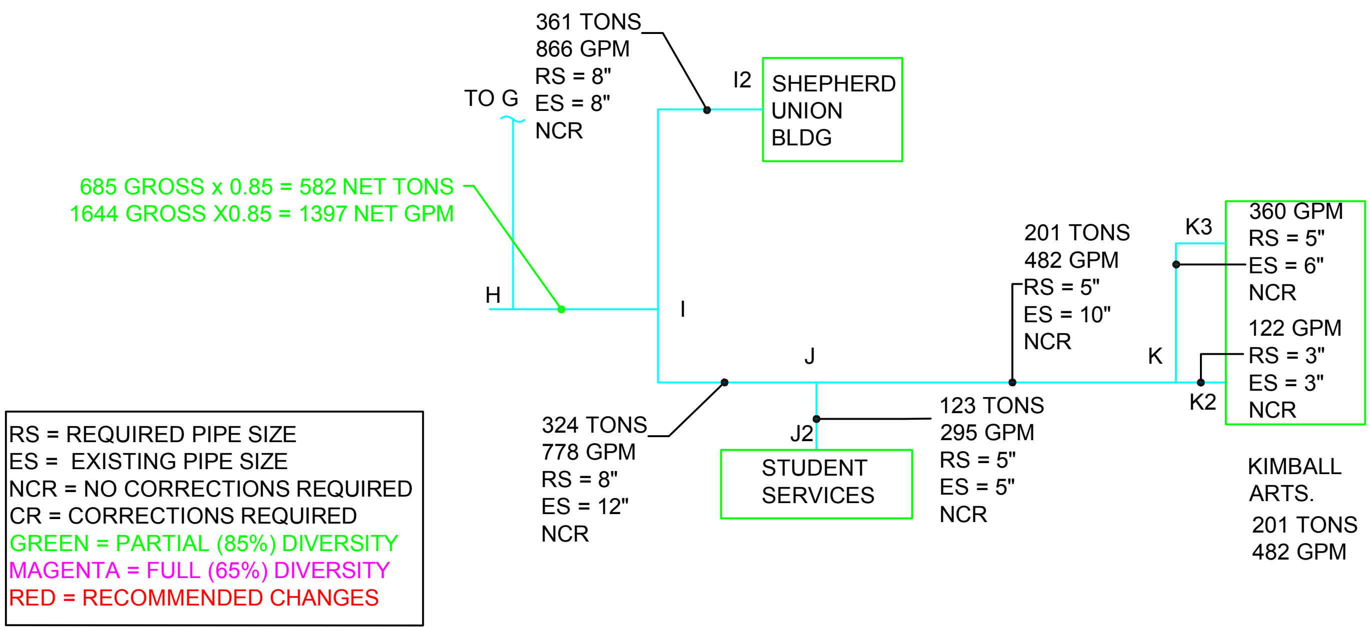

BRANCH #3 EXISTING

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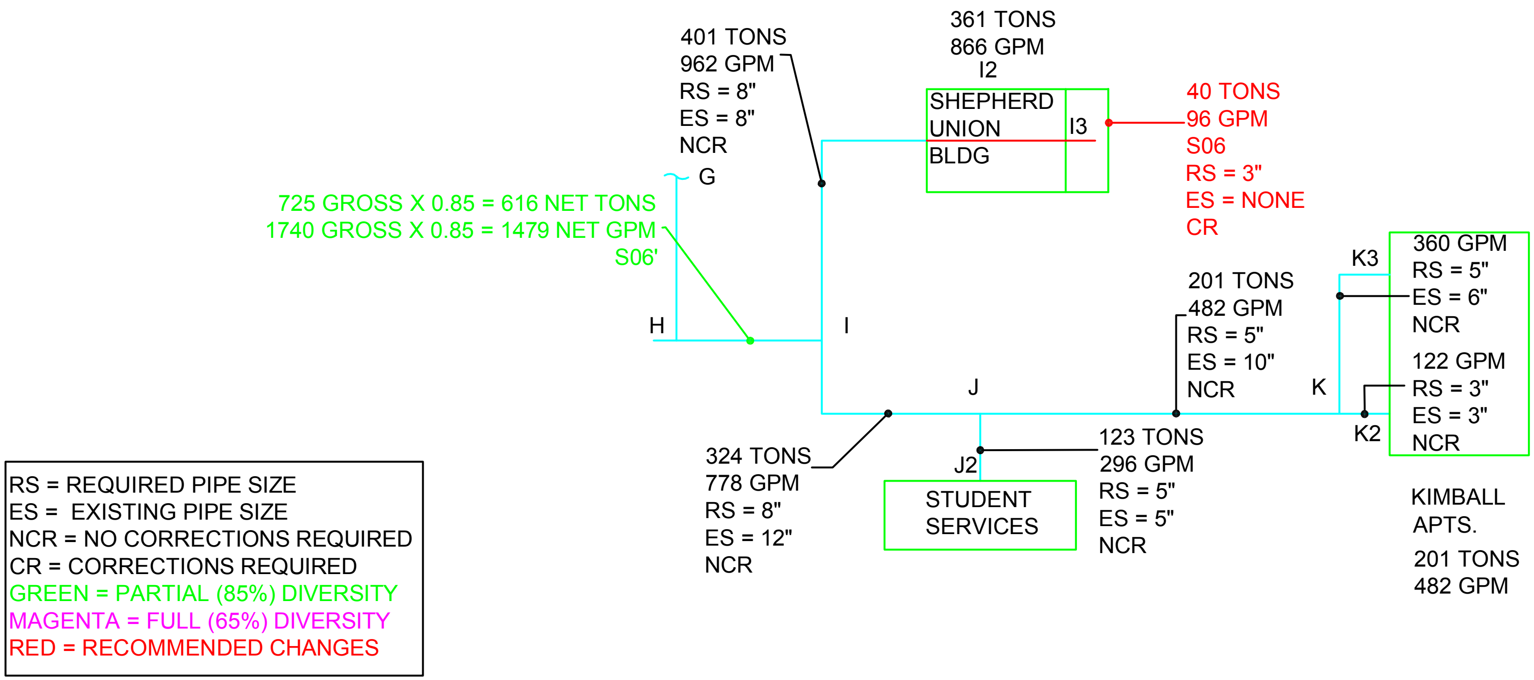

BRANCH #3A SUMMER 2006

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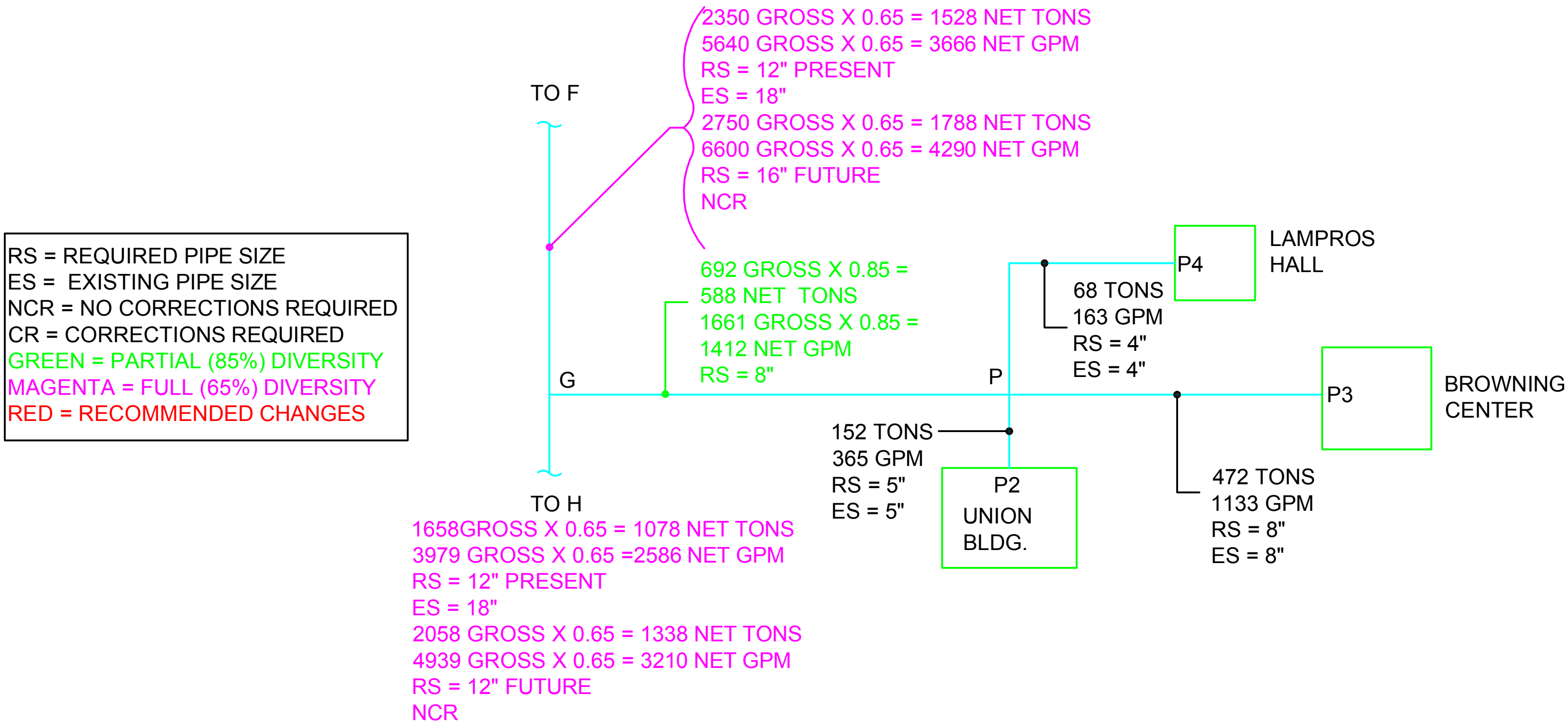

BRANCH #4 EXISTING AND FUTURE

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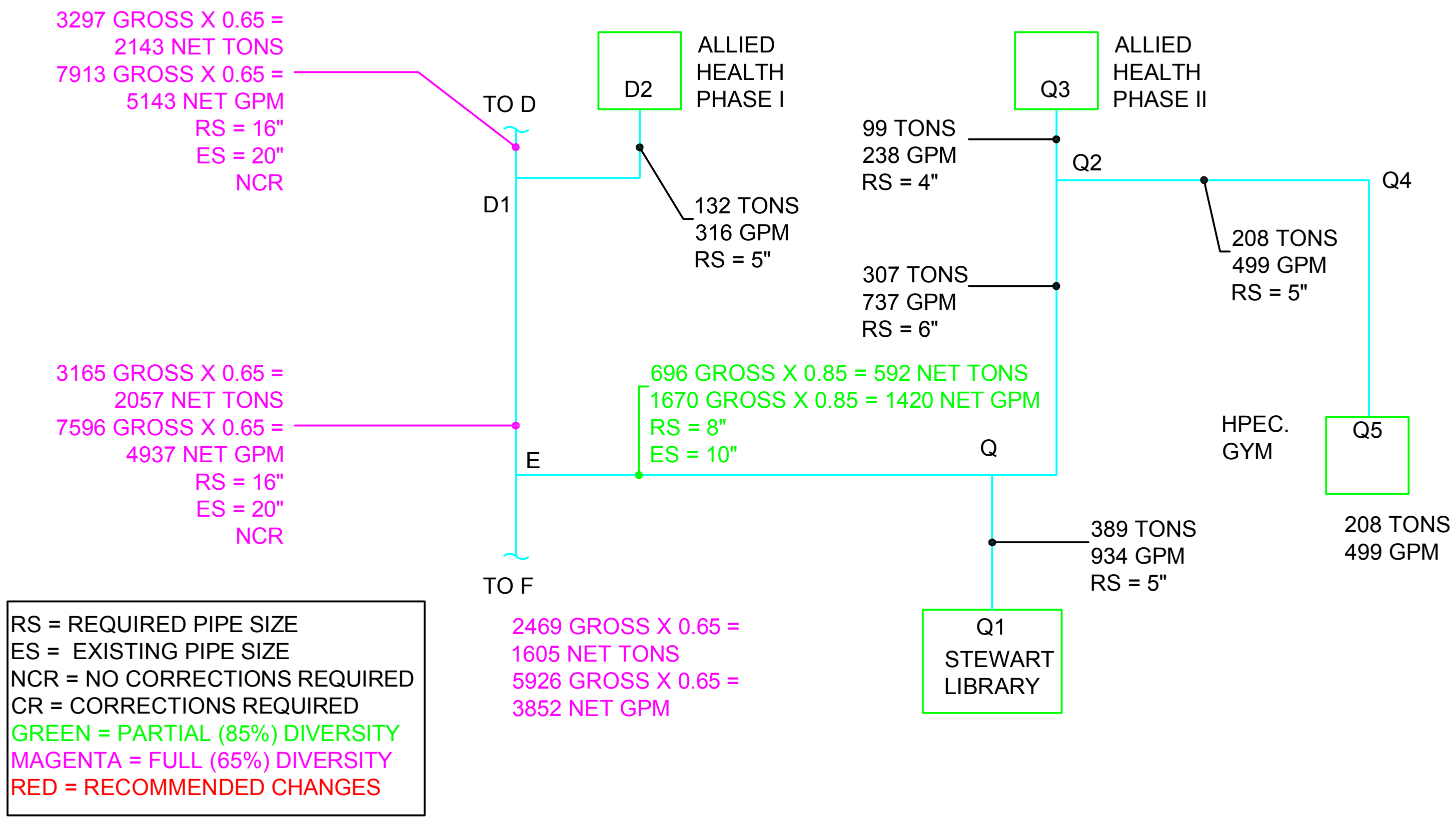

BRANCH #5 & #7 EXISTING

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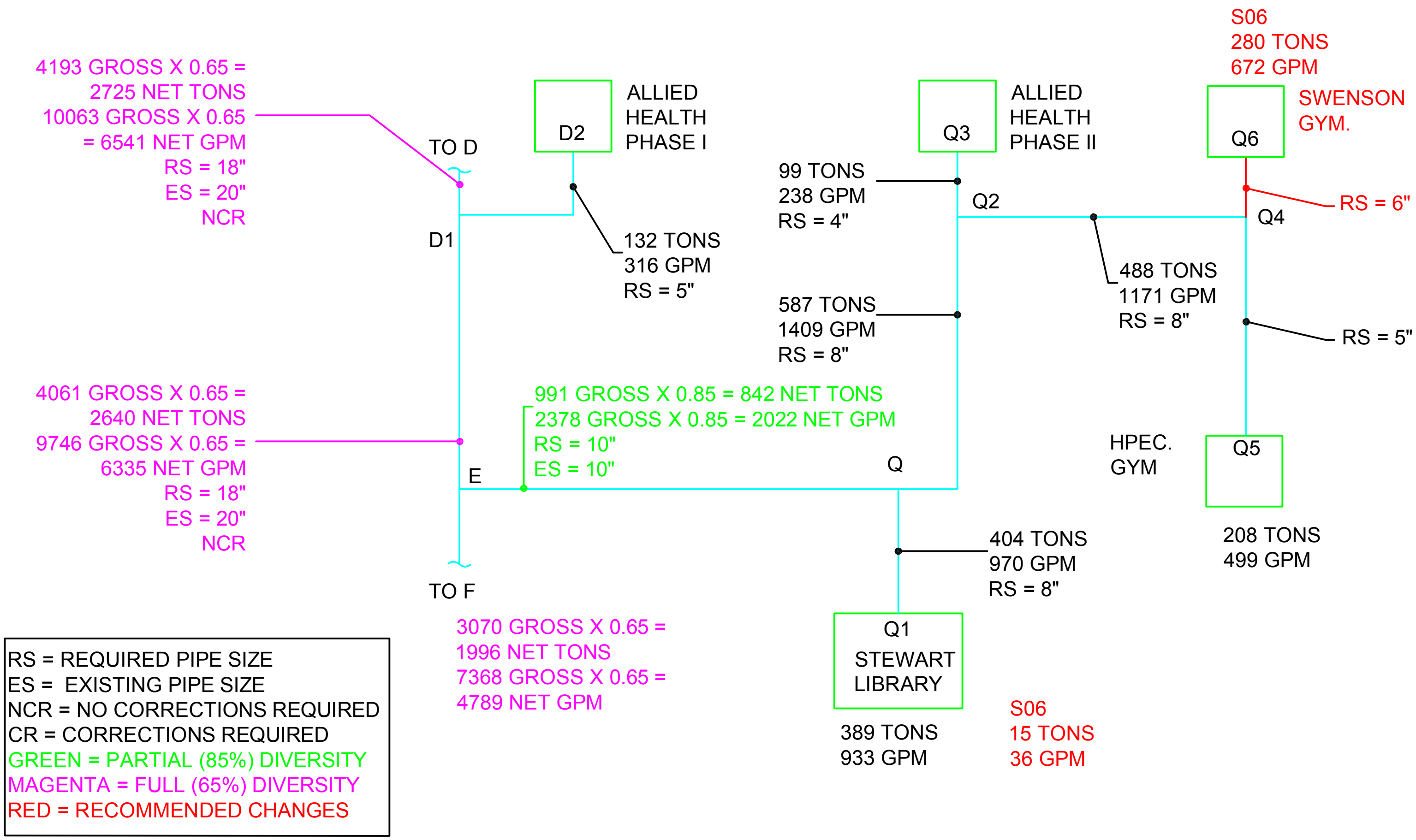
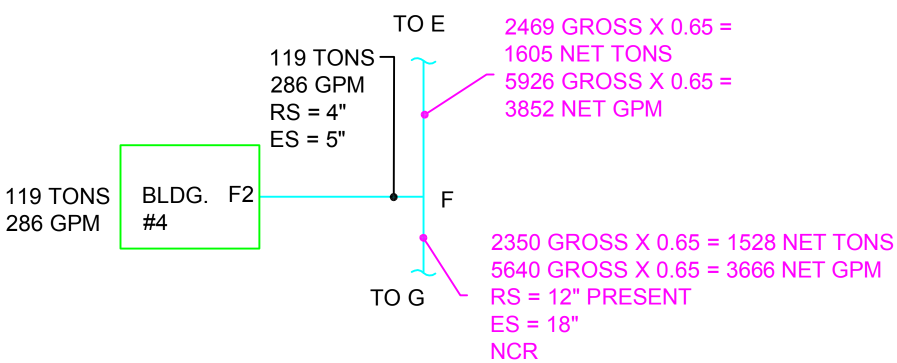


BRANCH #5 SUMMER 2006

NOT TO SCALE

RS = REQUIRED PIPE SIZE
ES = EXISTING PIPE SIZE
NCR = NO CORRECTIONS REQUIRED
CR = CORRECTIONS REQUIRED
GREEN = PARTIAL (85%) DIVERSITY
MAGENTA = FULL (65%) DIVERSITY
RED = RECOMMENDED CHANGES



BRANCH #6 EXISTING

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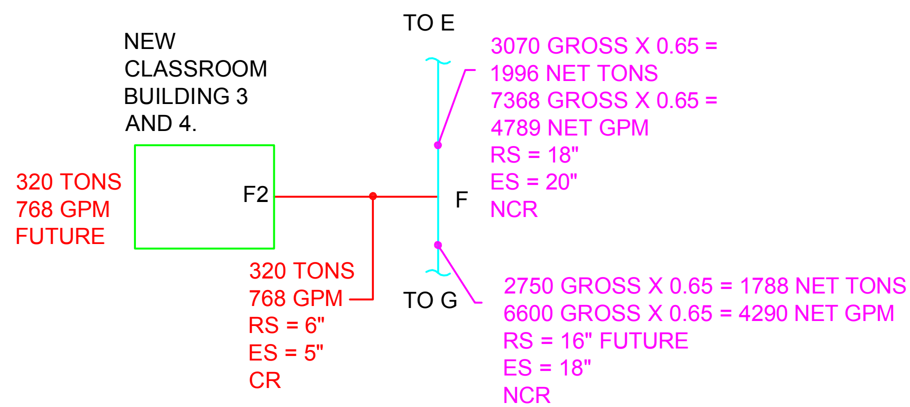

BRANCH #6A FUTURE

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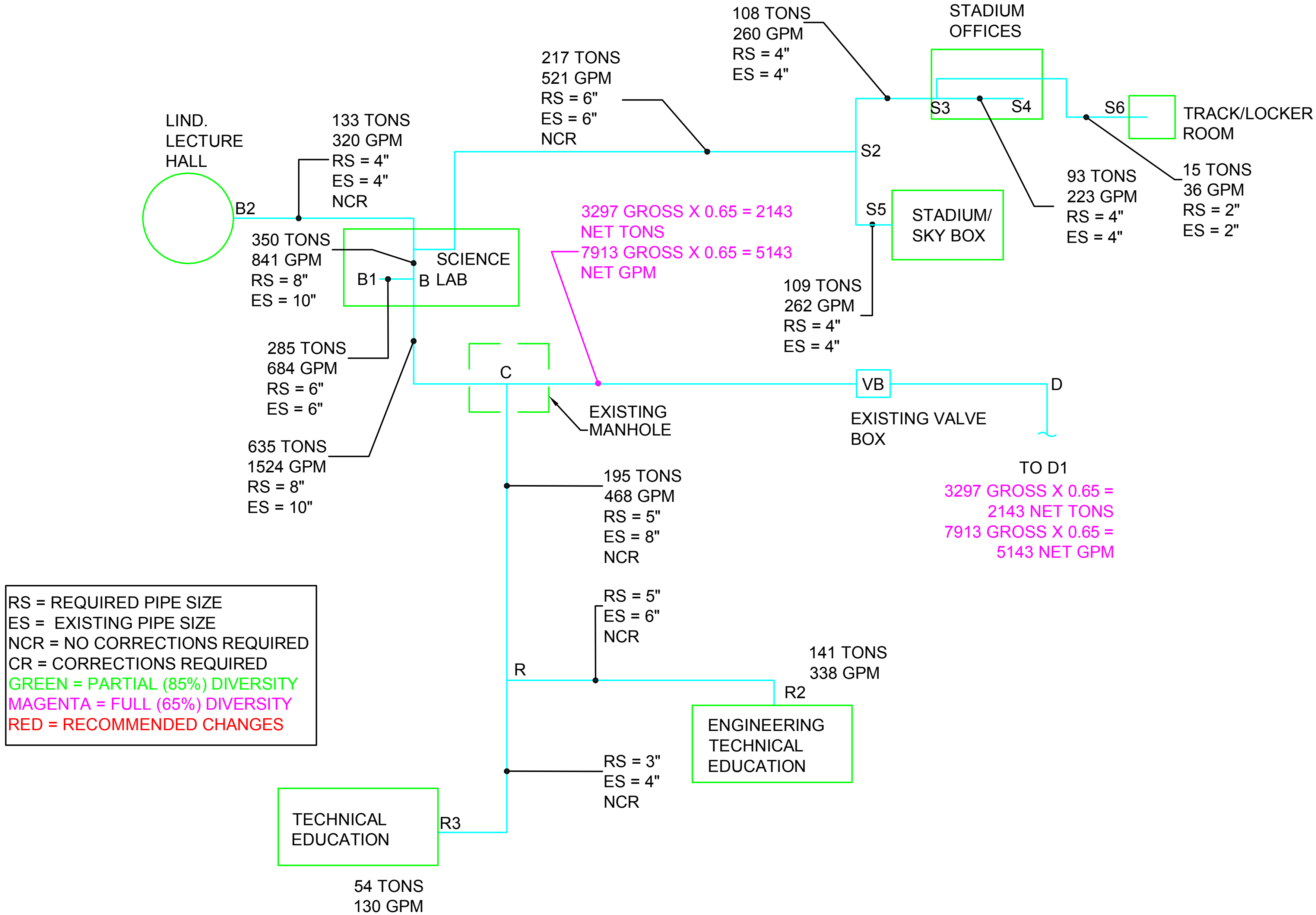

BRANCH #8 & #9 EXISTING

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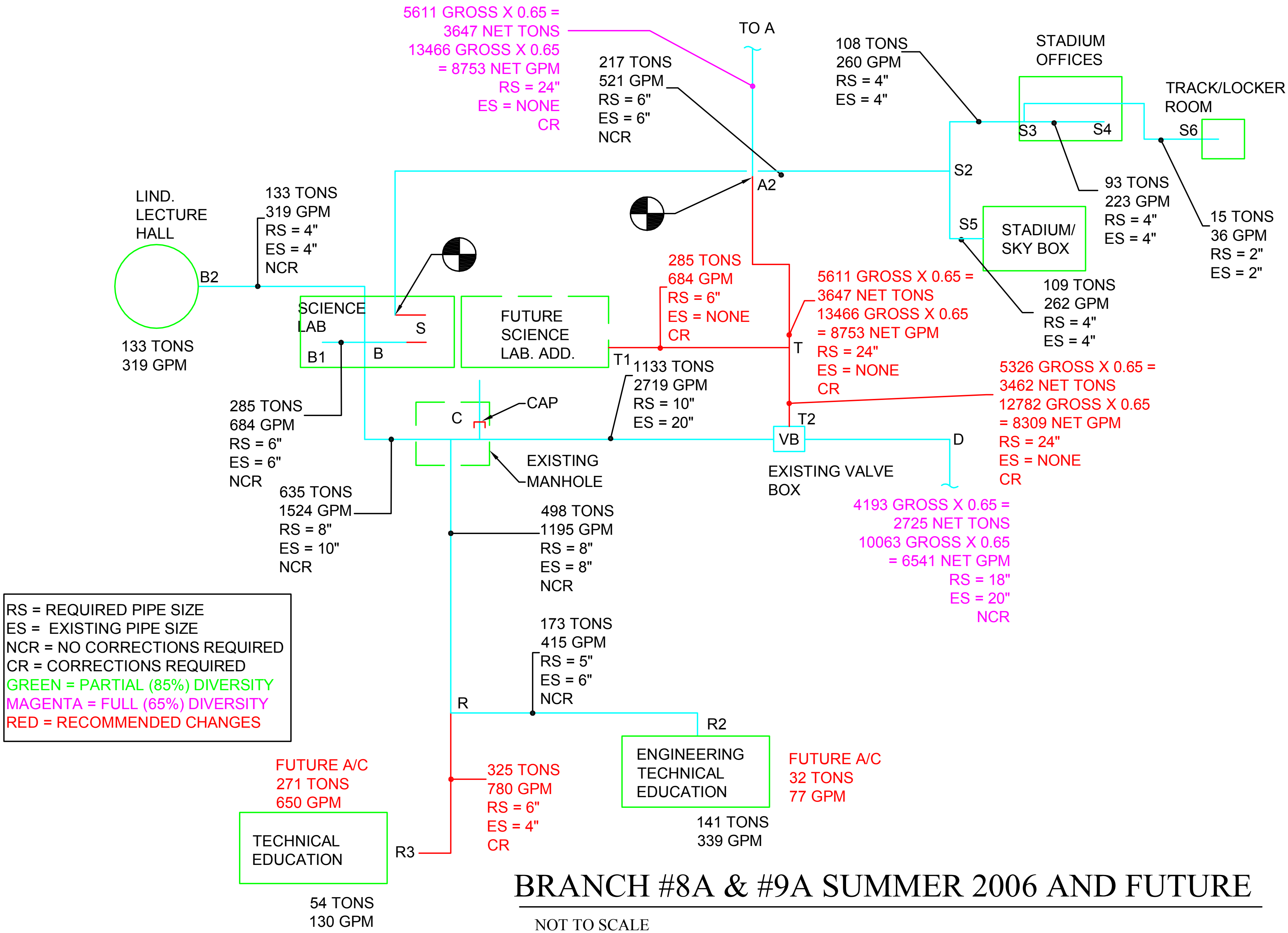
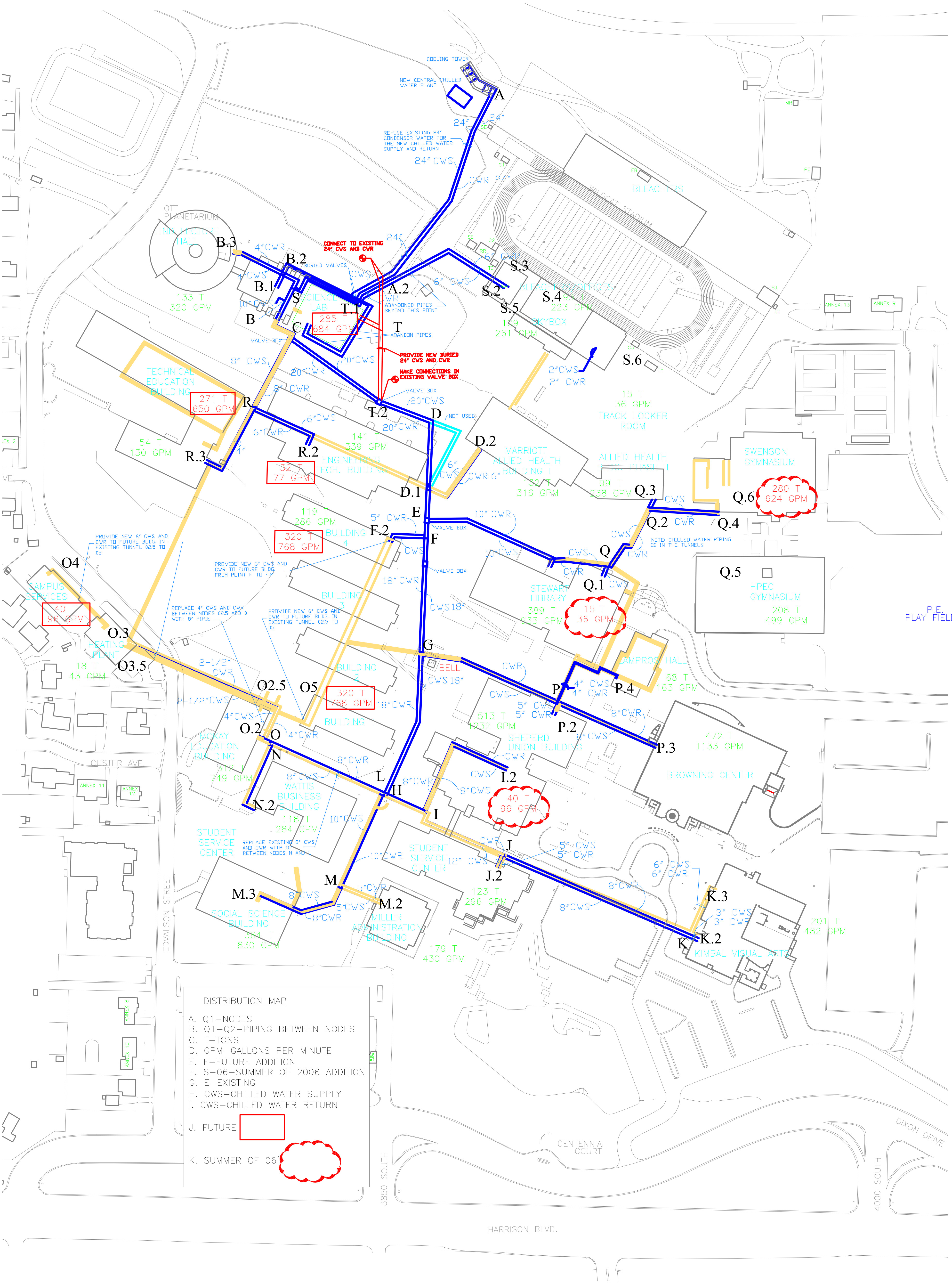


BRANCH #8A & #9A SUMMER 2006 AND FUTURE

NOT TO SCALE



WEBER STATE UNIVERSITY
CAMPUS PIPIPING DISTRIBUTION MAP
CHILLED WATER LOOP

4.3 CHILLED WATER PUMPING SYSTEM SUMMARY

A. The existing chilled water plant pumping system consists of primary pump loops for each chiller, and a secondary pump loop for the campus:

1. Primary Loops: There are two primary pumps for each chiller. Each pump in the Trane room is sized for approximately 50% of the chiller capacity, or 1300 GPM each. The two primary pumps in the Carrier room are closer to 100% redundant. Pump P-4 is sized for 2733 GPM and pump P-3 is sized for 2108 GPM. Pump P-4 runs as the lead primary pump, and pump P-3 runs as a manual back-up for the chilled water or condenser water as necessary.

2. Secondary Loop:
   a. Pumps P-1 and P-2 are the main campus pumps. Each is sized for 3000 GPM and 120 ft of head. Both pumps have Variable Frequency Drives.
   b. The VFD is ramped based on the worst case scenario of three differential pressure sensors in the campus loop. Currently this differential pressure has been set high enough to satisfy the pressure demands of the Skybox and Kimball Fine Arts buildings. This high pressure is causing problems at some of the buildings closer to the plant and at lower elevations. Most of the relief valves in these areas have been changed, or adjusted to handle the higher pressure, but there are still occasional problems. In addition, many of the buildings closer to the central plant have

pressure reducing valves in the chilled water lines to protect against this problem.

c. Both of P-1 and P-2 pumps need to operate simultaneously to deliver **6000 GPM** in order to meet the peak chiller capacity. In fact, with a 10 degree delta T on the chilled water, the maximum pumping capacity is closer to **2500** tons. This is approximately **490** tons less than the maximum chiller capacity. In a case where the campus load exceeds 2500 tons, it will be necessary to use a larger delta T, and if possible, a colder supply water temperature to meet that additional demand.

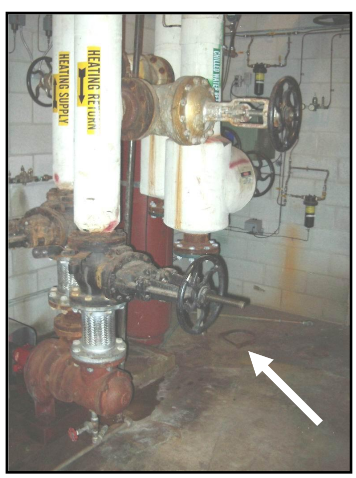
Existing Campus Load	GPM
➢ Existing connected load:	5,943
➢ Chilled water pump capacity:	6,000
➢ Excess capacity:	57

Summer 2006 Load	
➢ Projected summer 2006 load:	6,425
➢ Chilled water pump capacity:	6,000
➢ Capacity insufficiency:	425

Projected Future Load	
➢ Projected future load:	8,753
➢ Chilled water pump capacity:	6,000
➢ Capacity insufficiency:	2,753

B. The individual buildings vary in their chilled water distribution systems. Some buildings have main chilled water pumps, some have coil pumps, and some do not have pumps. Some of the pumps are running, and some have been shut-off and bypassed. See section 2.3 for an individual building load summary.

Chilled Water Pump
Student Services Building



Chilled Water Pump Removed
Administration Building

No Pumps – Piped Directly to Coils
Kimball Arts

C. Chilled Water Pumping System Summary

1. The existing pumps in the Trane room are fairly new pumps and are in good condition. The existing pumps in the Carrier room are older and in fair condition.
2. The existing campus pumping system has reached its' operating limits. It must operate at full capacity to meet current campus needs, and does not have adequate back-up. If a primary pump is lost, the campus capacity is reduced by 50% of one chiller. This could be as much as 625 tons. If a secondary pump is lost, the entire campus cooling capacity will be reduced by 50%.
3. The individual building requirements of the Skybox and Kimball Fine Arts buildings are requiring the campus loop to run at a higher pressure than needed.
   a. The static pressure in the system is a result of the elevation difference between the highest point in the system and the lowest point plus the system fill pressure. Currently, the high point in the system is the air handler at the top of the Skybox. The elevation of the 1st floor of the Skybox is approximately 4760 feet, and the approximate elevation of the highest chilled water coil in the skybox is approximately 4810 feet. The lowest point in the system is around the Business Building, Social Science Building, and Administration Building. The basement mechanical room elevations are approximately 4600 feet. This will result in a static pressure of approximately 90 psig at the lowest point in the system. If the fill pressure is 10 psig higher than the static resulting from elevation, then total static pressure of the system will be around 100 psig at the lowest point in the system.
   b. The pump pressure is 120 feet, or approximately 52 psig. The actual pressure at any point in the system will be the static pressure plus the working pressure, minus the line losses. The low buildings in the system will have a pressure of 142 psig – line losses from the pump to the building. These line losses from the pumps to these buildings will be around 10-15 psig. This will result in an overall pressure of approximately 137 – 142 psig at these low points. Some buildings have pressure reducing valves that may limit this pressure, but some do not. The flanges and fittings in these buildings are rated at 125 psig. There is a safety factor, but it is definitely better to not use a safety factor, and make the corrections in the system necessary to reduce the overall pressure at these buildings below 125 psig. This could be done most effectively by de-coupling the high points, which is the Skybox loop. It may also be done by adding pressure reducing valves at all of the lower points, but doing so, may result in the low buildings not having enough pressure left over to return the water to the central plant.
4. See Section 6 for new plant recommendations, as well as pumping system recommendations.

SECTION 5 – NEW CENTRAL CHILLED WATER PLANT OPTIONS

5.1 Introduction

A. This section provides six different chiller combinations and capacities for the new central chilled water plant.

B. Options or recommendations for Free Cooling and Thermal Ice Storage are also provided in this section.

C. The combination graphs indicate the different operational stages and the corresponding capacity of the chillers at these stages.

D. See Appendix A.6 for chiller optimization and SPLV (**S**ystem **P**art **L**oad **V**alue efficiency) summaries. These runs also have VFD (**V**ariable **F**requency **D**rive) options and costs.

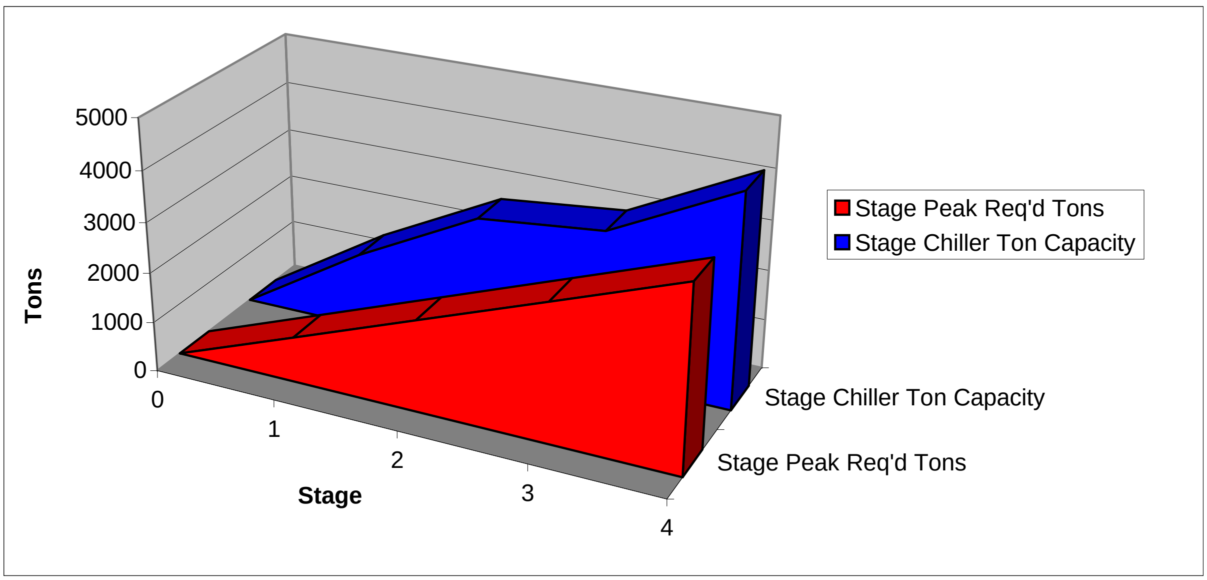
5.2 NEW CENTRAL CHILLED WATER PLANT CHILLER COMBINATIONS

New Central Chilled Water Plant Chiller Combinations: Combination A

Combination A			
Chiller #	New/Existing	Size (tons)	VFD
CH-1	New	1500	Yes
CH-2	Existing	1250	No
CH-3	New	1500	Optional***
CH-4	Existing	650	No
	Combination Capacity:	**4900**	

Campus Peak Tons Req'd	Combination Capacity	Excess Tons
3647	4900	1253

Stage	Chillers Operating	Standby Chillers	Stage Chiller Ton Capacity
0	0	1,2,3,4	0
1	1	2,3,4	1500
2	1,2	3,4	2750
3	1,3	2,4	3000
4	1,2,3	4	4250



*Chiller manufactures provide twin compressors for chillers over 1500 Tons.

**Plate and Frame Exchanger will be provided for the first stage of cooling during spring, winter, and fall
See Appendix A.4 for cut sheets.

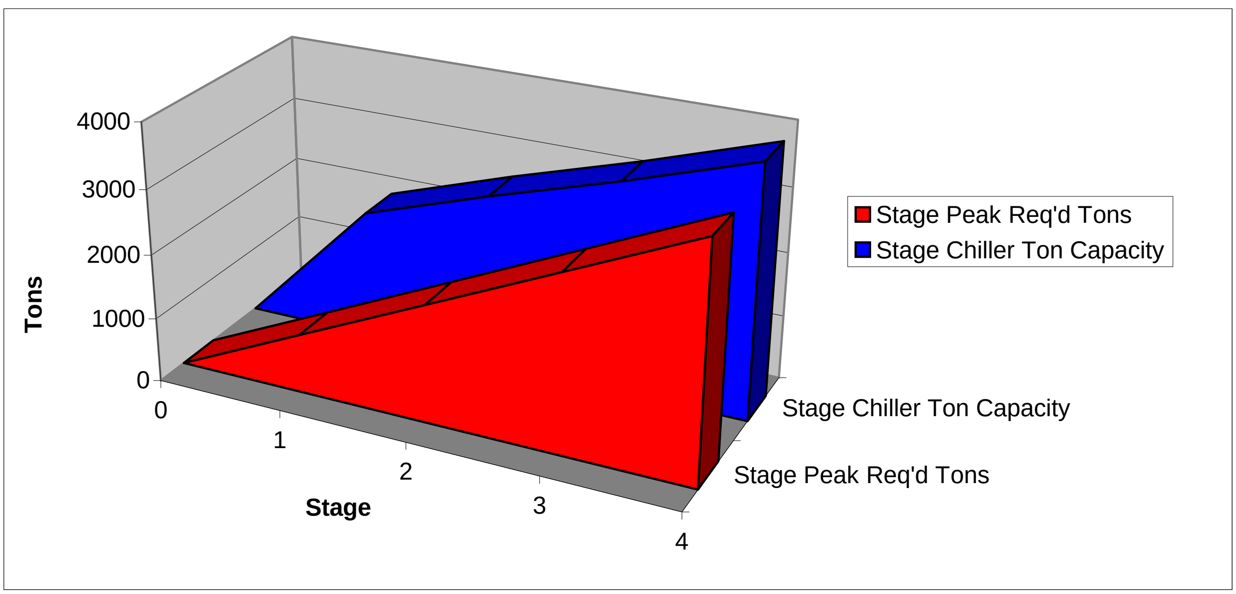
***See Appendix A.6. for option - Combination A and A-1 life cycle cost and optimization.

New Central Chilled Water Plant Chiller Combinations: Combination B

Combination B			
Chiller #	New/Existing	Size (tons)	VFD
CH-1	New	2000	Yes
CH-2	Existing	1250	No
CH-3	New	1250	No
CH-4	Existing	650	No
Combination Capacity:		**5150**	

Campus Peak Tons Req'd	Combination Capacity	Excess Tons
3647	5150	1503

Stage	Chillers Operating	Standby Chillers	Stage Chiller Ton Capacity
0	0	1,2,3,4	0
1	1	2,3,4	2000
2	1,4	2,3	2650
3	1,2	3,4	3250
4	1,2,4	3	3900



*Chiller manufactures provide twin compressors for chillers over 1500 Tons.

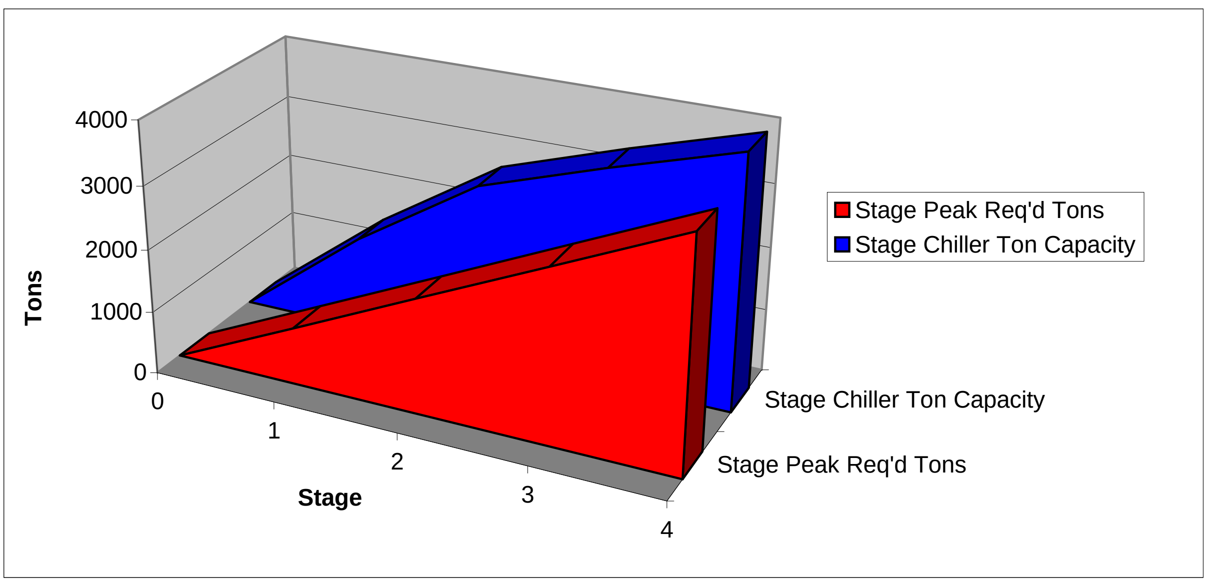
**Plate and Frame Exchanger will be provided for the first stage of cooling during spring, winter, and Fall
See Appendix A.4 for cut sheets.

New Central Chilled Water Plant Chiller Combinations: Combination C

Combination C			
Chiller #	**New/Existing**	**Size (tons)**	**VFD**
CH-1	New	1500	Yes
CH-2	Existing	1250	No
CH-3	New	1250	Optional***
CH-4	Existing	650	No
Combination Capacity:		**4650**	

Campus Peak Tons Req'd	Combination Capacity	Excess Tons
3647	4650	1003

Stage	Chillers Operating	Standby Chillers	Stage Chiller Ton Capacity
0	0	1,2,3,4	0
1	1	2,3,4	1500
2	1,2	3,4	2750
3	1,2,4	3	3400
4	1,2,3	4	4000



*Chiller manufactures provide twin compressors for chillers over 1500 Tons.

**Plate and Frame Exchanger will be provided for the first stage of cooling during spring, winter, and Fall See Appendix A.4 for cut sheets.

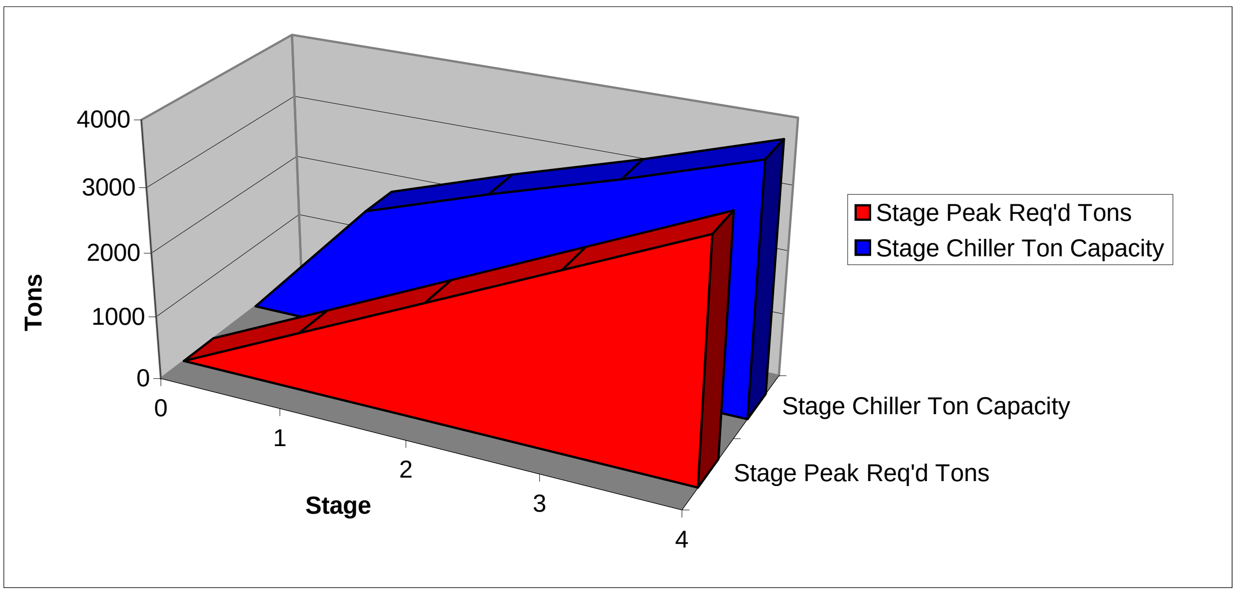
***See Appendix A.6 for option - Combination C and C-1 life cycle cost and optimization.

New Central Chilled Water Plant Chiller Combinations: Combination D

Combination D			
Chiller #	New/Existing	Size (tons)	VFD
CH-1	New	2000	Yes
CH-2	Existing	1250	No
CH-3	New	1500	No
CH-4	Existing	650	No
Combination Capacity:		**5400**	

Campus Peak Tons Req'd	Combination Capacity	Excess Tons
3647	5400	1753

Stage	Chillers Operating	Standby Chillers	Stage Chiller Ton Capacity
0	0	1,2,3,4	0
1	1	2,3,4	2000
2	1,4	2,3	2650
3	1,2	3,4	3250
4	1,2,4	3	3900



*Chiller manufactures provide twin compressors for chillers over 1500 Tons.

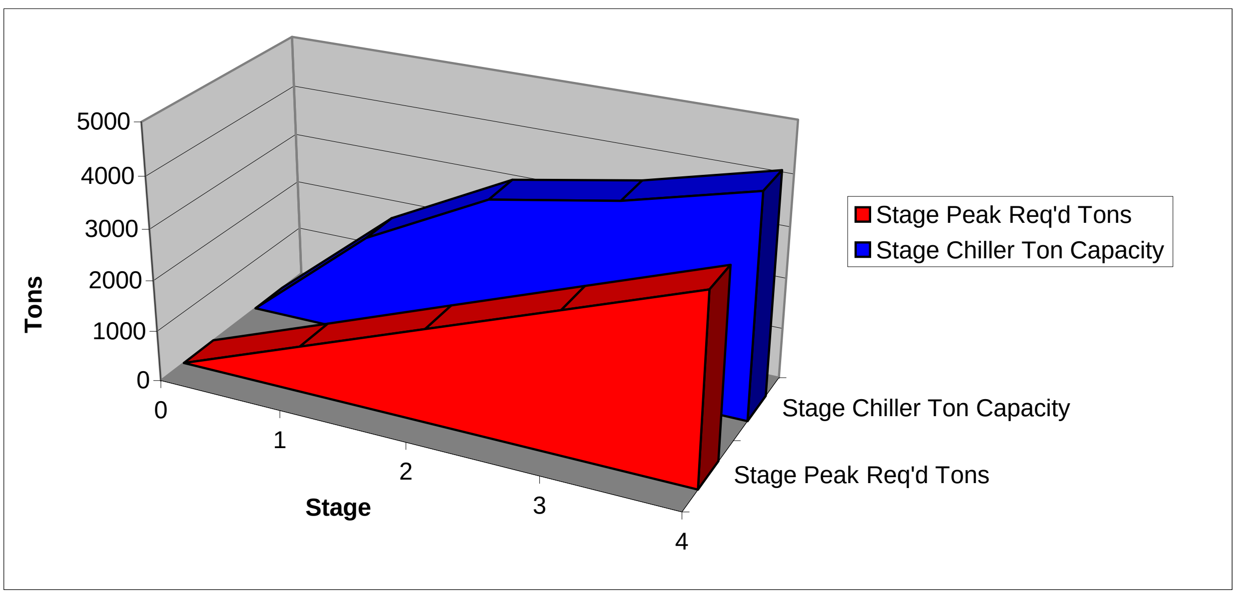
**Plate and Frame Exchanger will be provided for the first stage of cooling during spring, winter, and Fall
See Appendix A.4 for cut sheets.

New Central Chilled Water Plant Chiller Combinations: Combination E

Combination E			
Chiller #	New/Existing	Size (tons)	VFD
CH-1	New	2000	Yes
CH-2	Existing	1250	No
CH-3	New	1700	No
CH-4	Existing	650	No
Combination Capacity:		**5600**	

Campus Peak Tons Req'd	Combination Capacity	Excess Tons
3647	5600	1953

Stage	Chillers Operating	Standby Chillers	Stage Chiller Ton Capacity
0	0	1,2,3,4	0
1	1	2,3,4	2000
2	1,2	3,4	3250
3	1,3	2,4	3700
4	1,3,4	2	4350



*Chiller manufactures provide twin compressors for chillers over 1500 Tons.

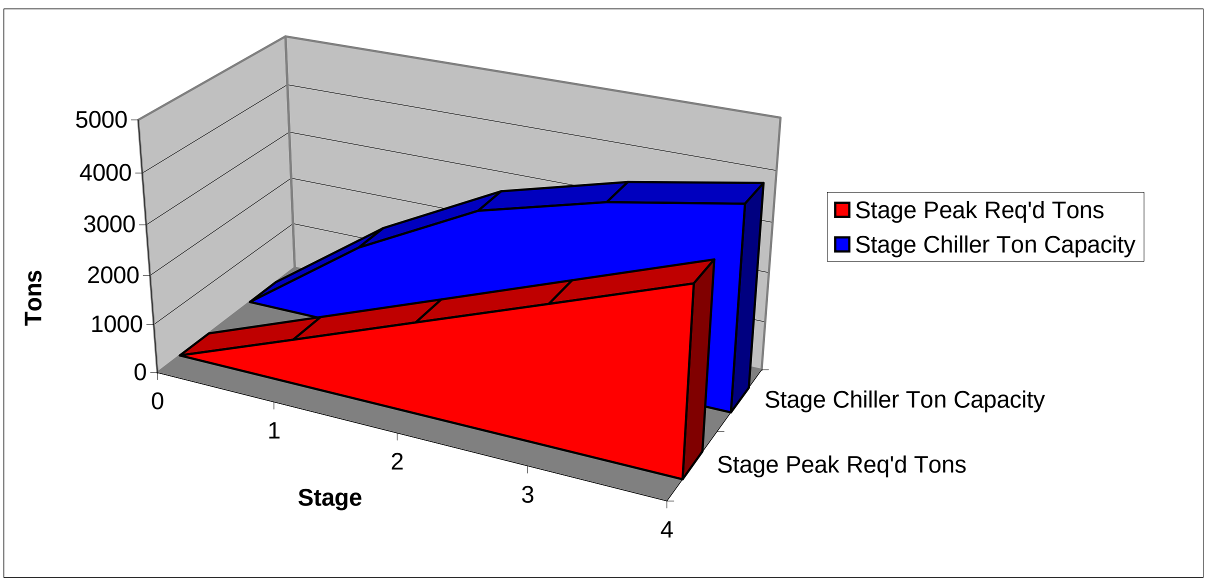
**Plate and Frame Exchanger will be provided for the first stage of cooling during spring, winter, and Fall
See Appendix A.4 for cut sheets.

New Central Chilled Water Plant Chiller Combinations: Combination F

Combination F			
Chiller #	**New/Existing**	**Size (tons)**	**VFD**
CH-1	New	1700	Yes
CH-2	Existing	1250	No
CH-3	New	1700	Optional***
CH-4	Existing	650	No
Combination Capacity:		**5300**	

Campus Peak Tons Req'd	Combination Capacity	Excess Tons
3647	5300	1653

Stage	Chillers Operating	Standby Chillers	Stage Chiller Ton Capacity
0	0	1,2,3,4	0
1	1	2,3,4	1700
2	1,2	3,4	2950
3	1,2,4	3	3600
4	1,3,4	2	4050



*Chiller manufactures provide twin compressors for chillers over 1500 Tons.

**Plate and Frame Exchanger will be provided for the first stage of cooling during spring, winter, and Fall
See Appendix A.4 for cut sheets.

***See Appendix A.6 for option - Combination F and F-1 life cycle cost and optimization.

5.3 Chiller Combination Cost Comparison

A. Combination A – (Two VFD's)

Approximate Chiller Cost: $1,043,000
Approximate System Part Load Value: 0.320 KW/Ton

Combination A-1 – (One VFD, One Constant)

Approximate Chiller Cost: $998,000
Approximate System Part Load Value: 0.352 KW/Ton

B. Combination B

Approximate Chiller Cost: $1,076,000
Approximate System Part Load Value: 0.393 KW/Ton

C. Combination C

Approximate Chiller Cost: $957,000
Approximate System Part Load Value: 0.329 KW/Ton

D. Combination D

Approximate Chiller Cost: $1,143,000
Approximate System Part Load Value: 0.352 KW/Ton

E. Combination E

Approximate Chiller Cost: $1,285,00
Approximate System Part Load Value: 0.337 KW/Ton

F. Combination F – (Two VFD's)

Approximate Chiller Cost: $1,266,000
Approximate System Part Load Value: 0.293 KW/Ton

Combination F-1 – (One VFD, One Constant)

Approximate Chiller Cost: $1,197,000
Approximate System Part Load Value: 0.336 KW/Ton

5.4 Plate and Frame Heat Exchanger (Free Cooling)

A. The campus is preparing to operate the chilled water system year round. One possible option to achieve significant energy savings during cooler periods such as winter, spring and fall is to use condenser water to cool the chilled water loop.

B. The condenser water can be used to cool the chilled water loop effectively through a Plate and Frame Heat Exchanger. The exchanger shall be sized for the capacity of the 1st stage chiller, when outdoor air wet bulb temperature is less than the chilled water set-point, minus the approach temperatures of the heat exchanger and the cooling tower.

C. The cooling tower can bring the condenser water loop temperature close to the outdoor wet bulb temperature. If the condenser water is used to maintain the normal chilled water set point of 45 degrees F, then the heat exchanger loop can handle the load when outdoor air wet bulb temperature is less than 40 degrees F. In Ogden, Utah, this condition is typically available from November through March, including ½ of April and ½ of October. This is an overall total of approximately 6 months a year where the chilled water demand could be met without the use of the chillers.

D. See recommendations Section 6.3 for further recommendations regarding the plate and frame heat exchanger. See section 6.2 B. for associated pumping recommendations.

E. See Appendix A.4 for preliminary Plate & Frame Heat Exchanger selection.

F. The change over between "free cooling" and mechanical cooling shall be accomplished automatically using electronic 3-way valves, return water temperature, and outdoor wet bulb temperature.

G. See Appendix A.6 for energy savings and approximate operating hours.

5.5 Thermal / Ice Storage Option

A. Due to the high peak demand cost, Weber State University has asked that the option for thermal storage be investigated. See Appendix A.5 for product literature.

B. The new efficient chillers are much more reliable then their older predecessors. See Appendix A.6 for KW/TON for part load conditions of the chillers.

C. The principle behind chilled water storage is to produce and store ice during off peak hours for use during the peak hours. This reduces on-peak electrical demand by shifting electrical demand to off-peak hours in order to obtain on-peak cooling at close to off-peak costs.

D. A common design mistake in using this system is under sizing the chillers so they are unable to handle the connected load when the ice storage system is down.

E. The best ice making machines, if this is used in lieu of using the chillers, can produce ice at 0.63 KW/TON.

F. Storage for the ice or chilled water consumes a large amount of real estate.

SECTION 6 – NEW CENTRAL CHILLER PLANT RECOMMENDATIONS

6.1 Recommended Central Chiller Plant Upgrades

A. Recommended Central Chiller Plant Chiller Combinations

1. Combinations “**A**” and “**F**” we feel are the best two choices for the new Central Chilled Water Plant.

2. Combination “**A”** is recommended for the following reasons:
   a. Using standard chiller sizes; not using two compressors with a one pass machine. This will likely achieve a more competitive bid and a lower initial cost per Ton.
   b. Requires less physical space, leaving more room for maintenance, etc.
   c. Even though this combination does not provide 100% back-up, it will provide sufficient back-up capacity (93%).
   d. Lower life cycle cost.
   e. This combination remains one of the more efficient combinations, although not quite as efficient as combination “F”.

3. Combination “**F**” is recommended for the following reasons:
   a. More efficient (lower SLPV).
   b. Total 100% back-up without having to install larger chillers.
   c. Some chiller manufactures can supply the 1700 Ton chiller using only one compressor; however, some manufactures like Carrier might have a problem.

4. Life Cycle Cost Analysis

Life Cycle Cost Approximations

Combo	Peak kw/ton	SPLV	Overall Annual Energy Cost	Initial Cost	Payback Term (yrs)
Combo A	0.425	0.32	$157,389	$1,043,000	5.09
Combo A1	0.425	0.352	$166,233	$998,000	0.00
Combo F	0.4	0.293	$145,844	$1,197,000	9.76
Combo F1	0.405	0.336	$158,508	$1,152,000	19.94

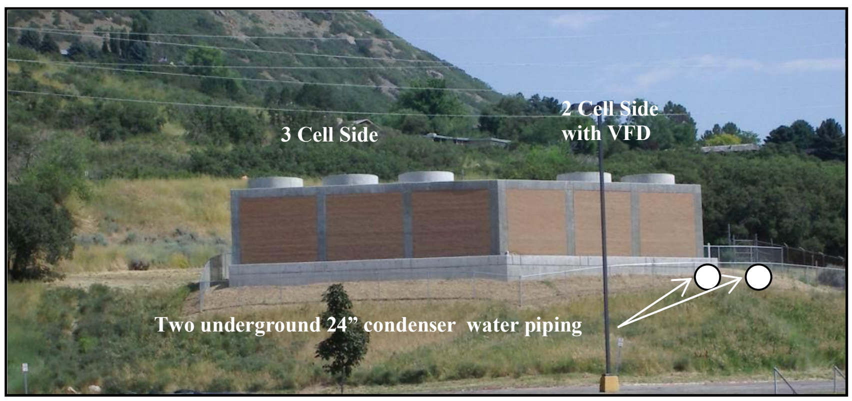
Peak Demand $/KW	$8.78
Operating $/KW	$0.28634
Operating Hours/yr	5070

The life cycle cost analysis shows that chiller combination A-1 with 1 new 1500 ton chiller with a VFD and 1 new 1500 Ton chiller without a VFD is the lowest cost for the 1st 5 years. Typically a life cycle cost that does not pay back within 5 years is not considered;

however, with energy costs escalating, a payback term of 5.2 years is definitely worth considering. Combinations F and F-1 are not as economical according to the life cycle cost analysis. The advantage with combinations F and F-1 is the 100% back-up for all conditions. The University will need to decide which is a higher priority, the life cycle cost or the 100% back up. Based off of that decision, the design team can then proceed with the combination that best meets the University's highest priorities.

B. Cooling Tower Addition

1. A five (5) cell Cooling Tower, manufactured by Tower Engineering, Inc. was installed at the end of 2000 and the beginning of 2001. The cooling tower is located east of parking lot W5 and north of the stadium on the crest of the hill. The total cooling tower consists of three (3) cells located on the north side and two (2) cells, with VFD drives, located on the south side.



2. Each of the cooling tower's five (5) cells has a capacity of 700 Tons and 2100 GPM. The total capacity of the cooling tower is 3500 Tons and 10,500 GPM.

3. 24" condenser water piping is routed west and underground from the tower basin to the existing central chilled water plant located in the lower floor of the Science Lab Building.

4. The existing cooling tower capacity is not large enough to handle the new proposed central chilled water plant.

5. Design options were discussed with Tower Engineering, Inc. The following paragraphs are results of these discussions, as well as our recommendations for adding capacity to the existing tower.

6. Since the installation of the new cooling tower, a maintenance procedure was conducted in which the fill was removed, the tower cells cleaned, and the fill replaced. The contractor however, did **not** install the fill per the manufactures recommendations resulting in lower tower efficiency.

7. Tower Engineering, Inc., through their engineering technical service department, came up with two options for increasing the capacity of the existing cooling tower in order to meet the increased load of the new central chiller plant.

   a. Option 1:
      1) Remove the entire existing ceramic tile from the existing five (5) cell tower and replace with a new high performance combination (HPC) ceramic plaster tile that is 30% more efficient than the existing fill.
      2) The HPC fill will increase the existing tower capacity from 700 Tons per cell to 900 Tons per cell. The total capacity of the existing tower will increase from 3500 Tons to 4500 Tons. New fill shall be installed in accordance with Tower Engineering instructions.
      3) If the new HPC fill is used in all five (5) cells, only one (1) additional 900 Ton cell would be required. The retrofitted tower would become a six (6) cell tower with an overall capacity of 5,400 Tons and 13,200 GPM.

   b. Option 2:
      1) Remove the entire existing ceramic tile from all five (5) cells and replace with the same tile using the pattern approved by Tower Engineering.
      2) The capacity of the cooling tower after the fill is installed properly is 3,500 Tons and 10,500 GPM.
      2) Provide one (1) new 900 Ton cell with the (HPC) tile to the existing five (5) cells with existing ceramic tile, making the tower into a six (6) cell tower. The tower would then have an overall capacity of 4,400 Tons and 13,200 GPM.

   c. The peak capacity of the new condenser water system is 4,560 Tons and 10,950 GPM. Option 1 provides 5,400 Tons and 13,200 GPM, adequately handling the peak demand. Option 2 provides 4,400 Tons and 13,200 GPM which is slightly less than demand in Tons, but adequate for GPM. Option 1 provides back-up if one cell should fail. The excess capacity in option 1 will also allow for increased chiller capacity.

8. We recommend Option 1 for the following reasons:

   - 30% more efficient cooling tower.
   - Adequately handles the new system loads.
   - Future available capacity.

9. Cooling Tower capacity summary:

Existing Cooling Tower Capacity	Ton	GPM
700 Tons x 5 cells	3,500	
2100 GPM x 5 cells		10,500
Totals	**3,500**	**10,500**

New Modified Tower Capacity	Ton	GPM
900 Tons x 5 cells	4,500	
New 900 Ton additional cell	900	
2100 GPM x 5 cells		10,500
2700 GPM additional cell		2,700
Totals	**5,400**	**13,200**

10. We also recommend a modification to the 24" condenser water piping from the tower. We recommend a new 24" condenser water line be routed from the tower basin to the new central chilled water plant.

11. The two existing 24" condenser water lines routed to the existing central chilled water plant, located in the basement of the Science Lab Building, will be re-used as the chilled water piping in the new scheme.

6.2 Recommended Campus Distribution System Upgrades

A. Campus Piping System Recommendations

1. Piping System Recommendations:

   Leave the chilled water distribution system a secondary loop, direct return system from the campus buildings to the central chilled water plant.

   a. Direct return piping is the most economical arrangement because it requires a minimum amount of piping.
   b. Friction, in the piping, is the principal source of operating costs in closed water systems. This being the case, a direct return system has less pipe friction than any other equivalent system.
   c. The direct return system is a simple system and the most efficient pumping system for multiple building systems with a central chilled water plant.

2. Central plant chiller room piping design guidelines:

   a. Provide a primary loop system.
   b. Install the piping so that the energy consumption of the chillers is not increased. Chillers are more vulnerable to incorrect installation due to the fact that their energy consumption is greatly affected by the piping arrangement.
   c. Arrange the piping so that all chillers receive the same water temperature.
   d. Insure that the required water flow through the chillers is always maintained.
   e. Install the chillers and piping in accordance with the manufacturer's instructions and recommendations.

3. Remove and replace the undersized chilled water piping, located in the existing campus distribution system noted in Section 4.2 A.

B. Campus Pumping System Recommendations

1. The new central chilled water plant should consist of four (4) chillers and one (1) plate and frame heat exchanger.

2. Primary (Chiller) Pumps: Each chiller and the plate and frame heat exchanger shall have a dedicated primary constant volume in-line pump. The primary pumps, serving the plate and frame exchanger and one (1) of the large chillers, shall have a manual bypass allowing each pump to back up the other in case of pump failure.

3. Secondary (Campus) Pumps: The campus loop shall be served by three (3) base mounted vertical or horizontal split case pumps.

a. Each pump shall be sized for 50% of the overall future net load, or approximately 4377 GPM per pump. The overall head pressure shall be designed to meet the needs of the Skybox and Kimball buildings. This arrangement allows one (1) pump to fail, while the remaining pumps still provide 100% of the capacity. It will also allow 1 pump to handle the campus load when the demand is less than 50% of the overall peak.

b. Each pump shall have a variable frequency drive. The VFD shall run off a differential static pressure sensor. This sensor shall be located in the tunnels between the Business building and the Student Service Center. The differential pressure shall be set to meet the design flow rates required at the longest runs, which is currently the Kimball building. In the future, if pumps are added at this building, or if another building is added at a longer run, then the differential pressure set-point shall be re-set to meet the needs at the new longest run.

4. <u>Tertiary (Building) Pumps:</u> The buildings that are connected to the campus chilled water loop should be modified to be consistent across campus. Each building should have building chilled water pumps with variable frequency drives, and two way automatic valves. In addition:

   a. **Tertiary pumps** should be added at buildings that currently do not have pumps, as well as at all new buildings. Tertiary pumps shall be repaired or replaced at buildings where they are already installed. Variable frequency drives shall be provided for these existing or replaced pumps. As tertiary pumps are added at the pump pressure critical path (lines with the highest pressure requirements), the secondary pump differential pressure set-point should be re-adjusted by a qualified Test and Balance Contractor to meet new pressure requirements. This will be determined by setting the differential pressure to maintain design flow at the buildings with the greatest pressure requirements. The buildings with the greatest pressure requirements will be those with the longest runs, and those without tertiary pumping systems.

   b. **Automatic Bypass:** Because of the existing conditions at each building, the new secondary pumps will be sized for the current largest pressure requirements. This pressure is adequate to provide the full chilled water flow at most buildings, and as a result, their tertiary pumps have been permanently bypassed. Existing manual bypasses shall be replaced with automatic bypasses. Buildings that do not currently have a bypass, as well as new buildings, shall be provided with an automatic bypass. This bypass shall include a 3-way valve upstream of the chilled water pump. This valve shall be controlled by the BMS. It shall bypass the pumps when the central pumping system is capable of meeting the chilled water demand. This shall be measured by chilled water return temperature. When the campus pumping system cannot meet the building chilled water demand, the bypass shall open to the pump, and the building chilled water pump VFD shall modulate to meet demand.

c. The first location to add the tertiary pumps is the Kimball Fine Arts building, because it is currently the longest run. Adding tertiary pumps at this building could reduce the overall system pressure requirements by as much as10-15 psig. If the campus chilled water loop goes to year round operation, this could save as much as $10,000 per year in pump energy costs.

d. The addition of the tertiary pumps and automatic bypass valves will give better building control, more flexibility, and better energy efficiency; however, these changes are not required immediately. The secondary loop will be designed to handle the existing system as is, allowing the changes to the building pumps to be made in the future as desired by the University.

5. <u>Skybox Pump Loop:</u>

a. The skybox buildings should be completely de-coupled from the rest of the campus chilled water loop. This can be done by providing a plate and frame heat exchanger at the old chiller room under the Science building. One side of the plate and frame will be fed by the campus system. The other side will be an entirely separate loop with two 100% redundant pumps, including air separator, expansion tank, water make-up, chemical treatment, etc. This pump loop can be tied into the existing 6” line that runs from the science building to the skybox buildings. This loop and its associated equipment shall be sized for the 217 tons and 521 GPM required at the skybox buildings. The plate and frame exchanger shall be sized with the ability to add plates in the future for increased capacity.

b. The new chiller plant location will be at an elevation of approximately 4750 feet. De-coupling the Skybox loop at the old plant will reduce the static pressure in the system by 60 feet, or approximately 26 psig. The additional line losses for the new plant location could be as high 30 feet, or 13 psig. Half of that will need to be added to the working pressure at the lower buildings to get the water back to the plant, and half of that will be lost between the plant and the buildings. In summary, after de-coupling the Skybox, and re-locating the chiller plant, the worst case scenario total overall pressure at the lower buildings would be approximately 118 – 123 psig.

c. This total overall pressure at the low buildings could be further reduced by adding the tertiary pumps at the Kimball Fine Arts Building. Such pumps could reduce the system working pressure by an additional 10-15 psig.

6. Condenser Water Pumps: Provide 3 condenser water pumps with variable frequency drives. These pumps shall be sized for 50% of the overall condenser water load. The VFD shall modulate to maintain minimum flows at each chiller. This shall be coordinated with the chiller manufacturer, and integrated into the chiller controls.

6.3 Plate and Frame Heat Exchanger – Free Cooling

A. We recommend the installation of a plate and frame heat exchanger in the new central chilled water plant for free cooling.

1. The plate and frame heat exchanger, pumps and piping are to be routed in a parallel bypass circuit with the new chillers. Size the plate and frame for 1500 tons of free cooling at design conditions. The chiller optimizer runs found in Appendix A.6 are very favorable for the free cooling option.

2. The Design parameters recommended for free cooling are as follows:

   a. Select plate and frame exchanger at no more than two degrees F. approach.
   b. Pressure drop on chilled water side and condenser water side through the plate and frame exchanger shall match the pressure drop through the chillers.
   c. Provide automatic change over between the free cooling (evaporation) and the mechanical chilling cycles. The reason for the automation is that with automation the system will take advantage of every occurrence when outdoor conditions are suitable for free cooling.

B. We recommend the following change over sequence:

1. Cycle Changeover (Mechanical to Evaporative) –

   a. When wet bulb temperature is less than the chilled water set point minus the approach temperatures of the plate and frame heat exchanger and cooling tower the following sequence will occur:
      1) Chillers are stopped.
      2) Chilled water pump continues to run.
      3) Condenser auto valve on lead chiller is open to plate and frame heat exchanger.
      4) Cooling tower set point is changed to chilled water supply set point to cool the condenser water loop.
      5) When condenser water supply temperature is less than the chilled water return temperature, the lead chiller's chilled water auto valve is open to the plate and frame heat exchanger.

2. Cycle Changeover (Evaporative to Mechanical) –

   a. When wet bulb temperature plus the approach temperatures of the plate and frame heat exchanger and the cooling tower is greater than the chilled water supply set point, the:

1) Lead chiller water auto valve will open to chiller.
2) Cooling tower set point will change to the mechanical cycle set point.
3) Lead chiller will start.
4) Lead chiller auto damper condenser valve will modulate to maintain the required head pressure.

6.4 Refrigeration Safety

A. Owner Liability

1. As an owner and user of refrigerants, DFCM, the engineer, and Weber State University are automatically liable for the requirements of ASHREA 15-1994 by being aware of the standard. In any new chiller equipment rooms, ASHRAE 15-1994 automatically applies.
2. ASHREA15-1994 requires that all chilled water plants be provided with some means for detecting and evacuating refrigerants from the space.

B. Room Evacuation and Ventilation

1. The new central cooling plant room must have a mechanical exhaust system interconnected to the refrigerant detector/sensor so that when the exposure limit of refrigerant is exceeded, an alarm will sound and the exhaust fan will activate. The ASHRAE formula for sizing ventilation capacities is $Q= 100 \times G^{0.5}$ where Q= air flow CFM and G= mass of refrigerant in lbs.

C. Emergency Breathing Apparatus

1. A self-contained breathing apparatus (SCBA) must be provided at entrances to the chiller room located on the outside of the room. The SCBA must be worn anytime the sensor has alarmed and someone needs to enter the room for any reason.

D. Chiller Room Requirements

1. Provide tight seal doors at any entrance into the new chiller plant.
2. All purge lines and relief devices from the chillers shall vent outside on the roof. Relief discharge must be located not less than 20 feet from ventilation openings and not less than 15 feet above ground level.
3. ASHRAE 15-1994 specifies that access to the chiller room should be restricted to authorized personnel.
4. Provide sensor/detectors in the chiller room at the noted locations:
   1) between the chillers at floor level.
   2) Refrigerant storage – floor area.
   3) Any point lower than floor.
5. Provide requirements noted in paragraph B-1 for chiller room evacuation.
6. Provide requirements noted in paragraph C-1 for self-contained breathing apparatus.

E. Refrigerant Storage

1. The total amount of refrigerant stored without relief valves piped in accordance with ASHRAE 15-1994 standard must not exceed 330 pounds.

WEBER STATE UNIVERSITY

CHILLED WATER STUDY COST ESTIMATE - Preliminary Opinion of Probable Costs
CHILLER PLANT - Combination A

7.1 A.

Item Description	Amount	Units		Materials		Labor		Cost		Total
Demolition										
Chiller - Carrier	1	LS			$	3,500.00	$	3,500.00	$	3,500.00
Chiller - 1250 Ton Relocation	1	LS			$	25,240.00	$	25,240.00	$	25,240.00
Chiller - 650 Ton Relocation	1	LS			$	20,240.00	$	20,240.00	$	20,240.00
Piping	1	LS			$	3,000.00	$	3,000.00	$	3,000.00
Pumps, Ex. Tanks, Electrical, Controls Softener	1	LS			$	23,000.00	$	23,000.00	$	23,000.00
Concrete										
Concrete Pads	36	CU. YD.	$	144.00	$	66.00	$	210.00	$	7,560.00
Cooling Tower										
Cooling Tower	1	EA	$	225,000.00	$	100,000.00	$	325,000.00	$	325,000.00
Meters and Gauges										
Thermometers	40	EA	$	90.00	$	12.00	$	102.00	$	4,080.00
Pressure Gauges	40	EA	$	36.00	$	34.00	$	70.00	$	2,800.00
Thermowells	30	EA	$	32.00	$	25.00	$	57.00	$	1,710.00
Supports and Anchors										
Pipe Hangers	96	EA	$	61.00	$	15.00	$	76.00	$	7,296.00
Pipe Supports	30	EA	$	200.00	$	7.00	$	207.00	$	6,210.00
Flanges/Wall Supports @ Penetrations	4	EA	$	920.00	$	203.00	$	1,123.00	$	4,492.00
Electrical										
VFD 250 HP	3	EA	$	27,380.00	$	3,100.00	$	30,480.00	$	91,440.00
VFD 100 HP	4	EA	$	11,715.00	$	1,600.00	$	13,315.00	$	53,260.00
VFD 60 HP	1	EA	$	8,458.00	$	1,425.00	$	9,883.00	$	9,883.00
VFD 30 HP	1	EA	$	4,675.00	$	975.00	$	5,650.00	$	5,650.00
VFD 20 HP	1	EA	$	3,300.00	$	735.00	$	4,035.00	$	4,035.00
Mechanical Identification										
Painting	1	LS	$	2,500.00	$	1,800.00	$	4,300.00	$	4,300.00
Valve Tags	90	EA	$	50.00	$	50.00	$	100.00	$	9,000.00
Name Plates	20	EA	$	40.00	$	60.00	$	100.00	$	2,000.00
Insulation										
Pump Casings	1	LS	$	1,800.00	$	600.00	$	2,400.00	$	2,400.00
Chilled Water Piping	800	LF	$	9.00	$	8.00	$	17.00	$	13,600.00
Equipment	1	LS	$	1,600.00	$	900.00	$	2,500.00	$	2,500.00
Plumbing										
Water Make-Up C/W (all assoc. valves)	1	LS	$	300.00	$	300.00	$	600.00	$	600.00
Water Piping, Valves, Insulation	1	LS					$	13,000.00	$	13,000.00
Pumps										
Condenser Water - Chilled Water Main - Chilled Water Circulators	10	LS	$	200,578.00	$	65,968.00	$	266,546.00	$	266,546.00
Sky Box Pumps	2	EA	$	6,900.00	$	2,000.00	$	8,900.00	$	17,800.00
Chiller/Equipment										
1500 Ton Chiller W/VFD	2	EA	$	521,500.00	$	21,700.00	$	543,200.00	$	1,086,400.00
Air Eliminator	1	EA	$	30,736.00	$	2,500.00	$	33,236.00	$	33,236.00
Expansion Tank	1	EA	$	25,147.00	$	1,000.00	$	26,147.00	$	26,147.00
Sky Box Plate & Frame, Piping, Ex. Tank, Air Eliminator	1	LS	$	45,679.00	$	9,300.00	$	54,979.00	$	54,979.00
Water Treatment										
Condenser Water - Treatment,Chemicals,Pumps,Piping, Valves	1	LS	$	3,000.00	$	2,000.00	$	5,000.00	$	5,000.00
Hydronic Piping										
Chilled and Condenser Water Piping & Valves	1	LS					$	398,000.00	$	398,000.00

WEBER STATE UNIVERSITY

CHILLED WATER STUDY COST ESTIMATE - Preliminary Opinion of Probable Costs

CHILLER PLANT - Combination A

7.1 A.

Item Description	Amount	Units	Materials	Labor	Cost	Total
Test & Balance						
Chillers	4	EA		$ 500.00	$ 500.00	$ 2,000.00
Pumps	10	EA		$ 250.00	$ 250.00	$ 2,500.00
Exchanger	1	EA		$ 300.00	$ 300.00	$ 300.00
Cooling Tower	6	EA		$ 320.00	$ 320.00	$ 1,920.00
Misc. O&M Manuals	4	EA		$ 400.00	$ 400.00	$ 1,600.00
Controls						
Automation System	1	LS	$ 138,600.00	$ 71,400.00	$ 210,000.00	$ 210,000.00
ASHRAE 15-94						
Panel, Sensors, Leads, F.A. Ductwork, Damper, Exhaust Fan	1	LS	$ 30,000.00	$ 15,000.00	$ 45,000.00	$ 45,000.00
					Sub-Total	**$ 2,797,224.00**
					15% O & H	**$ 419,583.60**
					Total	**$ 3,216,807.60**

WEBER STATE UNIVERSITY
CHILLED WATER STUDY COST ESTIMATE - Preliminary Opinion of Probable Costs
CHILLER PLANT - Combination F

7.1 B.

Item Description	Amount	Units	Materials	Labor	Cost	Total
Demolition						
Chiller - Carrier	1	LS		$ 3,500.00	$ 3,500.00	$ 3,500.00
Chiller - 1250 Ton Relocation	1	LS		$ 25,240.00	$ 25,240.00	$ 25,240.00
Chiller - 650 Ton Relocation	1	LS		$ 20,240.00	$ 20,240.00	$ 20,240.00
Piping	1	LS		$ 3,000.00	$ 3,000.00	$ 3,000.00
Pumps, Ex. Tanks, Electrical, Controls Softener	1	LS		$ 23,000.00	$ 23,000.00	$ 23,000.00
Concrete						
Concrete Pads	36	CU. YD.	$ 144.00	$ 66.00	$ 210.00	$ 7,560.00
Cooling Tower						
Cooling Tower	1	EA	$ 100,000.00	$ 225,000.00	$ 325,000.00	$ 325,000.00
Meters and Gauges						
Thermometers	40	EA	$ 90.00	$ 12.00	$ 102.00	$ 4,080.00
Pressure Gauges	40	EA	$ 36.00	$ 34.00	$ 70.00	$ 2,800.00
Thermowells	30	EA	$ 32.00	$ 25.00	$ 57.00	$ 1,710.00
Supports and Anchors						
Pipe Hangers	96	EA	$ 61.00	$ 15.00	$ 76.00	$ 7,296.00
Pipe Supports	30	EA	$ 200.00	$ 7.00	$ 207.00	$ 6,210.00
Flanges/Wall Supports @ Penetrations	4	EA	$ 920.00	$ 203.00	$ 1,123.00	$ 4,492.00
Electrical						
VFD 250 HP	3	EA	$ 27,380.00	$ 3,100.00	$ 30,480.00	$ 91,440.00
VFD 100 HP	4	EA	$ 11,715.00	$ 1,600.00	$ 13,315.00	$ 53,260.00
VFD 60 HP	1	EA	$ 8,458.00	$ 1,425.00	$ 9,883.00	$ 9,883.00
VFD 30 HP	1	EA	$ 4,675.00	$ 975.00	$ 5,650.00	$ 5,650.00
VFD 20 HP	1	EA	$ 3,300.00	$ 735.00	$ 4,035.00	$ 4,035.00
Mechanical Identification						
Painting	1	LS	$ 2,500.00	$ 1,800.00	$ 4,300.00	$ 4,300.00
Valve Tags	90	EA	$ 50.00	$ 50.00	$ 100.00	$ 9,000.00
Name Plates	20	EA	$ 40.00	$ 60.00	$ 100.00	$ 2,000.00
Insulation						
Pump Casings	1	LS	$ 1,800.00	$ 600.00	$ 2,400.00	$ 2,400.00
Chilled Water Piping	800	LF	$ 9.00	$ 10.00	$ 19.00	$ 15,200.00
Equipment	1	LS	$ 1,600.00	$ 1,000.00	$ 2,600.00	$ 2,600.00
Plumbing						
Water Make-Up C/W (all assoc. valves)	1	LS	$ 300.00	$ 300.00	$ 600.00	$ 600.00
Water Piping, Valves, Insulation	1	LS			$ 13,000.00	$ 13,000.00
Pumps						
Condenser Water - Chilled Water Main - Chilled Water Circulators	10	LS	$ 200,578.00	$ 65,968.00	$ 266,546.00	$ 266,546.00
Sky Box Pumps	2	EA	$ 6,900.00	$ 2,000.00	$ 8,900.00	$ 17,800.00
Chiller/Equipment						
1700 Ton Chiller W/VFD	2	EA	$ 609,000.00	$ 24,000.00	$ 633,000.00	$ 1,266,000.00
Air Eliminator	1	EA	$ 30,736.00	$ 2,500.00	$ 33,236.00	$ 33,236.00
Expansion Tank	1	EA	$ 25,147.00	$ 1,000.00	$ 26,147.00	$ 26,147.00
Sky Box Plate & Frame, Piping, Ex. Tank, Air Eliminator	1	LS	$ 45,679.00	$ 9,300.00	$ 54,979.00	$ 54,979.00
Water Treatment						
Condenser Water - Treatment,Chemicals,Pumps,Piping, Valves	1	LS	$ 3,000.00	$ 2,000.00	$ 5,000.00	$ 5,000.00
Hydronic Piping						
Chilled and Condenser Water Piping & Valves	1	LS			$ 420,000.00	$ 420,000.00

WEBER STATE UNIVERSITY

CHILLED WATER STUDY COST ESTIMATE - Preliminary Opinion of Probable Costs

CHILLER PLANT - Combination F

7.1 B.

Item Description	Amount	Units	Materials	Labor	Cost	Total
Test & Balance						
Chillers	4	EA		$ 500.00	$ 500.00	$ 2,000.00
Pumps	10	EA		$ 250.00	$ 250.00	$ 2,500.00
Exchanger	1	EA		$ 300.00	$ 300.00	$ 300.00
Cooling Tower	6	EA		$ 320.00	$ 320.00	$ 1,920.00
Misc. O&M Manuals	4	EA		$ 400.00	$ 400.00	$ 1,600.00
Controls						
Automation System	1	LS	$ 138,600.00	$ 71,400.00	$ 210,000.00	$ 210,000.00
ASHRAE 15-94						
Panel, Sensors, Leads, F.A. Ductwork, Damper, Exhaust Fan	1	LS	$ 30,000.00	$ 15,000.00	$ 45,000.00	$ 45,000.00
					Sub-Total	**$ 3,000,524.00**
					15% O & H	**$ 450,078.60**
					Total	**$ 3,450,602.60**

WEBER STATE UNIVERSITY

CHILLED WATER STUDY COST ESTIMATE - Preliminary Opinion of Probable Costs
Plate & Frame Exchanger (Free Cooling) Recommendation

7.2

Item Description	Amount	Units		Materials		Labor		Cost		Total
Supports and Anchors										
Pipe Hangers	10	EA	$	61.00	$	15.00	$	76.00	$	760.00
Mechanical Identification										
Valve Tags	8	EA	$	50.00	$	50.00	$	100.00	$	800.00
Name Plates	2	EA	$	40.00	$	60.00	$	100.00	$	200.00
Insulation										
Chilled Water Piping	160	LF	$	9.00	$	8.00	$	17.00	$	2,720.00
Exchanger										
Plate & Frame Exchanger	1	EA	$	90,000.00	$	11,000.00	$	101,000.00	$	101,000.00
Hydronic Piping										
Chilled Water	160	LF	$	88.00	$	48.00	$	136.00	$	21,760.00
Condenser Water	160	LF	$	88.00	$	48.00	$	136.00	$	21,760.00
Test & Balance										
Cooling Tower	6	EA			$	320.00	$	320.00	$	1,920.00
Condenser Water System	1	EA			$	300.00	$	300.00	$	300.00
Controls										
Chilled Water System	1	LS	$	2,000.00	$	3,000.00	$	5,000.00	$	5,000.00
Condenser Water System	1	LS	$	3,300.00	$	3,700.00	$	7,000.00	$	7,000.00
							Sub-Total		**$**	**163,220.00**
							15% O & H		**$**	**24,483.00**
							Total		**$**	**187,703.00**

WEBER STATE UNIVERSITY

CHILLED WATER STUDY COST ESTIMATE - Preliminary Opinion of Probable Costs

Campus Piping System For Future Connected Load

7.3

Item Description	Amount	Units	Materials	Labor	Cost	Total
Demolition						
Piping	1	LS		$ 10,000.00	$ 10,000.00	$ 10,000.00
Mechanical Identification						
Painting	1	LS	$ 200.00	$ 200.00	$ 400.00	$ 400.00
Valve Tags	1	EA	$ 50.00	$ 50.00	$ 100.00	$ 100.00
Insulation						
Chilled Water Piping	1000	LF	$ 9.00	$ 8.00	$ 17.00	$ 17,000.00
Water Treatment						
Flushing and Filling	1	LS	$ 1,000.00	$ 900.00	$ 1,900.00	$ 1,900.00
Hydronic Piping						
Chilled and Condenser Water Piping & Valves	1000	LF	$ 100.00	$ 60.00	$ 160.00	$ 160,000.00
					Sub-Total	**$ 189,400.00**
					15% O & H	**$ 28,410.00**
					Total	**$ 217,810.00**

WEBER STATE UNIVERSITY

CHILLED WATER STUDY COST ESTIMATE - Preliminary Opinion of Probable Costs

New Campus Chilled Water System Summary

7.4

Combination A

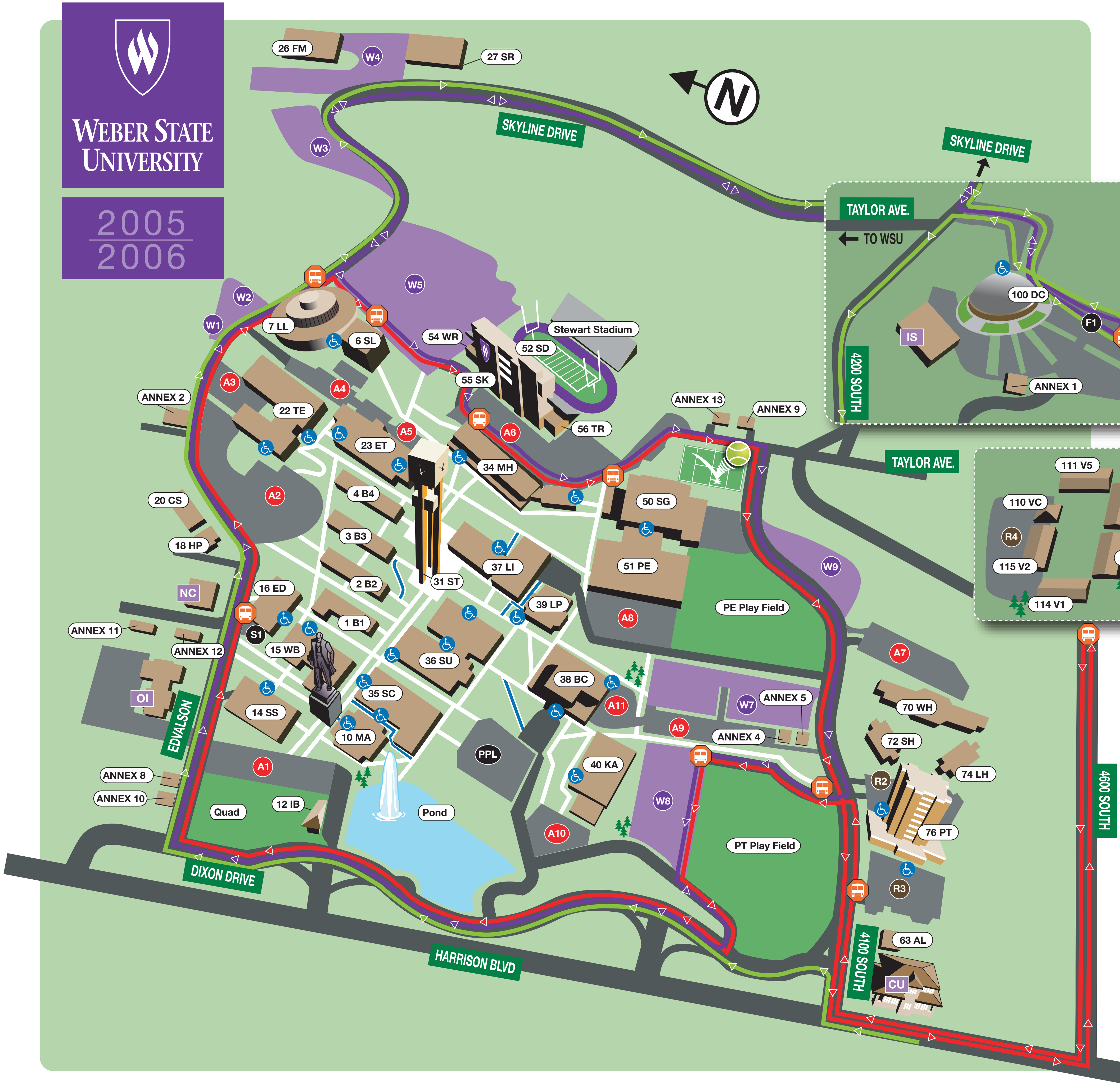
Item Description		Sub-Total		15% O & H		Total
Chiller Plant						
Chiller Plant - Combination A	$	2,797,224.00	$	419,583.60	$	3,216,807.60
Plate & Frame Recommendation						
Plate & Frame Exchanger (Free Cooling)	$	163,220.00	$	24,483.00	$	187,703.00
Campus Piping System For Future Connected Load						
Future Connected Load	$	189,400.00	$	28,410.00	$	217,810.00
	$	3,149,844.00	$	472,476.60	$	3,622,320.60

Sub-Total	$	3,149,844.00
15% O & H	$	472,476.60
Total	**$**	**3,622,320.60**

Combination F

Item Description		Sub-Total		15% O & H		Total
Chiller Plant						
Chiller Plant - Combination F	$	3,000,524.00	$	450,078.60	$	3,450,602.60
Plate & Frame Recommendation						
Plate & Frame Exchanger (Free Cooling)	$	163,220.00	$	24,483.00	$	187,703.00
Campus Piping System For Future Connected Load						
Future Connected Load	$	189,400.00	$	28,410.00	$	217,810.00
	$	3,353,144.00	$	502,971.60	$	3,856,115.60

Sub-Total	$	3,353,144.00
15% O & H	$	502,971.60
Total	**$**	**3,856,115.60**



WEBER STATE UNIVERSITY - OGDEN

Building Directory

1.	B1	Building 1
2.	B2	Building 2
3.	B3	Building 3
4.	B4	Building 4
6.	SL	Science Lab
7.	LL	Lind Lecture
10.	MA	Miller Administration
12.	IB	Information Booth
14.	SS	Social Science
15.	WB	Wattis Business
16.	ED	McKay Education
18.	HP	Heat Plant
20.	CS	Campus Services
22.	TE	Technical Education
23.	ET	Engineering Technology
26.	FM	Facilities Management
27.	SR	Stores and Receiving/ Mail Room
31.	ST	Stewart Bell Tower
34.	MH	Marriott Health
35.	SC	Student Service Center
36.	SU	Shepherd Union
37.	LI	Stewart Library
38.	BC	Browning Center
39.	LP	Lampros Hall
40.	KA	Kimball Visual Arts Center
50.	SG	Swenson Building
51.	SB	Stromberg Center
52.	SD	Stromberg Stadium Offices
54.	WR	Stromberg Strength Training
55.	SK	Stewart Stadium Sky Suites
56.	TR	Davidson Track Locker Rooms
63.	AL	Lindquist Alumni Center
70.	WH	Wasatch Hall
72.	SH	Stansbury Hall
74.	LS	LaSal Hall
76.	PT	Promontory Tower
100.	DC	Dee Events Center
110.	VC	Village Community Center
111-115.	V1-5	University Village

Annex Directory

Annex 1	Police Academy
Annex 2	English
Annex 4	Police
Annex 5	Parking and Environmental Health & Safety
Annex 8	English/ESL
Annex 9	Wilderness Recreation
Annex 10	Upward Bound
Annex 11	ROTC
Annex 12	Skills Enhancement Center
Annex 13	Athletics

Parking Lots

A1	A1 Permit and Visitor Meters
A2	A2 Permit and Visitor Meters
A3	A3 Permit
A4	A4 Permit
A5	A5 Permit
A6	A6 Permit
A7	A7 Permit
A8	A8 Permit
A9	A9 Permit
A10	A10 Permit
A11	A11 Permit
DC	Dee Center A,W and R Permits (Shuttle Available)
PPL	Public Pay Lot
R2	Residence Halls/W and A Permits
R3	Residence Halls/W and A Permits
R4	Residence Halls and A Permits
S1	Children's School Permit
W1-9	W, R/W and A Permits

Non-campus Buildings

CU	Weber State Credit Union
OI	Ogden LDS Institute
NC	Newman Center
IS	Ice Sheet

Disabled Access

Ride the Wildcat Express Shuttle.

All Weber State University parking is by permit only. You can buy a $20 pass and always find a place to park in one of the 3,000 available spaces at the Dee Events Center. The shuttle leaves every five minutes from 7 a.m. to 2 p.m. and every 20 minutes from 2 - 6 p.m. From 6-11 p.m., you can call 543-1439 for shuttle service times.

- Campus Route
- University Village and Campus Route
- Express Route
- Shuttle-bus Stops

Weber State University
3850 University Circle
Ogden, UT 84408
801-626-6000
weber.edu

A.2 REFERENCES

A.2 References

A. References Used:

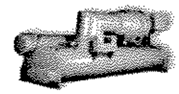
1. ASHRAE
2. Weber State University
3. Carrier Corporation
4. The Trane Company
5. Mueller Corporation
6. Bell & Gossett
7. RS Means Cost Data – 2005
8. Johnson Controls
9. Tower Engineering
10. Cameron Hydraulic Data
11. Current Industry Standards
12. Field Investigation

A.3 POTENTIAL NEW CHILLER COMPUTER RUN PERFORMANCE DATA

Centrifugal Chiller

Job Information

WHW - WSU Chiller Selections
Salt Lake City
(U41)Daniel Goulding



TRANE

Tag	CTV-1	Model number
Quantity	1	

Certified in accordance with the Water-Chilling Packages Using the Vapor Compression Cycle Certification Program, which is based on ARI Standard 550/590.

Sound pressure measured in accordance with ARI Standard 575-94.

ASHRAE 90.1 compliance	Yes	ASHRAE 90.1 Full Load Requirement: 0.518 kW/ton
		ASHRAE 90.1 Part Load Requirement: 0.494 kW/ton

Unit Information

Model	**CVHF**	Evap tube type	**IMCU**
Compressor size	**1470**	Evap tube thickness	**0.025"**
Motor size	**957**	Evap passes	**2**
Motor frequency	**60 Hz**	Cond shell size	**210L**
Motor voltage	**460**	Cond bundle size	**1610**
Impeller size	**306**	Cond tube type	**IMCU**
Orifice size	**1970**	Cond tube thickness	**0.028"**
Evap shell size	**210L**	Cond passes	**2**
Evap bundle size	**2100**		

Design Information

Cooling capacity	**1500.0 tons**	HCFC 123 refrigerant charge	**2400 lb**
Primary power	**722.7 kW**	Shipping weight	**40371 lb**
Primary efficiency	**0.482 kW/ton**	Operating weight	**48824 lb**
NPLV	**0.425 kW/ton**	Sound level	
Wye-delta starter type	**Remote Mounted WyeD**	Green Seal certification	**Yes**
Application type	**Standard cooling**	Free cooling option	**No**
		Heat rejected into equip room	**12.34 MBh**

Evaporator Information

Evap leaving temp	**44.00 F**
Evap flow rate	**2559.9 gpm**
Evap entering temp	**58.00 F**
Evap flow/capacity	**1.71 gpm/ton**
Evap water box type	**non-marine**
Evap pressure drop	**10.94 ft H2O**
Evap fouling factor	**0.00010 hr-sq ft-deg F/Btu**
Evap fluid type	**water**
Evap fluid concentration	**N/A**
Evap water box pressure	**150 psig evap. water pressure**
Evap min flow rate	**811.20 gpm**

Condenser Information

Cond entering temp	**75.00 F**
Cond flow rate	**3438.8 gpm**
Cond leaving temp	**87.00 F**
Cond flow/capacity	**2.29 gpm/ton**
Cond water box type	**non-marine**
Cond pressure drop	**18.31 ft H2O**
Cond fouling factor	**0.00025 hr-sq ft-deg F/Btu**
Cond fluid type	**water**
Cond fluid concentration	**N/A**
Cond water box pressure	**150 psig cond. water pressure**

Electrical Information

Motor LRA	**6989 A**	Min circuit ampacity	**1247 A**
Primary RLA	**989.8 A**	Max over current protection	**2000 A**

Centrifugal Chiller

Job Information

WHW - WSU Chiller Selections
Salt Lake City
(U41)Daniel Goulding

Tag	CTV-1	Model number
Quantity	1	

Certified in accordance with the Water-Chilling Packages Using the Vapor Compression Cycle Certification Program, which is based on ARI Standard 550/590.
Sound pressure measured in accordance with ARI Standard 575-94.

ASHRAE 90.1 compliance Yes
ASHRAE 90.1 Full Load Requirement: 0.518 kW/ton
ASHRAE 90.1 Part Load Requirement: 0.494 kW/ton

Unit Information

Model	CVHF	Evap tube type	IMCU
Compressor size	1470	Evap tube thickness	0.025"
Motor size	957	Evap passes	2
Motor frequency	60 Hz	Cond shell size	250L
Motor voltage	460	Cond bundle size	2500
Impeller size	314	Cond tube type	IMCU
Orifice size	2245	Cond tube thickness	0.028"
Evap shell size	250E	Cond passes	2
Evap bundle size	2480		

Design Information

Cooling capacity	1700.0 tons	HCFC 123 refrigerant charge	3150 lb
Primary power	837.5 kW	Shipping weight	49341 lb
Primary efficiency	0.493 kW/ton	Operating weight	61035 lb
NPLV	0.426 kW/ton	Sound level	
Wye-delta starter type	Remote Mounted WyeD	Green Seal certification	Yes
Application type	Standard cooling	Free cooling option	No
		Heat rejected into equip room	14.30 MBh

Evaporator Information

Evap leaving temp	44.00 F
Evap flow rate	2901.3 gpm
Evap entering temp	58.00 F
Evap flow/capacity	1.71 gpm/ton
Evap water box type	non-marine
Evap pressure drop	13.16 ft H2O
Evap fouling factor	0.00010 hr-sq ft-deg F/Btu
Evap fluid type	water
Evap fluid concentration	N/A
Evap water box pressure	150 psig evap. water pressure
Evap min flow rate	888.20 gpm

Condenser Information

Cond entering temp	75.00 F
Cond flow rate	3909.2 gpm
Cond leaving temp	87.00 F
Cond flow/capacity	2.30 gpm/ton
Cond water box type	non-marine
Cond pressure drop	9.98 ft H2O
Cond fouling factor	0.00025 hr-sq ft-deg F/Btu
Cond fluid type	water
Cond fluid concentration	N/A
Cond water box pressure	150 psig cond. water pressure

Electrical Information

Motor LRA	6989 A	Min circuit ampacity	1438 A
Primary RLA	1142.5 A	Max over current protection	2500 A

CenTraVac Chiller CTV-1

NPLV = 0.425 (Constant Flow)

% Load	Capacity	Evap LWT	Evap FR	Evap EWT	Evap PD	Cond EWT	Cond FR	Cond LWT	Cond PD	kW	Amps	Efficiency
100	1500.0	44.00	2559.9	58.00	10.94	75.00	3438.8	87.00	18.31	722.7	989.8	0.482
75	1125.0	44.00	2559.9	54.50	10.95	70.00	3438.8	78.86	18.30	478.2	679.3	0.425
50	750.0	44.00	2559.9	50.99	10.97	65.00	3438.8	70.85	18.29	305.4	475.0	0.407
25	375.0	44.00	2559.9	47.50	10.98	65.00	3438.8	67.97	18.29	190.2	347.5	0.507

FCLT-LAX	MODL-CVHF	NTON-1470	INDP-NO
HRTZ-60	SRTY-RSTR	VOLT-460	CPKW-957
CPIM-306	EVSZ-210L	EVBS-2100	EVTM-IMCU
EVTH-25	EVWP-2	CDSZ-210L	CDBS-1610
CDTM-IMCU	CDTH-28	ORSZ-1970	TEST-AIR
TTOL-AIR	ASTT-NO		

CenTraVac Centrifugal Chiller, Version 25.08, REVL 55074

CenTraVac Chiller CTV-1

NPLV = 0.426 (Constant Flow)

% Load	Capacity	Evap LWT	Evap FR	Evap EWT	Evap PD	Cond EWT	Cond FR	Cond LWT	Cond PD	kW	Amps	Efficiency
100	1700.0	44.00	2901.3	58.00	13.16	75.00	3909.2	87.00	9.98	837.5	1142.5	0.493
75	1275.0	44.00	2901.3	54.50	13.18	70.00	3909.2	78.83	9.95	542.7	759.0	0.426
50	850.0	44.00	2901.3	51.00	13.19	65.00	3909.2	70.84	9.90	346.6	522.4	0.408
25	425.0	44.00	2901.3	47.50	13.21	65.00	3909.2	67.96	9.89	214.7	374.0	0.505

FCLT-LAX	MODL-CVHF	NTON-1470	INDP-NO
HRTZ-60	SRTY-RSTR	VOLT-460	CPKW-957
CPIM-314	EVSZ-250E	EVBS-2480	EVTM-IMCU
EVTH-25	EVWP-2	CDSZ-250L	CDBS-2500
CDTM-IMCU	CDTH-28	ORSZ-2245	TEST-AIR
TTOL-AIR	ASTT-NO		

CenTraVac Centrifugal Chiller, Version 25.08, REVL 55074

Centrifugal Chiller Duplex

Job Information

WHW - WSU Chiller Selections
Salt Lake City
(U41)Daniel Goulding

TRANE

Tag	CDH-3	Model number	
Quantity	1		

Certified in accordance with the Water-Chilling Packages Using the Vapor Compression Cycle Certification Program, which is based on ARI Standard 550/590.
Sound pressure measured in accordance with ARI Standard 575-94.

ASHRAE 90.1 compliance Yes

ASHRAE 90.1 Full Load Requirement: 0.495 kW/ton
ASHRAE 90.1 Part Load Requirement: 0.472 kW/ton

Unit Information

Model	CDHF	Evap shell size	210D
Compressor size	2000	Evap bundle size	1610
Motor size LH	453	Evap tube type	IMCU
Motor size RH	588	Evap tube thickness	0.028"
Motor frequency	60 Hz	Evaporator passes	1
Motor voltage	460	Cond shell size	210D
Impeller size LH	261	Cond bundle size	1900
Impeller size RH	271	Cond tube type	IMCU
Orifice size LH circuit	1265	Cond tube thickness	0.028"
Orifice size RH circuit	1400	Condenser passes	1

Design Information

Cooling capacity	2000.0 tons	HCFC 123 refrig charge LH	1900 lb
Primary power	911.0 kW	HCFC 123 refrig charge RH	1900 lb
Primary efficiency	0.455 kW/ton	Shipping weight	66713 lb
Primary power LH	407.1 kW	Operating weight	77532 lb
Primary power RH	503.9 kW	Sound level	0 dBA
NPLV	0.384 kW/ton	Heat rejected into equip room	15.55 MBh
Wye-delta starter type LH	Unit Mounted WyeD		
Wye-delta starter type RH	Unit Mounted WyeD		

Evaporator Information

Evap leaving temp	44.00 F
Evap flow rate	4800.0 gpm
Evap entering temp	53.95 F
Evap flow/capacity	2.40 gpm/ton
Evap water box arrgmt	In RH end - out LH end
Evap water box type	non-marine
Evap pressure drop	17.87 ft H2O
Evap fouling factor	0.00010 hr-sq ft-deg F/Btu
Evap fluid type	water
Evap fluid concentration	N/A
Evap water box pressure	150 psig evap. water pressure
Evap min flow rate	1218.20 gpm

Condenser Information

Cond entering temp	75.00 F
Cond flow rate	6000.0 gpm
Cond leaving temp	84.11 F
Cond flow/capacity	3.00 gpm/ton
Cond water box arrgmt	In LH end - out RH end
Cond water box type	non-marine
Cond pressure drop	7.34 ft H2O
Cond fouling factor	0.00025 hr-sq ft-deg F/Btu
Cond fluid type	water
Cond fluid concentration	N/A
Cond water box pressure	150 psig cond. water pressure

Electrical Information

Motor LRA LH comp	2987 A	MCA LH comp	722 A
Motor LRA RH comp	4389 A	MCA RH comp	898 A
Primary RLA LH	570.0 A	Max over current protection LH	1200 A
Primary RLA RH	710.3 A	Max over current protection RH	1200 A

CenTraVac Duplex Chiller CDH-3

NPLV = 0.384 (Constant Flow)

% Load	Capacity	Evap LWT	Evap FR	Evap EWT	Evap PD	Cond EWT	Cond FR	Cond LWT	Cond PD	kW	Amps LH	Amps RH	Efficiency
100	2000.0	44.00	4800.0	53.95	17.87	75.00	6000.0	84.11	7.34	911.0	570.0	710.3	0.455
75	1500.0	44.00	4800.0	51.46	17.90	70.00	6000.0	76.70	7.31	590.5	383.3	488.2	0.394
50	1000.0	44.00	4800.0	48.97	17.93	65.00	6000.0	69.43	7.28	382.6	277.2	357.4	0.383
25	500.0	44.00	4800.0	46.49	17.96	65.00	6000.0	67.21	7.27	176.2	280.4		0.352

MODL-CDHF	STRM-CVSK	NTON-2000	HRTZ-60
SRL1-606	SRL2-935	VOLT-460	CPM1-453
PNC1-TERM	PNC2-TERM	SPC1-606	CPD1-261
SPC2-935	CPM2-588	CPD2-271	EVSZ-210D
EVBS-1610	EVTM-IMCU	EVTH-28	EVWP-1
CDSZ-210D	CDBS-1900	CDTH-28	CDTM-IMCU
ORC1-1265	ORC2-1400		

CenTraVac Duplex Centrifugal Chiller, Version 25.08, REVL 55074

Evergreen Chiller Performance Outputs

Tag Name: 1500 Ton with VFD

Chiller
- Chiller Model **19XR-8787592ELS64**
- Starter / VFD .... **VFD - Freestanding**
- Refrigerant Type **R-134a**

Cooler
- Size **87**
- Waterbox Type .... **Nozzle-in-Head, 150 psi**
- Passes **2**
- Tubing .... **Turbo-EDE2 (TBE2), .025 in, Copper**
- Fluid Type .... **Fresh Water**
- Fouling Factor (hr-sqft-F)/BTU **0.00010**

Compressor
- Size **592**

Flow Controls
- Float Valve Size **15**
- Flasc Orifice **73**

Weights
- Total Rigging Weight .... **42895** lb
- Total Operating Weight .... **49784** lb
- Refrigerant Weight .... **2800** lb

Condenser
- Size **87**
- Waterbox Type .... **Nozzle-in-Head, 150 psi**
- Passes **2**
- Tubing .... **Spike Fin III (SPK3), .025 in, Copper**
- Fluid Type .... **Fresh Water**
- Fouling Factor (hr-sqft-F)/BTU **0.00025**

Motor
- Size .... **ELS**
- Line Voltage/Hertz **460-3-60**

Output Type	Full Load	Part Load	Part Load	Part Load
Percent Load	100.00	75.00	50.00	25.00
Chiller Capacity	1,500 Tons	1,125 Tons	750 Tons	375 Tons
Chiller Input kW	723 kW	384 kW	186 kW	142 kW
Chiller Input Power	0.482 kW/Ton	0.342 kW/Ton	0.248 kW/Ton	0.378 kW/Ton
NPLV	0.296 kW/Ton			
Cooler				
Entering Temp.	54.0 F	51.5 F	49.0 F	46.5 F
Leaving Temp.	44.0 F	44.0 F	44.0 F	44.0 F
Flow Rate	3595.8 gpm	3595.8 gpm	3595.8 gpm	3595.8 gpm
Pressure Drop	34.5 ft wg	34.7 ft wg	34.8 ft wg	35.0 ft wg
Condenser				
Leaving Temp.	85.0 F	77.3 F	69.7 F	67.5 F
Entering Temp.	75.0 F	70.0 F	65.0 F	65.0 F
Flow Rate	4101.0 gpm	4101.0 gpm	4101.0 gpm	4101.0 gpm
Pressure Drop	30.6 ft wg	31.0 ft wg	31.5 ft wg	31.5 ft wg
Motor				
Motor Input Power	706 kW	375 kW	180 kW	137 kW
Motor RLA	1066	688	422	356
Motor OLTA	1151			
Motor LRDA	6686			
Chiller RLA	996	554	307	252
Chiller Inrush Amps	996			
Max Fuse/CB Amps	2000			
Min Circuit Ampacity	1244			

Messages:

(1) Certified in accordance with the ARI Water-Chilling Packages using the Vapor Compression Cycle Certification Program, which is based on ARI Standard 550/590-2003.

Tag Name: 1500 Ton Constant Volume

Chiller
- Chiller Model: **19XR-8787592ELS64**
- Starter / VFD: **Starter - Freestanding**
- Refrigerant Type: **R-134a**

Cooler
- Size: **87**
- Waterbox Type: **Nozzle-in-Head, 150 psi**
- Passes: **2**
- Tubing: **Turbo-EDE2 (TBE2), .025 in, Copper**
- Fluid Type: **Fresh Water**
- Fouling Factor (hr-sqft-F)/BTU: **0.00010**

Compressor
- Size: **592**

Flow Controls
- Float Valve Size: **15**
- Flasc Orifice: **73**

Weights
- Total Rigging Weight: **42895** lb
- Total Operating Weight: **49784** lb
- Refrigerant Weight: **2800** lb

Condenser
- Size: **87**
- Waterbox Type: **Nozzle-in-Head, 150 psi**
- Passes: **2**
- Tubing: **Spike Fin III (SPK3), .025 in, Copper**
- Fluid Type: **Fresh Water**
- Fouling Factor (hr-sqft-F)/BTU: **0.00025**

Motor
- Size: **ELS**
- Line Voltage/Hertz: **460-3-60**

Output Type	Full Load	Part Load	Part Load	Part Load
Percent Load	100.00	75.00	50.00	25.00
Chiller Capacity	1,500 Tons	1,125 Tons	750 Tons	375 Tons
Chiller Input kW	686 kW	479 kW	334 kW	216 kW
Chiller Input Power	0.458 kW/Ton	0.426 kW/Ton	0.446 kW/Ton	0.577 kW/Ton
NPLV	0.449 kW/Ton			
Cooler				
Entering Temp.	54.0 F	51.5 F	49.0 F	46.5 F
Leaving Temp.	44.0 F	44.0 F	44.0 F	44.0 F
Flow Rate	3595.8 gpm	3595.8 gpm	3595.8 gpm	3595.8 gpm
Pressure Drop	34.5 ft wg	34.7 ft wg	34.8 ft wg	35.0 ft wg
Condenser				
Leaving Temp.	85.0 F	77.5 F	70.0 F	67.6 F
Entering Temp.	75.0 F	70.0 F	65.0 F	65.0 F
Flow Rate	4084.6 gpm	4084.6 gpm	4084.6 gpm	4084.6 gpm
Pressure Drop	30.3 ft wg	30.8 ft wg	31.2 ft wg	31.3 ft wg
Motor				
Motor Input Power	685 kW	478 kW	333 kW	215 kW
Motor RLA	998	742	579	473
Motor OLTA	1078			
Motor LRYA	2106			
Motor LRDA	6686			
Max Fuse/CB Amps	2000			
Min Circuit Ampacity	1247			

Messages:

(1) Certified in accordance with the ARI Water-Chilling Packages using the Vapor Compression Cycle Certification Program, which is based on ARI Standard 550/590-2003.

A.4 PLATE AND FRAME HEAT EXCHANGER INFORMATION

ITT Heat Transfer Plate & Frame Specification

WHW
001

Item: 6

		Hot side	Cold side
PHE-Type	P100-350-TKTM-20		
Flowrate	(g.p.m.)	3600.01	3596.20
Inlet temperature	(°F)	55.00	40.00
Outlet temperature	(°F)	45.00	50.00
Pressure drop	(PSI)	10.02	10.02
Heat exchanged	(Btu/h)	18061369	

Thermodynamic proporties:		Water	Water
Density	(Lb/Ft^3)	62.37	62.39
Specific heat	(Btu/Lb*F)	1.00	1.00
Thermal conductivity	(Btu/h*Ft*F)	0.34	0.33
Mean viscosity	(cP)	1.32	1.43
Wall viscosity	(cP)	1.43	1.32
LMTD	(Ft^2*h*F/kBtu)		
Excess Surface	%	0.00	
Inlet branch		F1	F3
Outlet branch		F4	F2

Design of Frame / Plates:

Plate arrangement (passes*channel)		1 x 174 + 0 x 0
Plate arrangement (passes*channel)		1 x 175 + 0 x 0
Number of plates		350
Effective heat surface	(Ft^2)	3,745.84
Overall K-value Duty/Clean	(Btu/Ft^2*h*F)	961.90 961.90
Plate material		0.0197 inch AISI 304
Gasket material		NITRIL LOCK
Max. working temperature	(°F)	230.00
Working/test pressure	(PSI)	150.00 195.00
Liquid volume	(Ft^3)	29.32
Carry Bar Length	(Ft)	8.20 Max. No. of Plates 413
Net weight	(Lb)	
Frame type		IS

Connections HOT side : 8.00 '' Unlined studded port,150 # ANSI
Connections COLD side: 8.00 '' Unlined studded port,150 # ANSI

ITT Heat Transfer 175 Standard Parkway Cheektowaga, NY
Tel: 800-447-7700 Fax: 716-897-1777

ITT Heat Transfer Plate & Frame Specification

WHW Item: 6
001

		Hot side	Cold side
PHE-Type	P100-602-TMTL-43	Hot side	Cold side
Flowrate	(g.p.m.)	3600.00	3596.20
Inlet temperature	(°F)	53.00	40.00
Outlet temperature	(°F)	43.00	50.00
Pressure drop	(PSI)	10.07	10.06
Heat exchanged	(Btu/h)	18061369	

Thermodynamic proporties:		Water	Water
Density	(Lb/Ft^3)	62.38	62.39
Specific heat	(Btu/Lb*F)	1.00	1.00
Thermal conductivity	(Btu/h*Ft*F)	0.34	0.33
Mean viscosity	(cP)	1.37	1.43
Wall viscosity	(cP)	1.43	1.37
LMTD	(Ft^2*h*F/kBtu)		
Excess Surface	%	0.00	
Inlet branch		F1	F3
Outlet branch		F4	F2

Design of Frame / Plates:

Plate arrangement (passes*channel)		1 x 300 + 0 x 0
Plate arrangement (passes*channel)		1 x 301 + 0 x 0
Number of plates		602
Effective heat surface	(Ft^2)	6,458.34
Overall K-value Duty/Clean	(Btu/Ft^2*h*F)	928.16 928.16
Plate material		0.0197 inch AISI 304
Gasket material		NITRIL LOCK
Max. working temperature	(°F)	230.00
Working/test pressure	(PSI)	150.00 195.00
Liquid volume	(Ft^3)	50.50
Carry Bar Length	(Ft)	13.12 Max. No. of Plates 686
Net weight	(Lb)	
Frame type		IS

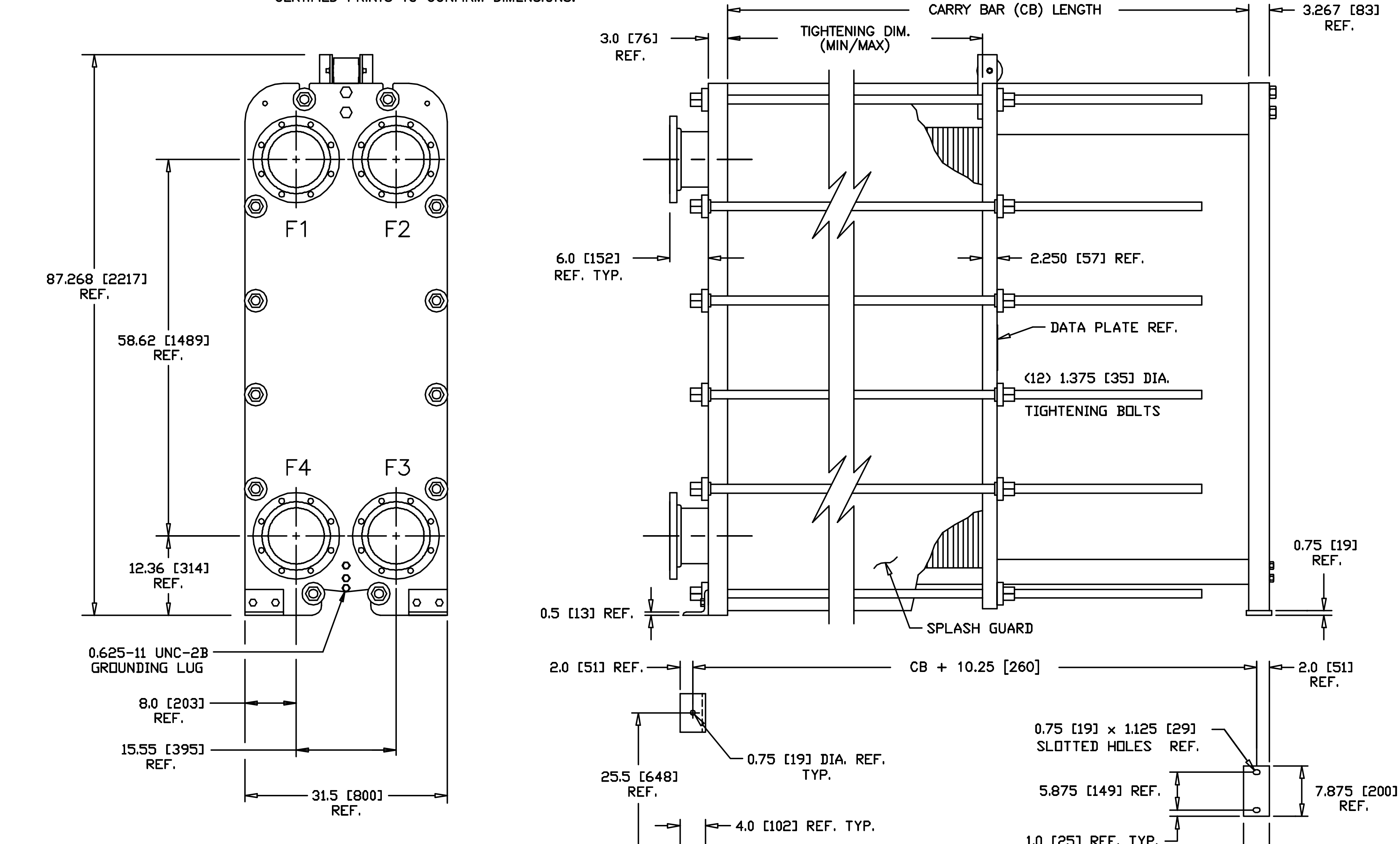
Connections HOT side : 8.00 '' Unlined studded port,150 # ANSI
Connections COLD side: 8.00 '' Unlined studded port,150 # ANSI

ITT Heat Transfer 175 Standard Parkway Cheektowaga, NY
Tel: 800-447-7700 Fax: 716-897-1777

FACTORY ORDER NO.

NOTE 1. DIMENSIONS IN INCHES AND [mm].
2. DIMENSIONS ARE SUBJECT TO CHANGE. REQUEST CERTIFIED PRINTS TO CONFIRM DIMENSIONS.

REV	REVISION NOTE	MADE	DATE



UNIT CONSTRUCTION	
THERMAL PLATES	–
GASKET TYPE	–
PLATE MIXTURE	–
MIX (SIDE 1)	–
MIX (SIDE 2)	–
PLATE QTY.	–
CARRY BAR	–
TIGHTENING BOLTS	STEEL (ZINC PLATED)
SPLASH GUARD	ALUMINUM
WEIGHT DRY/FULL	--- / --- (LBS)

DESIGN CONDITIONS	SIDE 1	SIDE 2
DESIGN PRESS. (PSI)	150	150
TEST PRESS. (PSI)	195	195
DESIGN TEMP. (°F)	–	–
MIN. TEMP. (°F)	32	32

CONNECTIONS

PORT	LOCATION	TYPE AND DESCRIPTION
SIDE 1 (IN)	F1	STEEL, 8"-150# ANSI FLANGE
SIDE 1 (OUT)	F4	STEEL, 8"-150# ANSI FLANGE
SIDE 2 (IN)	F3	STEEL, 8"-150# ANSI FLANGE
SIDE 2 (OUT)	F2	STEEL, 8"-150# ANSI FLANGE

MADE | DATE
CHECK | DATE
PLOT SCALE 0.094 : 1.0

ITT Bell & Gossett
Buffalo, NY U.S.A.

TITLE
MODEL P100

SIZE C | PART NUMBER | REV

MUELLER ACCU-THERM
PLATE HEAT EXCHANGER SPECIFICATION SHEET

PMC Spec. No.: 90430-01.01 Sales Manager: /TB
Ref No.: Date: 19 September, 2005

Design Data:	**Hot Side:**	**Cold Side:**	
Heat Transfer Media:	Water	Water	
Volume Flow Rate:	3600.0	3595.0	GPM
Mass Flow Rate:	1801851.1	1799664.6	LB/HR
Inlet Temperature:	55.0	40.0	°F
Outlet Temperature:	45.0	50.0	°F
Density	8.34	8.35	LB/GAL
Specific Heat:	1.001	1.003	BTU/LB F
Viscosity:	1.30	1.41	CPS
Thermal Conductivity:	0.334	0.330	BTU/FT H F
Pressure Drop:	10.1	10.2	PSI
Operating Pressure:	50	50	PSI G
Heat Transfer Rate:	18040736		BTU/H
Log Mean Temp Diff:	5.0		°F
Operating U-Value:	348		BTU/FT2 H F
Heat Transfer Area (All Frames):	10355.3		FT2

Mechanical Description:

Frame:

Type	B-20 Carbon Steel
Design Code	ASME Section VIII, DIV. 1
Design Pressure	100 PSI G
Design Temp. Max/Min	150 °F / 32°F
Test Pressure	130 PSI G
Frames In Parallel/Series/Total	2/ 1/ 2
A-Dim. Min./Max.	55.73/ 59.64 Inch
Overall Length	124.64 Inch
Overall Width	34.88 Inch
Overall Height	104.50 Inch
Guide Bar Length	120.00 Inch
Compression Bolt Length	96.00 Inch
Weight Operating/Empty	9390/ 5876 LB

Plate:

Type	120M H
Plate Material	0.4 MM 304 S/S
Plates/Frame	404
Passes-H/C	1/1
Channels-H/C	201/202
Gasket Material	NBR

Connections		**Location**
Hot In	6.00 Inch 316L S/S Studded	1F
Hot Out	6.00 Inch 316L S/S Studded	4F
Cold In	6.00 Inch 316L S/S Studded	3F
Cold Out	6.00 Inch 316L S/S Studded	2F

Notes:

Aluminum shroud omitted

The purchaser of the equipment bears total responsibility for suitability of use of all materials in this application.

We may have assumed some design values. If they differ from your requirements, a new design may be necessary.

MUELLER ACCU-THERM
PLATE HEAT EXCHANGER SPECIFICATION SHEET

PMC Spec. No.: 90430-01.01
Sales Manager: /TB
Ref No.:
Date: 19 September, 2005

Design Data:	Hot Side:	Cold Side:	
Heat Transfer Media:	Water	Water	
Volume Flow Rate:	3600.0	3595.0	GPM
Mass Flow Rate:	1801851.1	1799664.6	LB/HR
Inlet Temperature:	55.0	40.0	°F
Outlet Temperature:	45.0	50.0	°F
Density	8.34	8.35	LB/GAL
Specific Heat:	1.001	1.003	BTU/LB F
Viscosity:	1.30	1.41	CPS
Thermal Conductivity:	0.334	0.330	BTU/FT H F
Pressure Drop:	10.1	10.2	PSI
Operating Pressure:	50	50	PSI G
Heat Transfer Rate:	18040736		BTU/H
Log Mean Temp Diff:	5.0		°F
Operating U-Value:	534		BTU/FT2 H F
Heat Transfer Area (All Frames):	6749.0		FT2

Mechanical Description:

Frame:

Type	B-20 Carbon Steel
Design Code	ASME Section VIII, DIV. 1
Design Pressure	100 PSI G
Design Temp. Max/Min	150 °F / 32°F
Test Pressure	130 PSI G
Frames In Parallel/Series/Total	2/ 1/ 2
A-Dim. Min./Max.	36.42/ 38.98 Inch
Overall Length	88.63 Inch
Overall Width	34.88 Inch
Overall Height	104.50 Inch
Guide Bar Length	84.00 Inch
Compression Bolt Length	78.00 Inch
Weight Operating/Empty	7890/ 5593 LB

Plate:

Type	120M HV
Plate Material	0.4 MM 304 S/S
Plates/Frame	264
Passes-H/C	1/1
Channels-H/C	131/132
Gasket Material	NBR

Connections		Location
Hot In	6.00 Inch 316L S/S Studded	1F
Hot Out	6.00 Inch 316L S/S Studded	4F
Cold In	6.00 Inch 316L S/S Studded	3F
Cold Out	6.00 Inch 316L S/S Studded	2F

Notes:
Aluminum shroud omitted
The purchaser of the equipment bears total responsibility for suitability of use of all materials in this application.
We may have assumed some design values. If they differ from your requirements, a new design may be necessary.

MUELLER ACCU-THERM
PLATE HEAT EXCHANGER SPECIFICATION SHEET

PMC Spec. No.:	90430-01.01	Sales Manager:	/TB
Ref No.:		Date:	19 September, 2005

Design Data:	**Hot Side:**	**Cold Side:**	
Heat Transfer Media:	Water	Water	
Volume Flow Rate:	3600.0	3595.0	GPM
Mass Flow Rate:	1801851.1	1799664.6	LB/HR
Inlet Temperature:	55.0	40.0	°F
Outlet Temperature:	45.0	50.0	°F
Density	8.34	8.35	LB/GAL
Specific Heat:	1.001	1.003	BTU/LB F
Viscosity:	1.30	1.41	CPS
Thermal Conductivity:	0.334	0.330	BTU/FT H F
Pressure Drop:	5.7	5.8	PSI
Operating Pressure:	50	50	PSI G
Heat Transfer Rate:	18040736		BTU/H
Log Mean Temp Diff:	5.0		°F
Operating U-Value:	407		BTU/FT2 H F
Heat Transfer Area (All Frames):	8857.6		FT2

Mechanical Description:

Frame:

Type	B-20 Carbon Steel
Design Code	ASME Section VIII, DIV. 1
Design Pressure	100 PSI G
Design Temp. Max/Min	150 °F / 32°F
Test Pressure	130 PSI G
Frames In Parallel/Series/Total	2/ 1/ 2
A-Dim. Min./Max.	69.72/ 74.48 Inch
Overall Length	142.63 Inch
Overall Width	36.25 Inch
Overall Height	85.13 Inch
Guide Bar Length	138.00 Inch
Compression Bolt Length	132.00 Inch
Weight Operating/Empty	12358/ 9354 LB

Plate:

Type	80M HV
Plate Material	0.5 MM 304 S/S
Plates/Frame	492
Passes-H/C	1/1
Channels-H/C	245/246
Gasket Material	NBR

Connections		**Location**
Hot In	6.00 Inch 316L S/S Studded	1F
Hot Out	6.00 Inch 316L S/S Studded	4F
Cold In	6.00 Inch 316L S/S Studded	3F
Cold Out	6.00 Inch 316L S/S Studded	2F

Notes:

Aluminum shroud omitted

The purchaser of the equipment bears total responsibility for suitability of use of all materials in this application.

We may have assumed some design values. If they differ from your requirements, a new design may be necessary.

MUELLER ACCU-THERM
PLATE HEAT EXCHANGER SPECIFICATION SHEET

PMC Spec. No.: 90430-01.01 | Sales Manager: /TB
Ref No.: | Date: 19 September, 2005

Design Data:	Hot Side:		Cold Side:	
Heat Transfer Media:	Water		Water	
Volume Flow Rate:	3600.0		3595.0	GPM
Mass Flow Rate:	1801851.1		1799664.6	LB/HR
Inlet Temperature:	55.0		40.0	°F
Outlet Temperature:	45.0		50.0	°F
Density	8.34		8.35	LB/GAL
Specific Heat:	1.001		1.003	BTU/LB F
Viscosity:	1.30		1.41	CPS
Thermal Conductivity:	0.334		0.330	BTU/FT H F
Pressure Drop:	7.6		7.7	PSI
Operating Pressure:	50		50	PSI G
Heat Transfer Rate:		18040736		BTU/H
Log Mean Temp Diff:		5.0		°F
Operating U-Value:		437		BTU/FT2 H F
Heat Transfer Area (All Frames):		8258.7		FT2

Mechanical Description:

Frame:

Type	B-20 Carbon Steel
Design Code	ASME Section VIII, DIV. 1
Design Pressure	100 PSI G
Design Temp. Max/Min	150 °F / 32°F
Test Pressure	130 PSI G
Frames In Parallel/Series/Total	4/ 1/ 4
A-Dim. Min./Max.	43.98/ 46.81 Inch
Overall Length	105.89 Inch
Overall Width	26.75 Inch
Overall Height	85.50 Inch
Guide Bar Length	102.00 Inch
Compression Bolt Length	96.00 Inch
Weight Operating/Empty	5856/ 4430 LB

Plate:

Type	60M HV
Plate Material	0.5 MM 304 S/S
Plates/Frame	310
Passes-H/C	1/1
Channels-H/C	154/155
Gasket Material	NBR

Connections		Location
Hot In	4.00 Inch 316L S/S Studded	1F
Hot Out	4.00 Inch 316L S/S Studded	4F
Cold In	4.00 Inch 316L S/S Studded	3F
Cold Out	4.00 Inch 316L S/S Studded	2F

Notes:

Aluminum shroud omitted

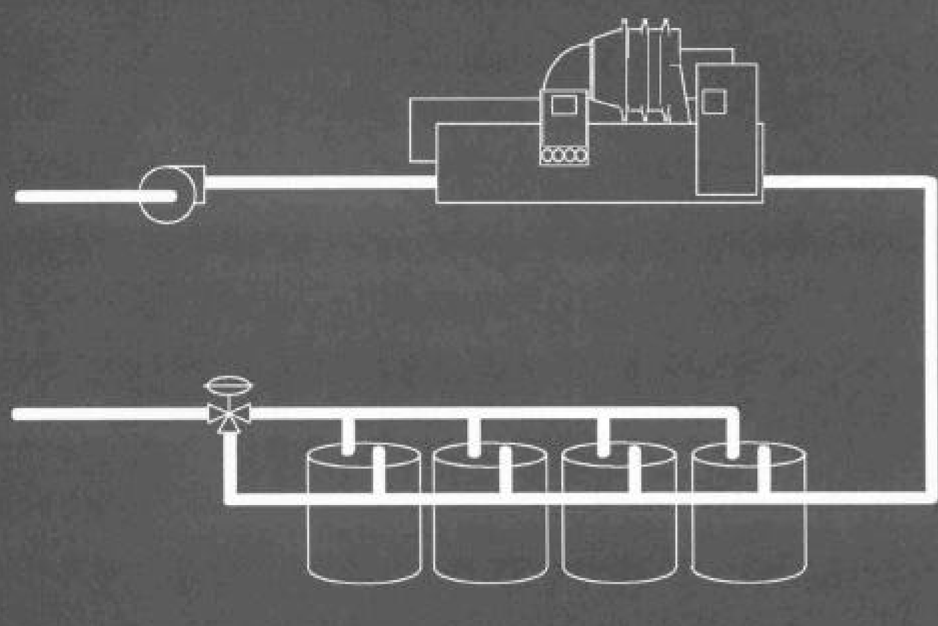
The purchaser of the equipment bears total responsibility for suitability of use of all materials in this application.

We may have assumed some design values. If they differ from your requirements, a new design may be necessary.

A.5 THERMAL/ICE STORAGE INFORMATION

Applications Engineering Manual

Ice Storage Systems



SYS-AM-10 (1087)

Ice Storage Systems

TABLE OF CONTENTS

The Trane Company, La Crosse, Wisconsin 54601

PURPOSE

The purpose of this manual is to serve as an aid to the designer of ice storage systems employing ethylene glycol. Commonly asked questions of thermal storage design, ice storage capacity, chiller selection and system control are addressed.

THERMAL STORAGE

WHY THERMAL STORAGE?

The current market for cool thermal storage is created by electric utilities. The benefits derived by the utility may include increased revenue, lower cost production, or shifting summer demand. Electric utilities supplement persuasive marketing programs with attractive utility rates to sell the thermal storage concept. Many utilities will contribute cash rebates on the basis of "avoided demand" for thermal storage systems.

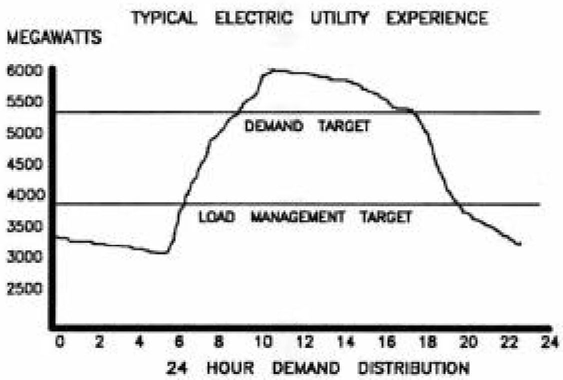


Figure 1

Electric utilities generate power from several different energy sources with energy cost ranging from low cost hydro and nuclear to expensive gas turbines. Lower energy cost nuclear and hydro plants have excess capacity during off-peak hours (typically 9pm to 9 am), while the cost of operating gas turbines for peaking often exceeds revenue from the power they generate. (figure 1) Lowering on-peak daytime demand and increasing off-peak nighttime demand enhances utility profitability. Load management just makes good economic sense. Thermal storage, pumped storage hydro projects, dual fuel rates, radio controlled water heaters all contribute to improved load management.

The increased capital cost of thermal storage systems can be offset by utility savings passed on to the owner. The vehicle to pass on savings may be high daytime demand charges (KW) that are waived during off-peak hours, discounts for off-peak power (KWH), or cash rebates for comfort systems that peak at a lower KW than some predetermined norm.

WHAT STORAGE MEDIA ARE COMMONLY USED?

Chilled water, ice, or phase change materials can be used as a storage medium. Few phase change materials (other than water) have left the laboratory, and even fewer have met with any real success. For most comfort cooling applications, water is hard to beat as a storage medium. It is simply an economic question, "should water be cooled or frozen?"

CHILLED WATER STORAGE

Conceptually, chilled water storage appears to be the simpler design. However, as several details are analyzed, the advantages of ice storage become more appealing. Chilled water storage is more than simply "a wide spot in the pipe." Water stores heat by increasing its temperature. The specific heat of water is one btu per degree pound. 12000 degree-pounds are required to store one tonhour of cooling. Maximizing the temperature rise of the system will reduced the mass of water required.

Chilled water storage is traditionally designed on a 20 degree temperature rise, which equates to almost 10 cubic feet of water per tonhour. Actually obtaining a 20 degree temperature rise may be very difficult. Chillers have very little difficulty cooling water to the minimum design temperature, typically 40 °F. However, the cooling system may not be able to raise the stored water temperature by the full 20 degrees. Leakage of cold supply water into the warmer return water can occur at any of several locations in the system. A leaking control valve, or control valve out of control can pass cool supply water into the return. Poor storage tank design can allow warm return water to bypass "trapped" cool water, or warm return water can mix with cool supply water still in the tank and lessen its cooling potential. Designs to minimize these problems are often costly and difficult to control. Often the solution is to allow for a certain degree of tank "poisoning" and increase storage volume to compensate for this loss.

ICE STORAGE

The latent heat of fusion or the heat absorbed by one pound of ice when it melts is 144 btu per pound. This equates to less than 1.5 cubic feet of ice per tonhour. (Water weighs 62.4 pounds per cubic foot while ice weighs approximately 57 pounds per cubic foot.).

The volume of ice must be permeated with channels of fluid to transport heat into and out of the body of ice. These channels of fluid are usually pipe or tubing inside the ice or open space around the ice. The fluid in the pipe can be brine or refrigerant. Brine systems use ethylene glycol to transport heat into and out of the ice. Refrigerant systems circulate refrigerant through the pipe to remove heat from the tank, but circulate water through the free area around the ice when adding heat to the tank.

EUTECTIC SALTS

Eutectic (yoo-tek-tic) describes a mixture or compound easily fused or fusing at the lowest possible temperature. The eutectic salt used in thermal storage applications is a salt hydrate that fuses at 47 °F. In a crystalline form the salt fuses with several water molecules. In the amorphous form the salt disassociates from the water molecules, or "melts". Energy in the form of heat must be added to the hydrate to cause the disassociation.

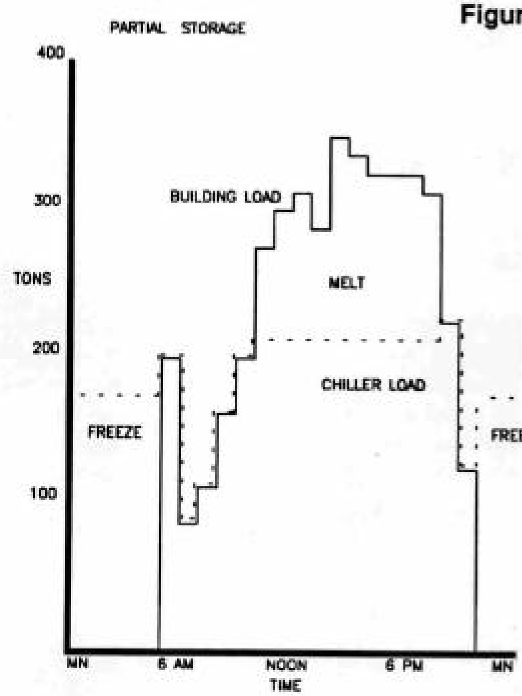
The heat of fusion of this salt hydrate is 41 btu per pound, compared to 144 btu per pound heat of fusion for water, or a sensible heat gain of 20 btu per pound for chilled water storage. Eutectic salts can be used to store heat at a higher temperature than ice and lower volume than water.

The salt and water is packaged in plastic containers (approximately 8" by 24" by 1.75"). The container or "tray" is constructed with internal weight bearing supports and spacers to maintain vertical separation between trays. The trays can be stacked in a chilled water storage tank to increase the the capacity of the storage system. The tank design for a eutectic salt system must provide for uniform entrance velocity to the trays. The slow laminar flow into the tray section requires additional space for headers and supply diffusers.

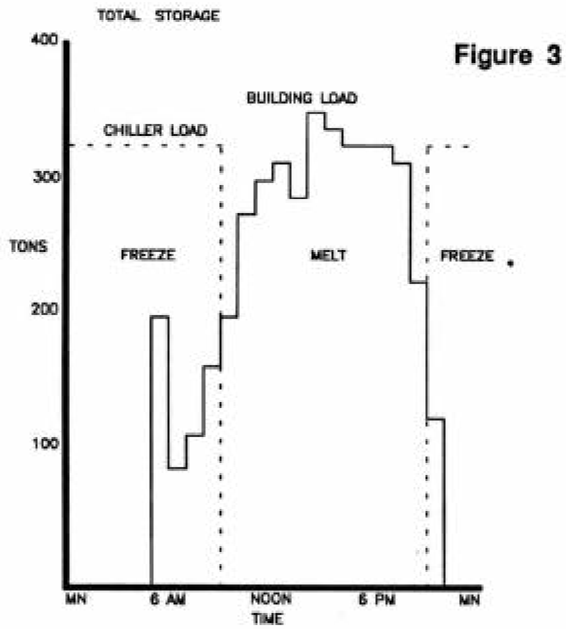
WHEN IS PARTIAL STORAGE OR TOTAL STORAGE USED?

Thermal storage systems can be placed in two general classifications; partial storage and total storage. Partial storage (figure 2) only trims the peak refrigeration load and requires some chiller operation during on-peak periods. The storage volumes are manageable and the demand savings are attractive. Total storage systems (figure 3) must produce the entire daily refrigeration load the evening before. No chiller operation is allowed during on peak periods. Total storage systems require enormous volumes of thermal storage and are usually attractive only where time of day rates offer substantial discounts for off peak power, or where utility rebates are offered.

Figure 2



System costs and utility savings are both a function of storage capacity. A modest investment in storage capacity will result in some initial reduction in chiller tonnage and cost. However, the reduction in chiller cost is insufficient to cover the cost of the storage system and required system controls.



The investment in storage must generate a savings in utility cost to cover the cost of the investment and provide an adequate return. An energy and economic analysis is required. The optimum storage capacity may actually exceed the capacity that results in the smallest chiller selection.

ICE STORAGE

WHAT ARE THE ADVANTAGES OF ICE STORAGE?

Ice can reduce the storage volume by as much as a factor of five. Ice also reduces the weight of the storage system. A chilled water system typically weighs as much as 700 pounds per tonhour of storage; while an ice system weighs as little as 90 pounds per tonhour. The lighter weight of ice storage systems allow them to be placed almost anywhere in the building.

The performance of a manufactured ice storage tank is a known variable, eliminating much of the guess work and disappointment with chilled water storage. Manufactured ice storage tanks eliminate the cost of large field erected tanks.

The modular concept of ice storage tanks, the ease of pumping ethylene glycol, the reliability of packaged chillers, and the power of building automation combine for an effective and highly reliable ice storage system.

HOW IS THE ICE STORED?

The ice storage tank must perform three functions.

First the tank is a holding area for the ice. Simply a container.

Second, the ice tank requires a heat exchanger to separate the chilled water system, at a higher pressure, from the atmospheric pressure at which ice is usually stored.

Third, the tank performs a second heat exchange function in separating the non-freezing fluid (refrigerant or glycol) from the freezing medium, water. Several physical arrangements have evolved to meet these three functions.

ICE BUILDERS

Ice builders are large, open, insulated steel tanks containing several feet of steel pipe in a serpentine coil. Ice is built up on the outside of the pipe while refrigerant (R-22) or sometimes glycol is circulated through the pipe. The pipe material may be schedule 40 black steel pipe or extruded steel tubing. The ice may be built up to a thickness of 1 to 2.5 inches. Greater ice thickness equates to greater storage capacity, but lower efficiencies. Because of the inefficiencies, the current trend is to a lower ice thickness.

Ice is melted by circulating water around the ice. Separation between the cylinders of ice is maintained by pipe spacing and water agitation. Agitation promotes even ice melting and prevents ice bridging between pipes during freezing. Because of the spacing between pipes, half of the tank volume remains as water even when the storage system is fully charged. This excess water in the ice builder increases the volume and weight by a factor of two or more when compared to more compact ice storage systems.

The open ice tanks are usually located at lower levels or at grade because of their weight. Because the tanks are open, an additional heat exchanger is required to isolate the tanks from the static head of the chilled water system.

Ice builders are conventionally used with refrigerant based ice plants, which can be costly and complex. To avoid this expense, many ice builder manufacturers have redesigned the metal tanks for use with ethylene glycol. However, this redesign does not reduce the weight or volume requirement of this type of ice storage system.

ICE BOTTLES

Ice bottles are similar to ice builders in that they build ice on the outside of schedule 40 steel pipe. The bottles are designed for either refrigerant or glycol circulation through the pipe. Ice is melted by circulating water around the cylinders of ice. Unlike the open ice builder, the bottle is a closed vessel. In essence the ice bottle is a large shell and tube heat exchanger with sufficient volume in the shell to contain the ice. Like a heat exchanger, the bottle is a pressurized vessel, eliminating the need for another heat exchanger between the ice and system chilled water.

ICE TANKS

Ice tanks are modular, insulated polyethylene tanks, approximately 8 feet in diameter and 8 feet in height. Each tank contains a coiled heat exchanger constructed of 5/8 inch polyethylene tubing. A glycol solution chilled to 22-24 °F is circulated through the tubing, freezing over 13000 pounds of water in each tank. The water remains in the tank to be frozen solid with no need for agitation. The ice is melted by circulating warm glycol through the tubing.

The open tanks remain at atmospheric pressure, however, the coiled heat exchanger is a closed system. The polyethylene, polyvinyl chloride construction of the heat exchanger is suitable for operating pressures up to 90 psi. A heat exchanger is required only if the designer wishes to eliminate ethylene glycol from the chilled water system or anticipates operating pressures in excess of 90 psi. Generally the additional glycol required is less expensive than a heat exchanger.

Ice tanks of this type are designed for glycol solutions only. A solution of 25 percent ethylene glycol and 75 percent water, by weight, is most commonly used. Lower than 25 percent may not provide adequate chiller protection. Concentrations greater than 25 percent needlessly reduce heat transfer and add pressure drop.

ICE FLAKES

Ice flakes are produced by a packaged ice maker. This ice storage system is unlike previously discussed systems in that the ice is stored in an open tank below the ice maker; not on the pipe or tube that produces the ice. The ice is produced on plates above the tank. Hot gas defrost is used to melt the ice off the plates. When free, the plates fracture into palm sized flakes of ice that fall into the tank below. This system is also called an ice harvester or ice shucker.

HOW IS THE ICE PRODUCED?

ICE PLANTS

The ice tank employed in an ice plant is a large insulated tank containing several feet of steel pipe. The ice is built up on the outside of the pipe while the refrigerant (R-22) is circulated through the tubes.

There are several methods to circulate the refrigerant within the ice builder pipe. Pumping large volumes of refrigerant (R-22) is possible but the pumping system must not allow premature formation of flash gas in the system. Refrigerant is circulated through the ice builder pipe by:

1. direct expansion
2. liquid recirculation (liquid overfeed)
3. gravity (flooded system)

Ice storage systems of this nature require very large refrigerant charges and incur substantial construction costs due to the number of field erected components. Due to these construction costs, many ice plants are difficult to justify except in larger tonnage applications.

DIRECT EXPANSION

Direct expansion employs the pressure difference between the high-side receiver and the suction line accumulator to transport refrigerant through the ice builder. Proper sizing of the suction line should minimize oil return problems. From a design viewpoint, direct expansion offers a simple and reliable system.

This method suffers from some inefficiencies compared to other systems. For example, 15 to 20 percent of the pipe length must be used to provide superheat and is not available for making ice. This results in an additional cost penalty for additional surface and/or lower efficiencies due to lower suction temperatures.

LIQUID RECIRCULATION

Liquid recirculation systems use either the compressor or a separate liquid feed pump to circulate refrigerant. The recirculation rate is 2 to 3 times the evaporation rate. This causes liquid overfeed systems, as they are sometimes called, to return a two phase mixture from the ice tank to a low pressure receiver. From the low pressure receiver, refrigerant vapor is returned to the compressor while the refrigerant liquid is available for recirculation to the ice tank. The liquid level control meters additional refrigerant from the high pressure receiver to the low pressure receiver to make up refrigerant returned to the compressor. The design of the feed pump is critical in liquid recirculation systems. Proper design of the pumping system must be followed to prevent flashing of the refrigerant at the pump suction or in the pump itself. Semihermetic pumps or open pumps with specially designed seals are used to keep refrigerant losses to a minimum.

Pumping drums use hot gas from the compressor to recirculate refrigerant thereby eliminating the need for the refrigerant feed pump. The "pumper" is a smaller receiver that is located below the low pressure receiver. When vented to the low pressure receiver, liquid refrigerant drains by gravity into the pumper drum. The pumper is then isolated from the low pressure receiver by means of solenoid valves and hot gas is used to pressurize the pumper, forcing refrigerant from the pumper through the ice tank. Two pumping drums are used so one is filling while the other is draining. The "double pumper" replaces the expensive and high maintenance liquid feed pump.

GRAVITY SYSTEMS

Gravity feed systems eliminate the need for pumping refrigerant altogether. With gravity systems a low pressure receiver, or surge drum, is paired with each ice tank as a coil header. The vertical header carries the refrigerant to the ice tank inlet while a suction line returns refrigerant from the ice tank back to the surge drum. At the surge drum, vapor is returned to the compressor while liquid is recirculated to the ice tank. Due to the large refrigerant charge and the cost of multiple surge drums and controls, gravity flooded systems may be impractical in larger ice storage systems.

OIL RETURN AND ACCESSORIES

Oil return is a special concern with all liquid recirculation systems. At the low pressure receiver, refrigerant vapor is drawn off by the compressor but the oil remains in the receiver. When a liquid feed pump or pumper drum is used, sufficient pressure drop is available to employ an oil return system. The liquid line to the ice tank is tapped and a small amount of refrigerant is bled off to an expansion valve. The line downstream of the expansion valve is sized to maintain sufficient velocity to carry the entrained oil back to the compressor inlet. With a gravity flooded system, sufficient head is not available and a separate oil recovery system must be used. In addition to an oil return or oil recovery system, an oil separator in the compressor discharge line is a must.

Finally, there are ice tank accessories. To maintain uniform ice thickness, the water in the ice tank must be thoroughly mixed. An air pump is used to agitate the ice tank water during both the freezing and melting cycles. During the melt cycle, chilled water must circulate around the ice covered pipes. An ice thickness probe is required to prevent the ice tank from overfreezing or "bridging". Bridges of ice forming between the ice covered pipes will impede the flow of chilled water through the ice bundle during the melt cycle.

ICE FLAKES

Ice flakes are produced by a packaged ice maker. This system is also called an ice harvester or ice shucker. Ice harvesters are available as packaged systems. The ice plates, compressors, pumps, piping and controls, and sometimes the condenser ship as a package to be mounted above a field fabricated storage tank. The ice harvester components may ship separately for field assembly in larger applications.

Ice harvesters produce ice by removing heat from the tank of water located directly below the unit. Water drawn from the tank is sprayed directly on refrigerated plates by a water recirculation pump. The recirculation rate is approximately 10 to 11 gpm per ton of unit ice producing capacity. System return water at higher temperatures is also sprayed on the refrigerated plates, warming the spray temperature. Warmer spray temperatures raise the suction temperature, increasing unit capacity, but reducing or completely eliminating ice production.

The ice harvester may also be used as as water chiller by supplying warmer water to the plates. However, coordinating chiller operation with a controlled rate of ice utilization is difficult. As either a chiller or an ice maker the ice and/ or chilled water discharge to the tank directly below. The ice harvester may have sufficient capacity to meet the load, however if the chilled water discharge is greater than 32 °F, ice will be consumed.

ETHYLENE GLYCOL SYSTEMS

Ethylene glycol, or brine as it is called, is simply used as a low temperature heat transfer medium to transfer heat from the ice storage tanks to a packaged chiller and from the cooling coils to either the ice storage tanks or the chiller. The use of freeze protected chilled water eliminates the design time, field construction, large refrigerant charges and leaks associated with ice plants.

Brine ice storage tanks create ice by circulating the low temperature brine through polyethylene tubing. The polyethylene tubing is coiled inside insulated polystyrene tanks. The water / ethylene glycol mixture is also used for cooling by circulating the warm brine through the tubing, melting the ice. The water that experiences a phase change remains in the tank. Since no water circulates around the tubing, the ice tank may be frozen solid. The problems of ice bridging and an air pump for agitation are eliminated. In this configuration the brine ice tank is a sealed system similar to a packaged chiller or a car battery.

The heat transfer surface of the brine ice tank can be increased to four to five times the area used in refrigerant ice tanks due to the low cost of polyethylene. The extended heat transfer area decreases the approach temperature required to make ice. Centrifugal or reciprocating chillers producing 23 to 26 °F brine are well suited for this application. Centrifugal chillers have an excellent track record in low temperature applications including food processing, cosmetics, pharmaceutical, clean rooms, other industrial applications, and of course, ice rinks.

WHEN IS ICE PRODUCED?

The second judgment is to determine the time allowed to make ice. The available time or "ice making window" is NOT simply the utility offpeak hours. If the utility does not offer lower kwh charges during offpeak hours, ice may be produced anytime ice production does not interfere with building comfort cooling or contribute to the building electrical demand. If a discount is offered for offpeak power (kwh), additional utility savings can be obtained by deferring as much cooling load as possible to offpeak hours.

Ice production can begin any time metered electrical demand is low and the ice building chiller is not required for incidental cooling

HOUR	CHILLER	UTILITY
MDN	FREEZE	OFF PEAK
3 AM	|	|
6 AM	BUILDING PULLDOWN	|
9 AM	COMFORT COOLING	|
NOON	COOLING / MELT	ON PEAK
3 PM	|	|
6 PM	COMFORT COOLING	|
9 PM	FREEZE	OFF PEAK
MDN	|	|

Figure 4

loads. (figure 4) The initiation of the ice build cycle is controlled by time, usually early evening, when the building is essentially shutdown. The ice cycle is terminated when the ice tanks are fully charged, electrical demand is high, or the chiller is required for comfort cooling; whichever occurs first.

There are many methods to determine the quantity of ice actually produced depending on the design of the ice storage tank. Water expands as it freezes. Simply measuring the water level in the tank can give an indication of the percent of ice produced. As ice is produced, the heat transfer rate diminishes, reducing the leaving glycol temperature from the ice tank. The ice making mode can be terminated when tank exit temperature reaches a predetermined temperature.

WHEN IS THE ICE MELTED?

There are several strategies for melting ice. The most common include; chiller priority, ice priority, and demand limited

Chiller Priority. Chiller priority systems place the chiller and the ice storage tanks in series with the ice downstream of the chiller (figure 5). The chiller and tempering valve on the ice storage tanks are both set at the desired chilled glycol setpoint. The chiller is preferentially loaded due to its upstream position. The ice storage tanks are bypassed as long as the chiller can meet the load. Only when chiller capacity is exceeded is ice allowed to supplement the chiller.

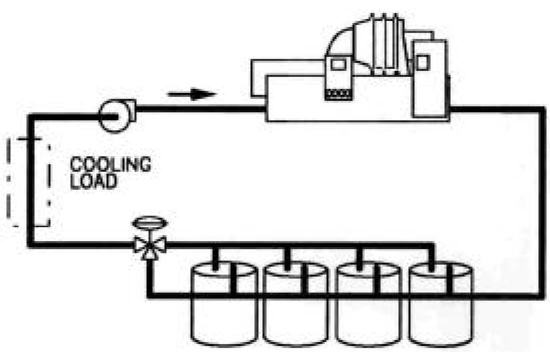


Figure 5

Chiller priority is the simplest of the ice melting strategies. Stable, reliable control is provided at all times. Chiller performance is maximized since the chiller receives the warmest return glycol. The fraction of the load met by ice can be altered by simply changing the chiller setpoint.

Ice is consumed only during peak load conditions with chiller priority. This strategy is best suited for utilities that do not offer lower offpeak rates. Producing ice is more expensive than cooling if the kwh cost is the same daytime and nighttime, therefore ice is consumed only when it actually reduces electrical demand.

Ice priority. Ice priority systems place the ice storage tanks and the chiller in series with the chiller downstream of the ice storage tanks (figure 6) . The chiller and tempering valve on the ice storage tanks are both set at the desired chilled glycol setpoint. The ice storage is preferentially loaded due to its upstream position. The chiller is idle as long as the ice storage can meet the load. Only when ice storage capacity is exceeded is the chiller allowed to supplement the ice storage.

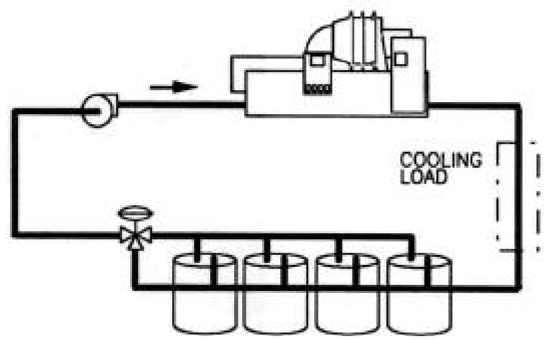


Figure 6

Ice priority will provide stable, reliable control at all times. The fraction of the load met by ice can be altered by simply changing the tempering valve setpoint. Ice consumption is maximized since the ice is preferentially loaded. This strategy is suitable for utilities that offer lower offpeak rates. It is beneficial to melt as much ice as possible since lower offpeak rates make producing ice less expensive than daytime cooling. Ice priority is well suited for low temperature air systems since lower leaving glycol temperature is guaranteed by the chiller.

Demand limited. Demand limited systems place the chiller and the ice storage tanks in series. Either cooling source, ice or chiller, may be upstream. The fraction of the load met by ice can be altered by simply changing the setpoint of the upstream cooling source.

Demand limited systems offer the advantages of both ice and chiller priority, while allowing the design flexibility of placing either cooling source downstream. The chiller contribution to the load is dictated by the building automation system. Prudent control of the chiller can maximize both demand reduction and the quantity of ice consumed. By maximizing the the quantity of ice consumed daily, demand limited systems maximize the savings from offpeak kwh rates. However, demand limited control is not possible without some form of building automation.

HOW MUCH ICE STORAGE IS REQUIRED?

Determination of how much of the onpeak load should be met with ice storage is arbitrary. As more of the "day" load is committed to ice storage, chiller "day" capacity and building electrical demand are reduced. (figure 7)

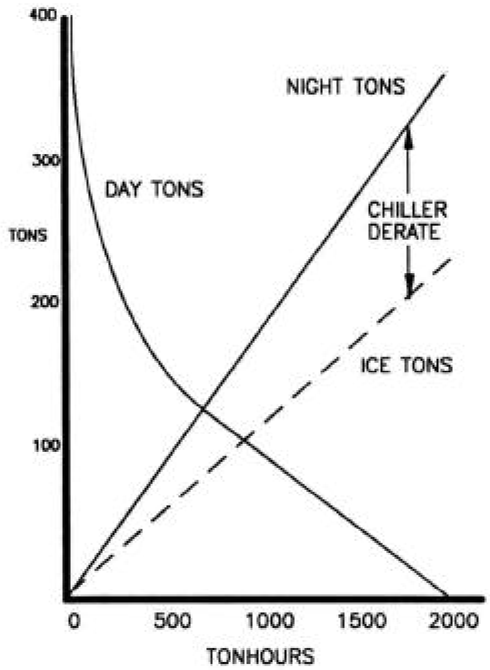


Figure 7

However, greater ice storage capacity requires greater chiller "night" capacity. The designer's first impulse is often to select the ice storage capacity that results in equal "day" and "night" nominal capacities. While this selection results in the smallest chiller net capacity, it does not necessarily represent the best life cycle cost system.

Additional ice storage capacity beyond the "balance point" increases chiller cost as well as storage cost. However, as chiller capacity and ice storage are increased, further demand reduction is achieved. The best life cycle cost ice storage system is reached when additional chiller and ice storage capacity do not result in justifiable savings. Many utilities will contribute to the cost of analysis to determined the justifiable amount of ice storage as well as cash rebates for further demand reduction.

CHILLER

WHAT IS THE DAY CHILLER CAPACITY?

The total onpeak cooling load must be met with some combination of ice and chiller. Total tonhours of cooling required during the onpeak hours less the tonhours of ice available equals the tonhours of cooling that must be met by the chiller. Chiller onpeak tonhours divided by onpeak hours equals the average chiller onpeak capacity. A chiller of this capacity is adequate if it receives this load each hour. Often this is not possible.

If onpeak hourly loads less than the average chiller load exist, the chiller may not be able to meet its onpeak cooling duty. Additional load is shifted to the ice, resulting in premature ice depletion. One solution is to increase the portion of onpeak cooling to ice. This results in a lower average onpeak chiller requirement. However a greater offpeak chiller capacity may now be required. An alternate solution is to simply increase onpeak chiller capacity. However this may impinge on demand reduction if left uncontrolled.

WHAT IS THE NIGHT CHILLER CAPACITY?

Ice producing chiller capacity depends on final leaving fluid temperature and the type of compressor employed. Reciprocating, helical rotary, and single stage centrifugal compressors usually suffer a greater derate than three stage centrifugal chillers. Exact chiller selections must be made only after all operating parameters are known. Derate factor is the ratio of ice producing capacity to nominal capacity.

$$\text{Derate factor} = \frac{\text{ice producing capacity}}{\text{nominal capacity}}$$

CHILLER	DERATE FACTOR
CVHB	0.65
CVHE	0.80
CGAC	0.60
CGWC	0.65
RTHA	0.70

The type of ice storage vessel used also influences chiller selection. The average charge rate is simply tonhours of storage divided by hours available to produce ice. However, the ice storage vessel does not freeze water at a constant rate. As ice thickness increases the rate of freezing decreases. The decrease in charge rate reduces chiller load and increases the time required to recharge the storage system. The chiller selected must possess sufficient capacity to freeze the ice storage array in the allotted time period, and maintain stable operation throughout the entire charging cycle.

AT WHAT LEAVING GLYCOL TEMPERATURE IS THE CHILLER SELECTED?

The required leaving fluid temperature is determined by the type of ice storage vessel finally selected. For a given heat transfer rate the delta T may be balanced against the flowrate. In most cases, selecting a higher delta T, therefore a lower gpm, and a lower leaving chiller fluid temperature, allows more efficient ice production. However, leaving fluid temperatures below 20 °F may be counter productive. When the resulting pressure drop is excessive, alternate evaporator options should be considered.

Figure 8

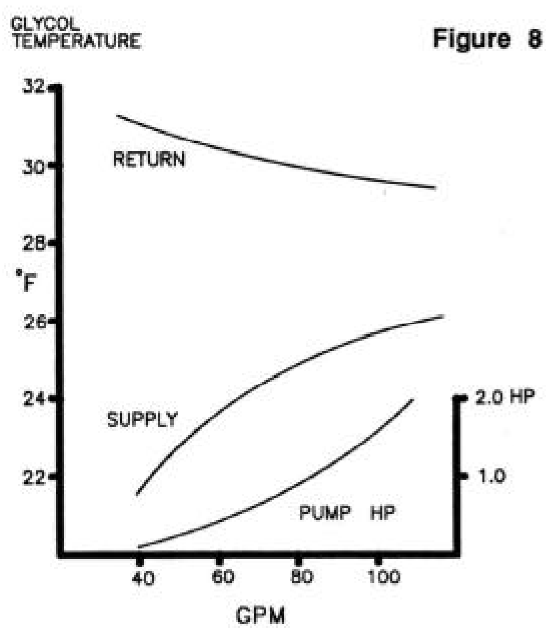
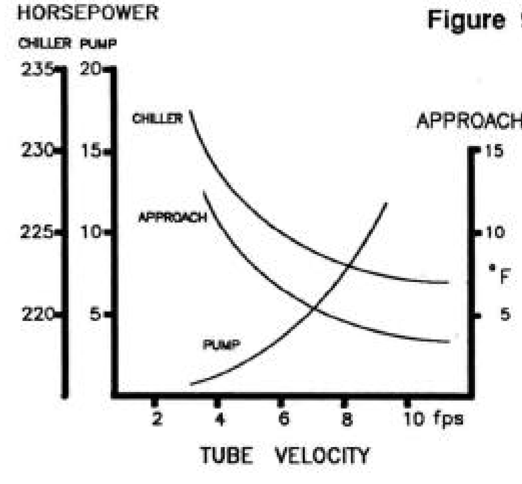


Figure 8 plots supply glycol temperature and gpm at a constant charge rate of 15 tons per hour per tank (Calmac™ Model 1190). The return glycol temperature increases at lower flow rates due to longer fluid retention time. The charging temperature has a profound affect on tank temperature rise and per tank pump horsepower. Higher tank temperature rise and lower pump horsepower require chiller leaving fluid temperatures between 22 - 24 °F. These lower leaving temperatures have in impact on chiller selection.

Figure 9



Lower leaving fluid temperatures require lower evaporator suction temperatures. The presence of ethylene glycol in the evaporator also lowers suction temperature. The selection of centrifugal chillers to produce lower leaving glycol temperatures is facilitated by closer evaporator approaches (figure 9). Tube velocity significantly influences the approach temperature. Tube velocity below 6 feet per second increases approach temperature and chiller horsepower. Tube velocity above 8 to 9 feet per second increases evaporator pressure drop and pump horsepower.

DESIGN

HOW IS THE DESIGN DAY LOAD DETERMINED?

The selection of ice storage capacity begins with an hourly, design day load profile. A design day load profile can be obtained by using the ULTRA LOAD PROGRAM or special execution of the TRACE PROGRAM. (See TRC-SFB-1 for instructions on obtaining a design day load profile from TRACE.)

The first two steps in selecting chiller capacity and tank capacity are critical judgments. Building diversity and time allowed for producing ice must be ascertained. Defining these two variables with complete certainty is difficult. Determining the peak load (tons) of a building requires only a calculation of the magnitude of the load. Other than solar, little load diversity is considered. However, a determination of building daily load (tonhours) requires an indepth understanding of building utilization. Often this data is unavailable to the system designer, or exists only as a rough estimate at best. An optimistic estimate will result in a building short of cooling capacity, while a conservative estimate results only in added equipment expense.

The load profile developed must include allowance not only for loads added after building completion, like additional personal computers, but longer than planned duration of loads, like frustrated PC users staying after hours. Extended usage has no direct bearing on design load (tons), but does have direct impact on daily load (tonhours). Increased daily load (tonhours) has a direct bearing on chiller and storage capacity.

HOW ARE COINCIDENT NIGHTTIME COOLING LOADS MET?

Some building cooling loads persist during offpeak hours. Such loads include data processing centers, CAD-CAM work stations, building security areas, after hours building usage, and building cool down loads the following morning. These loads must be addressed by the ice storage system design. Viable options include accessory chillers, extended chiller delta T, or simply narrowing the ice production window.

Accessory chillers. Often persistent off peak cooling loads can be met with secondary chillers. Remotely located concentrated loads may be best met with dedicated chillers separate from the ice storage system. It may be desirable to transfer these loads to the primary ice storage system during onpeak hours. If persistent offpeak loads are scattered throughout the building, a centrally located standby chiller using the primary distribution system may be a solution. If the standby chiller uses the primary distribution system, ice production must be isolated from the primary distribution system. Accessory chillers are best suited for persistent offpeak loads of significant magnitude and lengthy duration. Minimal offpeak loads may be best met by expanding the chiller delta T.

Expanded chiller delta T. When the persistent offpeak cooling loads are minimal, it may be possible to meet those loads with cool ethylene glycol solution discharged from the ice storage tank. This fluid is rarely more than one or two degrees below freezing temperature and poses no threat of coil frosting or uncontrollable condensation to properly designed systems. Use of ice tank discharge chilled glycol during the freezing cycle not only increases the chiller load but increases the return glycol temperature. Care must be taken to assure the selected chiller can still produce chilled glycol temperatures required for freezing. Since cooling loads with this method uses higher kw per ton rates, it is best suited for loads of smaller magnitude.

Smaller ice production window. Often the offpeak cooling loads can be of significant magnitude but of short duration. Most buildings can be precooled before occupancy in as little as two hours. Since this cooling is before occupancy it does not contribute to demand, and often enjoys a lower offpeak electrical rate. At higher chiller loading, with warmer evaporator temperatures, lower condenser temperatures, and lower electric rates, this can be the least costly cooling of the day. Preoccupancy cool down requires significant chiller capacity; often leaving little or no capacity for ice production.

Many building have significant activity after "normal" closing hours. These loads occur while ambient drybulb and wetbulb temperatures are still high. By deferring ice production until later night time hours, the overlap of ice production and comfort cooling can be eliminated. The efficiency of ice production is increased by deferring a greater portion of the load until cooler condensing temperatures can be achieved. The hours of ice production may be only nine hours even when utility offpeak hours may be twelve hours or more.

HOW IS THE CAPACITY OF THE ICE STORAGE TANK DETERMINED?

The selection of ice storage tanks must meet several design parameters. These include:

1. Storage capacity
2. Discharge rate
3. Charge rate
4. Required discharge temperature
5. Pressure drop

The ice storage system finally selected must provide both the required capacity (tonhours) and rate (tons) of cooling. A casual review of the hourly design day load profile would suggest that the design discharge rate is simply design tons less the capacity of the chiller finally installed. This would be true if the chiller were the sole contributor to the building electrical demand. However, this is not always the case. The building electrical demand has several contributors. Electrical system diversity may not coincide with building load diversity.

An ice storage system that can handle more than its fair share of the cooling load for short periods of time, when the energy management system can benefit most from major reductions in demand, offers an added advantage. Such ice storage systems are called demand limited systems.

The desired discharge rate is the rate that provides the greatest reduction in demand for a modest investment. There is not any fast and easy formula for determining the maximum affordable discharge rate. System designs that minimize chiller capacity and discharge rate may reduce system cost, but also severely limit system flexibility in operation. The greatest long term benefit from ice storage systems is derived from systems that have the flexibility to adapt to changing building utilization. This may require some surplus chiller and ice capacity in the initial design.

Ice storage vessels that store ice on the same heat exchanger that produces the ice serve two functions: storage and heat transfer. These two functions are combined in a single ice storage tank. For Example, a Calmac™ 1190 tank is comprised of a tank and a heat exchanger. The tank contains 13150 pounds of water. The btu difference between 13150 pounds of water at 60 °F and 13150 pounds of ice at 28 °F is 2,288,000 btu or 190 tons. From a storage point of view, a Calmac™ 1190 ice storage tank always contains 190 tonhours of cooling when completely frozen. However, to gain access to that cooling the system must add heat to the tank through the heat exchanger.

The performance of the ice storage heat exchanger affects the discharge rate and discharge temperature. Heat exchanger performance is a function of flow rate through each tank. When the flow rate is dictated by the system, the flow rate through each can be altered by increasing or decreasing the number of tanks. The heat exchange surface per tank is dictated by the ice storage tank design. When the tube surface required for heat transfer exceeds the surface required for storage, additional tanks are required and the quantity of ice stored in each tank is less than the nominal storage capacity. The reduction of utilized ice storage capacity per tank is called K factor. Simply stated, K factor equals the tube surface required for ice storage divided by the surface required for heat transfer.

The number and type of ice storage vessels selected also influences the pressure drop of the glycol loop. Not only is the pressure drop of the ice tank a concern, but the flowrate required to produce the desired amount of ice in the allowable time has a direct bearing on the pressure drop for the entire glycol pumping system. There is a significant benefit gained by maximizing the temperature rise in the ice storage tank during the charge cycle.

HOW IS THE TUBE SURFACE REQUIRED FOR HEAT TRANSFER DETERMINED?

The tube surface required for heat transfer is a function of flowrate (gpm) and desired discharge temperature. The heat transfer rate is roughly equivalent to the product of flow (gpm) and temperature drop (delta T).

$$\text{Heat Transfer Rate} \cong \text{gpm} \bullet \text{delta T}$$

Since gpm and delta T are inversely proportional, a given heat transfer rate can produce a large delta T (low discharge temperature) at low gpm; or large gpm (greater discharge rate) at smaller delta T (higher discharge temperatures). When both large discharge rates and low discharge temperature are required, the heat transfer rate must be increased (lower K factor). The relationship of gpm and delta T during discharge is defined by K factor and is determined by the ice tank manufacturer by testing. Manufacturer's data will indicate the required K factor for the application.

A similar temperature rise and flowrate relationship exist during the freeze cycle. However, during the charging cycle the heat transfer rate can be increased by simply lowering the fluid temperature produced by the chiller. Since flowrate (gpm) and temperature rise (delta T) are still proportional, lowering the

	TAG	FPF	MBH	LDB	LWB	APD	GPM	WTR	WPD	EWT	GLYCOL
1	WATER	132	454.9	55.4	54.8	.36	93.0	9.8	19.3	45.0	0.0
2	GLYCOL	132	419.5	56.5	55.8	.36	93.0	9.7	21.7	45.0	25.0
3	MORE FINS	168	454.7	55.1	54.8	.40	93.0	10.5	21.7	45.0	25.0
4	LESS GPM	132	412.2	56.7	56.0	.36	88.0	10.0	19.3	45.0	25.0
5	LOWER EWT	132	454.4	55.4	54.8	.36	88.0	11.1	19.4	42.3	25.0

Figure 10

chiller leaving fluid temperature greatly reduces gpm and pumping horsepower.

Not all ice storage tank designs result in the same nominal heat transfer rate. Metal tanks, due to expense, contain less heat transfer surface per tonhour of storage capacity. This is indicated by the higher flowrates and lower fluid temperatures required to achieve freezing. However, most metal tank designs melt ice by direct contact with water, resulting in higher K factors. While metal tanks can maintain lower discharge temperatures, the heat transfer rate is still determined by available surface, and tank manufactures should be consulted to determine the required heat transfer surface.

DOES ETHYLENE GLYCOL AFFECT PRESSURE DROP AND HEAT TRANSFER?

The addition of ethylene glycol to the chilled water system will reduce heat transfer efficiency, and therefore coil and chiller capacity. The reduction in coil capacity is in the order of 4-6 percent. This lost capacity can be recouped by increased tube velocity, increased temperature difference, or increased coil surface area.

The addition of ethylene glycol also increases the system pressure drop. The increased pressure drop can be negated by increased coil and chiller delta T, improved piping design, or the selection of low pressure drop coils.

The effect of ethylene glycol can be observed in the following delta flow coil selection. A four row, 132 fins per foot, coil is selected to cool 12000 cfm at 80/67 entering air conditions with a face velocity of 400 foot per minute. 93 gpm of 45 degree chilled water is used.

When 25 percent ethylene glycol is substituted as the the cooling fluid, capacity is lost while leaving air temperature and water pressure drop increase. (figure 10) The capacity can be regained by increasing coil surface to 168 fins per foot, at an increase of 0.04 inches wg.

Selections 4 and 5 illustrate the effect of increasing water temperature rise. The flowrate is reduced to 88 gpm to alleviate water pressure drop. Entering water temperature is reduced by less than 3 degrees to regain original coil capacity.

The effect of ethylene glycol on heat transfer and pressure drop is minimal and can be easily compensated. The impact increases with increasing glycol concentrations; keep glycol concentration to a minimum. When addressed in the design, the impact of glycol is easily tolerated. By allowing a lower leaving chiller temperature and therefore greater delta T, glycol affords greater savings in pipe cost and pumping horsepower.

IS THE ICE UPSTREAM OR DOWNSTREAM OF THE CHILLER?

Starting with the ice production mode as a base, next determine the location of the cooling loads relative to the chiller, ice storage tanks, and system pump.

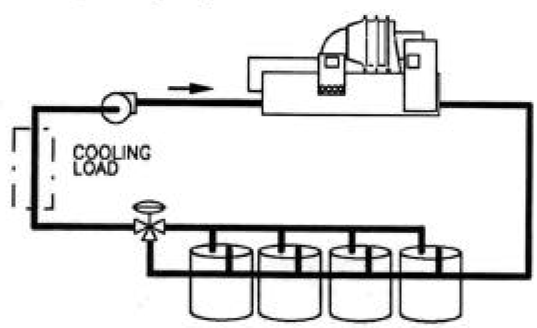


Figure 11

Ice downstream. This series arrangement is the most common. It allows the chiller to be preferentially loaded by returning chilled fluid from the cooling load directly to the chiller. (figure 11) This greatly simplifies controls by allowing both the chiller controls and the ice storage controls to be set to the desired supply fluid temperature. Ice storage will contribute to meeting the load only after available chiller capacity is fully exploited. Ice contribution can be increased at any time by simply limiting the chiller.

This configuration allows the chiller to operate at higher leaving temperatures when chiller and ice are used concurrently. This increases chiller capacity and chiller performance during critical onpeak hours. By placing the ice storage tanks before the cooling load, warmer fluid (28 - 32 °F) is available for residual cooling loads during the ice production mode.

With the ice storage tanks downstream of the chiller, the ice storage discharge must produce leaving fluid temperatures suitable for cooling under all load conditions. For normal comfort cooling applications discharge fluid temperatures are suitable during most if not all of the discharge cycle. For applications requiring colder than normal fluid temperatures, the ice storage heat transfer surface can be increased (see K factor) or the chiller can be placed downstream of the ice storage tanks.

Ice upstream. By placing the chiller downstream of the ice storage tanks, colder than normal supply fluid temperatures can be guaranteed. (figure 12) This arrangement is found only in process cooling and low temperature air comfort cooling systems.

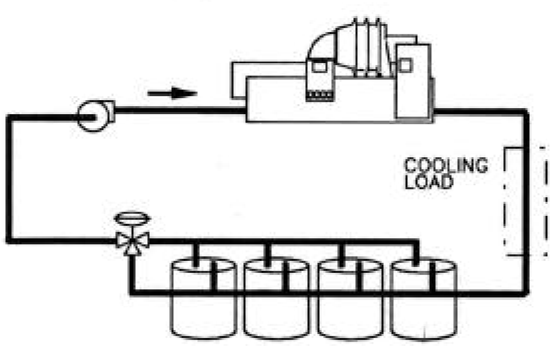


Figure 12

Controls are complicated by the necessity to constantly change the ice storage leaving fluid temperature control to obtain the desired ice contribution. Care must be taken to defer adequate load to the chiller and not consume the ice prematurely.

This configuration places the chiller at a disadvantage by demanding colder leaving fluid temperature while simultaneously denying the chiller of warmer entering fluid temperature. While this arrangement may provide the greatest storage capacity per tank, the added storage capacity comes at the cost of chiller performance. Maximizing per tank storage capacity in any arrangement is not difficult with an automated control system.

Either upstream or downstream, the chiller and ice are in series during all modes of cooling, providing the distribution system with greatly enhanced delta T capability. The larger system delta T reduces system cost and energy requirements. Neither arrangement requires a heat exchanger. Ethylene glycol solution is sent directly to the cooling coils.

Each arrangement supplies and returns cooling fluid from the same location. Drawing cooling fluid from one end of the chiller and returning it to the other end places the chiller, ice, and cooling load in parallel. Parallel configurations greatly complicate system hydronics and are usually reserved for systems with unusual requirements.

ARE TWO PUMPS REQUIRED?

Transfer of cold fluid to the cooling load may be accomplished by either a secondary pump or a diverting valve. (figure 13) A secondary pumping scheme is well suited for high system

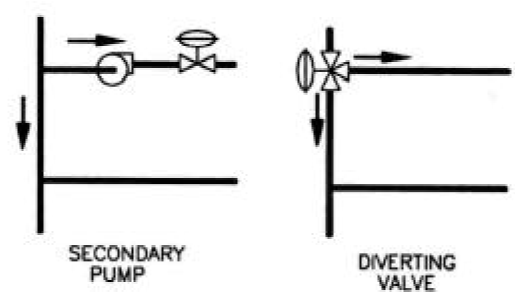


Figure 13

pressure losses or variable flow systems. A positive shutoff valve is required to prevent unwanted escape of cold fluid to the system during the ice production mode. A two position diverting valve may be a less complicated approach. However the pressure drop / gpm relation of pump and system should be evaluated at both valve positions to assure flow remains within allowable limits.

WHEN IS A HEAT EXCHANGER REQUIRED?

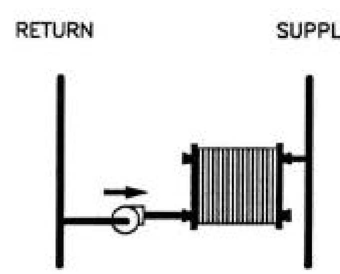
Large campus type systems contain substantial volumes of water. Charging the entire chilled water loop with glycol solution may be an unwarranted expense. A heat exchanger can be employed to contain the glycol fluid to a small primary loop, separate from the main distribution system.

A heat exchanger may also be required to shield the Calmac™ ice storage tank from operating pressures in excess of 90 psi. A heat exchange may also be used to protect the glycol solution from a highly contaminated chilled water loop or a chilled water loop prone to leaking.

WHERE IS THE HEAT EXCHANGER LOCATED?

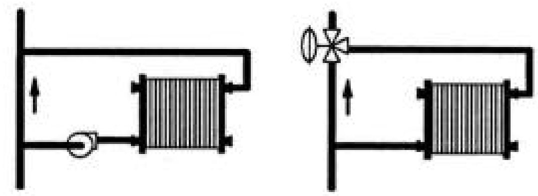
The heat exchanger can be located anywhere in the chilled water system where a chiller might be located. In large tonnage systems or in partial storage systems the ice storage system is only one of several sources of cooling. The location of the heat exchanger should assure compatibility with all other sources of cooling.

Equal loading is achieved by locating the the chilled water side of the heat exchanger between the chilled water return and supply. (figure 14) In this configuration the heat exchanger is parallel to other comfort cooling chillers in the chilled water system, or may act as the sole source of daytime cooling in total storage systems.



EQUAL LOADING

Figure 14



PREFERENTIAL LOADING

Figure 15

Preferential loading is achieved by returning water chilled by the heat exchanger to the same fluid stream from which it came. This can be accomplished by a diverting valve or a secondary pump. (figure 15) The ice storage system is preferentially loaded by placing the ice tanks in chilled water return. Placing the ice tanks in chilled water supply will preferentially load the chillers. Equally loaded or preferentially loaded, the heat exchanger capacity can be controlled by the glycol flow rate.

CONTROL

HOW IS THE CHILLER CONTROLLED?

Chiller control is a function of the type of ice storage system. Total storage systems and multiple chiller systems may operate the ice producing chiller at only one temperature. Additional chiller control may not be required when the chiller is selected and operated at only one condition. However, partial storage systems require the chiller to operate as both an ice maker and a conventional chiller. Control automation is required to initiate and terminate the production of ice.

The ice production cycle is initiated by time of day programming. In the ice producing mode the chiller is actually controlled by the ice storage tanks. The ice storage tanks must present a load greater than the ice producing capacity of the chiller. This allows the chiller to operate at maximum ice production capacity. It is undesirable to causes either a reciprocating or centrifugal chiller to unload during ice production.

Toward the end of the ice production cycle, as ice thickness reaches its maximum, chiller leaving fluid temperature and chiller delta T are lower. The chiller must operate safely at this final condition. In this mode, no chiller temperature controls are required to produce ice. The chiller simply operates at maximum capacity during the ice production cycle. Chiller controls only start and stop the chiller.

Ice production is terminated when the ice storage tanks reach full capacity, off peak rates end, or continued ice production interferes with building demand control or comfort cooling. Several methods are available to determine when the ice tanks are totally recharged. The simplest may be chiller return glycol temperature.

Transition from ice production to conventional chiller operation must proceed with out upsetting chiller safety controls. Rapid, major increases in return glycol temperature may increases motor amp draw faster than centrifugal chiller controls can respond, causing nuisance trips due motor current overload. Reciprocating chillers use a controller that has freeze protection "imbedded" in the temperature control. Reciprocating chillers may not return to conventional cooling duty until chiller leaving fluid temperature exceeds 35°F.

HOW IS THE ICE STORAGE CONTROLLED?

The discharge rate of the ice storage system is controlled by varying the fluid flow through the ice storage tanks. This is accomplish by a 3-way mixing or "tempering" valve. (figure 16)

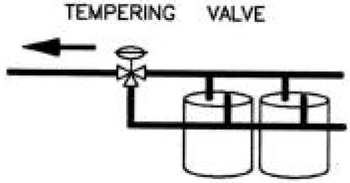


Figure 16

The valve attempts to maintain leaving fluid temperature by mixing cold fluid with warmer fluid bypassing the ice storage tanks. The valve is positioned to direct all the fluid through the tanks during the freezing cycle. In this mode, the tanks are a source of heat.

HOW IS THE HEAT EXCHANGER CONTROLLED?

The capacity of the heat exchanger can be controlled by any number of methods.

1. chilled water flow
2. glycol flow
3. chilled water temperature
4. glycol temperature.

A three way mixing valve in either the glycol loop or chilled water loop can be used for capacity control. A bypass valve is required on the glycol loop to prevent sending fluids at subfreezing temperatures to the heat exchanger during the freeze cycle. This same valve can be used to control heat exchanger capacity. The three way valve controls heat exchanger capacity by varying the quantity of glycol sent to the heat exchanger. (figure 17)

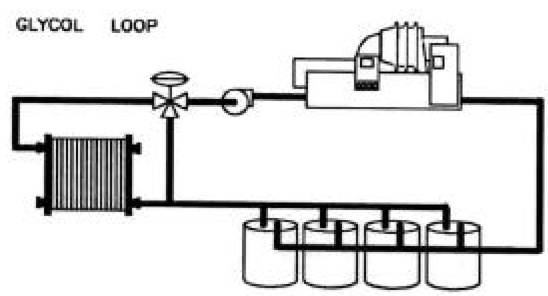


Figure 17

The capacity of the heat exchanger can also be controlled by the temperature or flow rate of chilled water. As the temperature of return water entering the heat exchanger increases, so does the capacity of the heat exchanger. During the melt cycle, the capacity of the heat exchanger is determined by the combined approach temperatures of the heat exchanger and the ice tanks. The temperature of the glycol determines the max capacity of the heat exchanger. Glycol temperatures vary between 33 to 45 °F during the melt cycle. A two to four degree approach at the heat exchanger will produce leaving chilled water temperatures between 35 and 49 °F if left uncontrolled. These temperatures are well within the range of normal comfort cooling applications. Control of the heat exchanger may not be required.. However, if the rate of melting is crucial to the control strategy, some form of capacity control is required.

A.6 CHILLER LIFE CYCLE AND OPTIMIZER COMPUTER RUNS / ECONOMIC ANALYSIS

5 Year Constant Dollar Cost Model

Chiller Combination A
Two new 1500 with vfds

Approximate Energy Cost

	Chilled Water		Condenser Water		Tons	KW/Ton	KW	Hours	kWH	Demand Cost	Energy Use Cost
	LWT ˚F	EWT ˚F	EWT ˚F	LWT ˚F						$8.78/kW/month	$0.0286340/kWH
	44	54	80		3647	0.425	1549.98	82	127098	$27,217.56	$3,639.32
	44	54	75		3282	0.406	1332.61	245	326490.4		$9,348.73
	44	54	80		2954	0.386	1140.27	263	299891.3	$20,023.16	$8,587.09
	44	54	75		2659	0.4	1063.47	313	332864.6		$9,531.25
	44	54	75		2393	0.372	890.12	392	348927.2	$7,815.26	$9,991.18
	44	54	70		2154	0.343	738.656	517	381885.3		$10,934.90
	44	54	75		1938	0.317	614.398	525	322559.2	$5,394.42	$9,236.16
	44	54	70		1744	0.287	500.628	575	287861.2		$8,242.62
	44	54	70		1570	0.273	428.586	721	309010.9		$8,848.22
	44	54	65		1413	0.267	377.25	685	258416.5		$7,399.50
	44	54	65		1272	0.29	368.773	752	277317.1	$3,237.82	$7,940.70

Annual Energy Cost	$157,387.87
5 Year Energy Cost:	$786,939.37
Chiller Purchase Price:	1,043,000
5 Year Life Cycle Evaluation Total:	$1,829,939.37

1. Executive Summary

System Part Load Value (SPLV):	**PLV**
Comination A	0.320 kW/Ton
IPLV or NPLV (ARI 550/590-1998):	
Carrier 1500 Ton VFD	0.296 kW/Ton
Trane 1250	0.354 kW/Ton
Carrier 1500 Ton VFD	0.296 kW/Ton
Trane 650	0.354 kW/Ton

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Comination A
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower(1)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

3. Chiller System Operating Conditions

Bin Temp (F)	Bin MCWB (F)	Building Load (%)	Building Load (Tons)	Chillers On	Chiller Load (%)
97.5	61.5	100	4,900	4	100
92.5	60.5	95	4,667	4	95
87.5	59.5	90	4,433	4	90
82.5	57.9	86	4,200	3	99
77.5	55.9	81	3,967	3	93
72.5	54.2	76	3,734	3	88
67.5	51.9	71	3,500	3	82
62.5	49.5	67	3,267	3	77
57.5	47.1	62	3,034	3	71
52.5	43.8	57	2,800	3	66
47.5	40.4	42	2,067	2	75
42.5	36.9	37	1,834	0	0
37.5	33.4	33	1,601	0	0
32.5	29.4	28	1,367	0	0
27.5	25.1	23	1,134	0	0
22.5	20.8	18	901	0	0
17.5	16.0	14	667	0	0
12.5	11.2	9	434	0	0
7.5	5.9	4	201	0	0

4a. Chiller System Performance

	CH-1				CH-2				CH-3			
Bin Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)
97.5	1,500	0.433	44.00	67.52	1,250	0.412	44.00	67.52	1,500	0.433	44.00	67.52
92.5	1,429	0.411	44.00	66.44	1,190	0.398	44.00	66.44	1,429	0.411	44.00	66.44
87.5	1,357	0.386	44.00	65.35	1,131	0.384	44.00	65.35	1,357	0.386	44.00	65.35
82.5	1,482	0.408	44.00	63.78	1,235	0.379	44.00	63.78	1,482	0.408	44.00	63.78
77.5	1,400	0.377	44.00	61.81	1,167	0.358	44.00	61.81	1,400	0.377	44.00	61.81
72.5	1,318	0.344	44.00	60.06	1,098	0.341	44.00	60.06	1,318	0.344	44.00	60.06
67.5	1,235	0.308	44.00	57.77	1,029	0.337	44.00	57.77	1,235	0.308	44.00	57.77
62.5	1,153	0.267	44.00	55.35	961	0.333	44.00	55.35	1,153	0.267	44.00	55.35
57.5	1,071	0.248	44.00	55.00	892	0.334	44.00	55.00	1,071	0.248	44.00	55.00
52.5	988	0.237	44.00	55.00	824	0.338	44.00	55.00	988	0.237	44.00	55.00
47.5	1,128	0.256	44.00	55.00	940	0.331	44.00	55.00	0	0.000	44.00	n/a
42.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
37.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
32.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
27.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
22.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
17.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
12.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
7.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a

Minimum ECWT condition has been reached for chiller(s): CH-1, CH-2, CH-3
Tower cycling assumed to hold minimum ECWT.

4b. Chiller System Performance

	CH-4				System	
Bin Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Total (kW)	Total (kW/Ton)
97.5	650	0.412	44.00	67.52	2083	0.425
92.5	619	0.398	44.00	66.44	1894	0.406
87.5	588	0.384	44.00	65.35	1710	0.386
82.5	0	0.000	44.00	n/a	1678	0.400
77.5	0	0.000	44.00	n/a	1474	0.372
72.5	0	0.000	44.00	n/a	1282	0.343
67.5	0	0.000	44.00	n/a	1108	0.317
62.5	0	0.000	44.00	n/a	936	0.287
57.5	0	0.000	44.00	n/a	829	0.273
52.5	0	0.000	44.00	n/a	747	0.267
47.5	0	0.000	44.00	n/a	599	0.290
42.5	0	0.000	44.00	n/a	0	0.000
37.5	0	0.000	44.00	n/a	0	0.000
32.5	0	0.000	44.00	n/a	0	0.000
27.5	0	0.000	44.00	n/a	0	0.000
22.5	0	0.000	44.00	n/a	0	0.000
17.5	0	0.000	44.00	n/a	0	0.000
12.5	0	0.000	44.00	n/a	0	0.000
7.5	0	0.000	44.00	n/a	0	0.000

5. SPLV Worksheet

Bin Temp (F)	Building Load (%)	Building Load (Tons)	Cooling Hours	Cooling (Ton-hrs)	Bin Wgt Factor	System (kW/Ton)	Bin Ratio
97.5	100	4,900	82	401,800	0.0238	0.425	0.0560
92.5	95	4,667	245	1,143,345	0.0677	0.406	0.1668
87.5	90	4,433	263	1,165,992	0.0690	0.386	0.1790
82.5	86	4,200	313	1,314,645	0.0778	0.400	0.1948
77.5	81	3,967	392	1,555,008	0.0921	0.372	0.2478
72.5	76	3,734	517	1,930,256	0.1143	0.343	0.3329
67.5	71	3,500	525	1,837,650	0.1088	0.317	0.3437
62.5	67	3,267	575	1,878,525	0.1112	0.287	0.3883
57.5	62	3,034	721	2,187,308	0.1295	0.273	0.4740
52.5	57	2,800	685	1,918,293	0.1136	0.267	0.4259
47.5	42	2,067	752	1,554,459	0.0920	0.290	0.3175
42.5	37	1,834	776	0	0.0000	0.000	0.0000
37.5	33	1,601	857	0	0.0000	0.000	0.0000
32.5	28	1,367	828	0	0.0000	0.000	0.0000
27.5	23	1,134	671	0	0.0000	0.000	0.0000
22.5	18	901	221	0	0.0000	0.000	0.0000
17.5	14	667	135	0	0.0000	0.000	0.0000
12.5	9	434	70	0	0.0000	0.000	0.0000
7.5	4	201	132	0	0.0000	0.000	0.0000
Total:			5,070	16,887,281	1.0000		3.1267

Bin Wgt Factor = Bin Ton-hrs / Total Ton-hrs
Bin Ratio = [Bin Wgt Factor] / [System kW/Ton]
SPLV = 1 / [sum of Bin Ratios]
SPLV = 1 / [3.1267] = 0.320 kW/Ton

6. Procedure for Calculating IPLV for Chillers

Procedure for Calculating IPLV for Water-Cooled Electric Chillers

Chiller Load (%)	LCHWT (F)	Cond Temp (F)	Wgt Factor	Chiller (kW/Ton)	Bin Ratio
100	44.00	85.00	0.01	A	0.01/A
75	44.00	75.00	0.42	B	0.42/B
50	44.00	65.00	0.45	C	0.45/C
25	44.00	65.00	0.12	D	0.12/D
Total:			1.00		

IPLV = 1 / [sum of Bin Ratios]
IPLV = 1 / [0.10/A + 0.42/B + 0.45/C + 0.12/D]
per ARI Standard 550/590-1998

1. Summary of Custom Weighting Factors and ECWTs

	Custom Weighting Factors				Custom Entering Condenser Temperatures (F)			
Chiller	**25%**	**50%**	**75%**	**100%**	**25%**	**50%**	**75%**	**100%**
CH-1 - Carrier 1500 Ton VFD	0.000	0.000	0.558	0.442	n/a	n/a	55.6	63.0
CH-2 - Trane 1250	0.000	0.000	0.588	0.412	n/a	n/a	55.5	63.0
CH-3 - Carrier 1500 Ton VFD	0.000	0.000	0.558	0.442	n/a	n/a	55.6	63.0
CH-4 - Trane 650	0.000	0.000	0.000	1.000	n/a	n/a	n/a	66.1

2. Input Data Summary

Weather

City .... Salt Lake City, Utah

Schedule .... On All Day: Weekday

.... On All Day: Saturday

.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Comination A

Chillers in Plant 4

Plant Control .... Sequenced

Full Load LCHWT .... 44.0 F

Tower Configuration .... One Tower for System

Cooling Tower .... 6 Cell Tower(1)

.... Detailed Cooling Tower Model

Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

3. Chiller System Operating Conditions

Bin Temp (F)	Bin MCWB (F)	Building Load (%)	Building Load (Tons)	Chillers On	Chiller Load (%)
97.5	61.5	100	4,900	4	100
92.5	60.5	95	4,667	4	95
87.5	59.5	90	4,433	4	90
82.5	57.9	86	4,200	3	99
77.5	55.9	81	3,967	3	93
72.5	54.2	76	3,734	3	88
67.5	51.9	71	3,500	3	82
62.5	49.5	67	3,267	3	77
57.5	47.1	62	3,034	3	71
52.5	43.8	57	2,800	3	66
47.5	40.4	42	2,067	2	75
42.5	36.9	37	1,834	0	0
37.5	33.4	33	1,601	0	0
32.5	29.4	28	1,367	0	0
27.5	25.1	23	1,134	0	0
22.5	20.8	18	901	0	0
17.5	16.0	14	667	0	0
12.5	11.2	9	434	0	0
7.5	5.9	4	201	0	0

4a. Custom PLV Worksheet for CH-1 (Carrier 1500 Ton VFD)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin		50% Bin		75% Bin		100% Bin	
							(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)
97.5	67.5	82	5,537	123,000	1,500	100	0	0	0	0	0	0	5,537	123,000
92.5	66.4	245	16,279	350,004	1,429	95	0	0	0	0	0	0	16,279	350,004
87.5	65.3	263	17,187	356,936	1,357	90	0	0	0	0	0	0	17,187	356,936
82.5	63.8	313	19,964	463,992	1,482	99	0	0	0	0	0	0	19,964	463,992
77.5	61.8	392	24,229	548,826	1,400	93	0	0	0	0	0	0	24,229	548,826
72.5	60.1	517	31,049	681,267	1,318	88	0	0	0	0	0	0	31,049	681,267
67.5	57.8	525	30,328	648,582	1,235	82	0	0	0	0	30,328	648,582	0	0
62.5	55.3	575	31,824	663,009	1,153	77	0	0	0	0	31,824	663,009	0	0
57.5	55.0	721	39,655	771,991	1,071	71	0	0	0	0	39,655	771,991	0	0
52.5	55.0	685	37,675	677,045	988	66	0	0	0	0	37,675	677,045	0	0
47.5	55.0	752	41,360	847,887	1,128	75	0	0	0	0	41,360	847,887	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		5,070	295,086	6,132,540			0	0	0	0	180,842	3,608,514	114,244	2,524,026

4b. Custom PLV Worksheet for CH-2 (Trane 1250)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	67.5	82	5,537	102,500	1,250	100	0	0	0	0	0	0	5,537	102,500
92.5	66.4	245	16,279	291,670	1,190	95	0	0	0	0	0	0	16,279	291,670
87.5	65.3	263	17,187	297,447	1,131	90	0	0	0	0	0	0	17,187	297,447
82.5	63.8	313	19,964	386,660	1,235	99	0	0	0	0	0	0	19,964	386,660
77.5	61.8	392	24,229	457,355	1,167	93	0	0	0	0	0	0	24,229	457,355
72.5	60.1	517	31,049	567,723	1,098	88	0	0	0	0	0	0	31,049	567,723
67.5	57.8	525	30,328	540,485	1,029	82	0	0	0	0	30,328	540,485	0	0
62.5	55.3	575	31,824	552,507	961	77	0	0	0	0	31,824	552,507	0	0
57.5	55.0	721	39,655	643,326	892	71	0	0	0	0	39,655	643,326	0	0
52.5	55.0	685	37,675	564,204	824	66	0	0	0	0	37,675	564,204	0	0
47.5	55.0	752	41,360	706,572	940	75	0	0	0	0	41,360	706,572	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		5,070	295,086	5,110,450			0	0	0	0	180,842	3,007,095	114,244	2,103,355
Cust Wgt Factors:								0.000		0.000		0.588		0.412
Custom Entering Condenser Temperatures (F):								n/a		n/a		55.5		63.0

4c. Custom PLV Worksheet for CH-3 (Carrier 1500 Ton VFD)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin		50% Bin		75% Bin		100% Bin	
							(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)
97.5	67.5	82	5,537	123,000	1,500	100	0	0	0	0	0	0	5,537	123,000
92.5	66.4	245	16,279	350,004	1,429	95	0	0	0	0	0	0	16,279	350,004
87.5	65.3	263	17,187	356,936	1,357	90	0	0	0	0	0	0	17,187	356,936
82.5	63.8	313	19,964	463,992	1,482	99	0	0	0	0	0	0	19,964	463,992
77.5	61.8	392	24,229	548,826	1,400	93	0	0	0	0	0	0	24,229	548,826
72.5	60.1	517	31,049	681,267	1,318	88	0	0	0	0	0	0	31,049	681,267
67.5	57.8	525	30,328	648,582	1,235	82	0	0	0	0	30,328	648,582	0	0
62.5	55.3	575	31,824	663,009	1,153	77	0	0	0	0	31,824	663,009	0	0
57.5	55.0	721	39,655	771,991	1,071	71	0	0	0	0	39,655	771,991	0	0
52.5	55.0	685	37,675	677,045	988	66	0	0	0	0	37,675	677,045	0	0
47.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		4,318	253,726	5,284,653			0	0	0	0	139,482	2,760,627	114,244	2,524,026

4d. Custom PLV Worksheet for CH-4 (Trane 650)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	67.5	82	5,537	53,300	650	100	0	0	0	0	0	0	5,537	53,300
92.5	66.4	245	16,279	151,668	619	95	0	0	0	0	0	0	16,279	151,668
87.5	65.3	263	17,187	154,672	588	90	0	0	0	0	0	0	17,187	154,672
82.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
77.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
72.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
67.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
62.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
57.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
52.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
47.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		590	39,002	359,641			0	0	0	0	0	0	39,002	359,641
Cust Wgt Factors:								0.000		0.000		0.000		1.000
Custom Entering Condenser Temperatures (F):								n/a		n/a		n/a		66.1

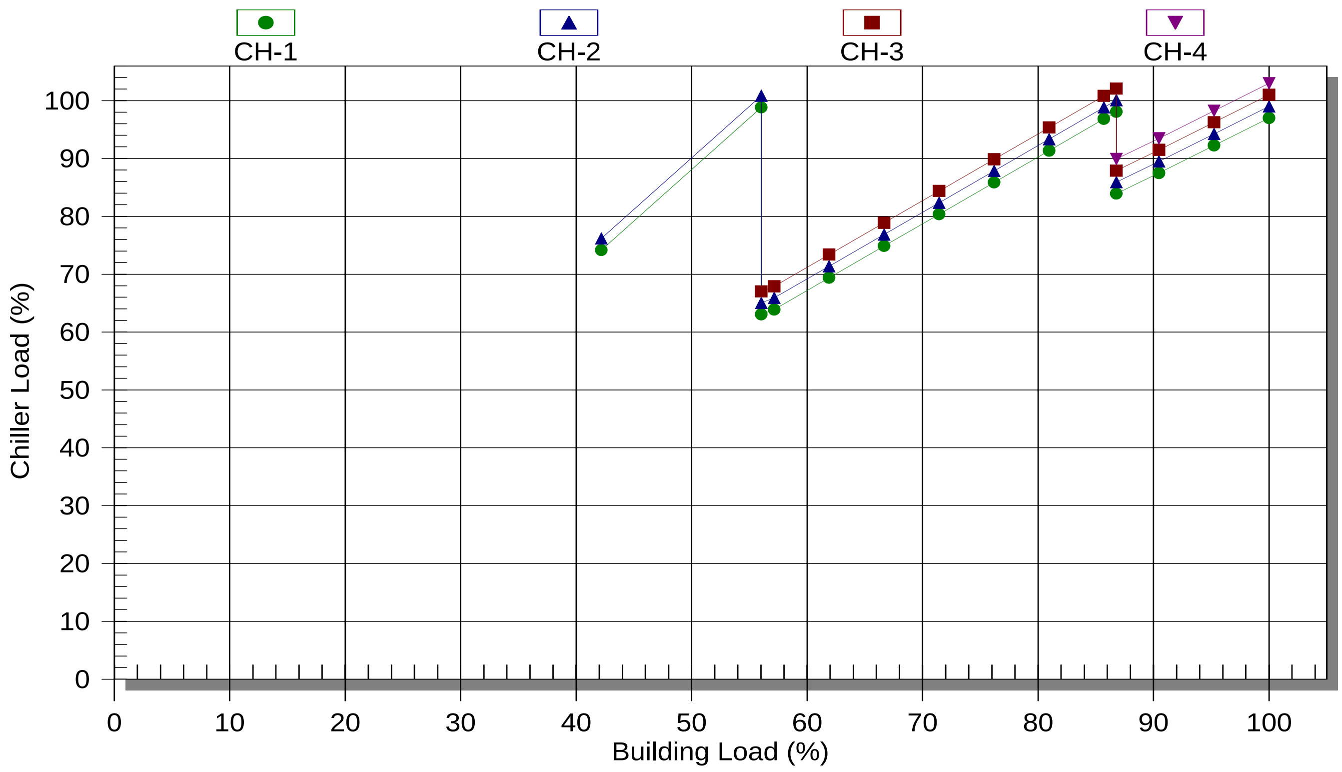
KEY for Custom PLV Worksheet table(s):
[Avg DB] = Midpoint temperature for bin.
[Cond Temp] = Entering condenser temperature for bin. Entering water temperature for water-cooled chillers. Entering air temperature for air-cooled chillers.
[Tot Hrs] = Hours of operation in bin.
[CWH] = Condenser temperature hours. [Tot Hrs] times [Cond Temp]. Later used to derive the four average entering condenser temperature values for the PLV calculation.
[Load] = Chiller load for bin.
[Load (%)] = Chiller load as a percentage of full load capacity.
[Total (Ton-hrs)] = Chiller [Load] times [Tot Hrs]. Later used to derive the four weighting factors for the PLV calculation.
[Bin (CWH)] = [CWH] values separated into the four PLV bins: 25%, 50%, 75% and 100% load according to chiller load for each bin.
[Bin (Ton-hrs)] = Values separated into the four PLV bins: 25%, 50%, 75% and 100% load according to the chiller load for each bin.
[Cust Wgt Factor] = The four custom PLV weighting factors. [Total (Ton-hrs)] for PLV Bin divided by [Total (Ton-hrs)] for the chiller.
[Cust Ent Cond Temps] = The four custom condenser temperature values for the PLV calculation = [Total (CWH)] for PLV bin divided by [Tot Hrs] in the PLV bin.

5a. Average Weighting Factors and Entering Condenser Temperatures (CH-1, CH-3)

	25% Bin			50% Bin			75% Bin			100% Bin		
Chiller	**Hrs**	**CWH**	**Ton-hrs**	**Hrs**	**CWH**	**Ton-hrs**	**Hrs**	**CWH**	**Ton-hrs**	**Hrs**	**CWH**	**Ton-hrs**
CH-1	0	0	0	0	0	0	3,258	180,842	3,608,514	1,812	114,244	2,524,026
CH-3	0	0	0	0	0	0	2,506	139,482	2,760,627	1,812	114,244	2,524,026
Totals:	0	0	0	0	0	0	5,764	320,324	6,369,141	3,624	228,489	5,048,051
Cust Wgt Factor:			0.000			0.000			0.558			0.442
Cust Ent Cond Temps (F):			n/a			n/a			55.6			63.0

Grand Total Ton-hrs = 11,417,192

Average weighting factors and entering condenser temperatures are calculated because the following chillers are all identical: CH-1, CH-3. Over the life of the chiller plant, these chillers will be rotated to operate in each of the CH-1, CH-3 sequencing positions. Therefore, a lifecycle PLV must consider each chiller operating in each of these sequencing positions.



Note: Individual chiller curves in this graph have been adjusted up or down so the number of chillers operating at each point can be seen. If the curves had not been adjusted, all curves would lie on top of each other. Because of the adjustment each chiller load shown on the graph is only accurate to within a few percentage points plus or minus of the original calculated values.

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

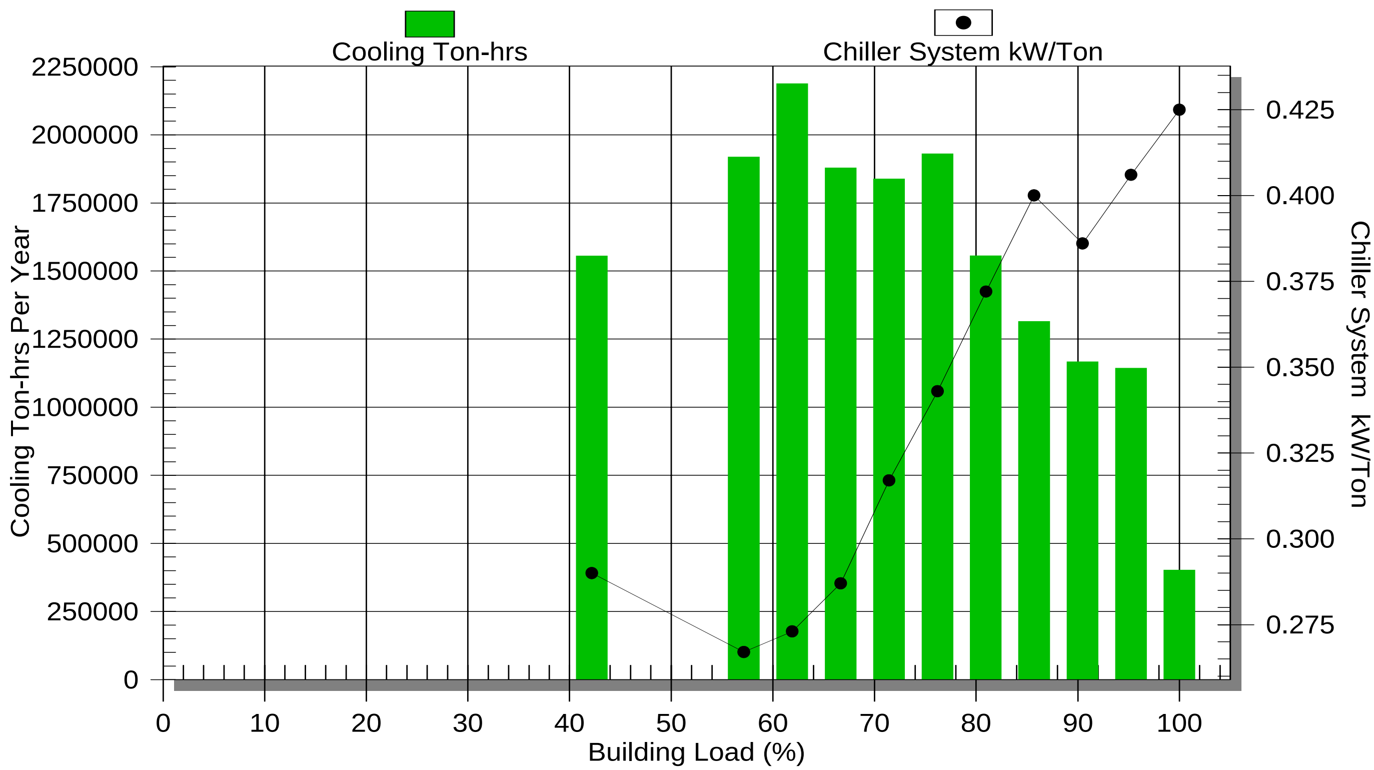
Loads

User-Defined Load Profile

Chiller System

Name .... Comination A
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower(1)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton



2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Comination A
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower(1)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

5 Year Constant Dollar Cost Model

Chiller Combination A-1
One new 1500 with vfd, one without

Approximate Energy Cost

	Chilled Water		Condenser Water		Tons	KW/Ton	KW	Hours	kWH	Demand Cost	Energy Use Cost
	LWT ˚F	EWT ˚F	EWT ˚F	LWT ˚F						$8.78/kW/month	$0.0286340/kWH
	44	54	80		3647	0.425	1549.98	82	127098	$27,217.56	$3,639.32
	44	54	75		3282	0.412	1352.31	245	331315.4		$9,486.88
	44	54	80		2954	0.397	1172.77	263	308437.4	$20,593.77	$8,831.80
	44	54	75		2659	0.405	1076.76	313	337025.4		$9,650.39
	44	54	75		2393	0.386	923.62	392	362058.9	$8,109.38	$10,367.19
	44	54	70		2154	0.367	790.341	517	408606.2		$11,700.03
	44	54	75		1938	0.351	680.296	525	357155.4	$5,973.00	$10,226.79
	44	54	70		1744	0.334	582.612	575	335002.2		$9,592.45
	44	54	70		1570	0.328	514.932	721	371265.8		$10,630.82
	44	54	65		1413	0.326	460.613	685	315519.7		$9,034.59
	44	54	65		1272	0.29	368.773	752	277317.1	$3,237.82	$7,940.70

Annual Energy Cost	$166,232.50
5 Year Energy Cost:	$831,162.50
Chiller Purchase Price:	998,000
5 Year Life Cycle Evaluation Total:	$1,829,162.50

1. Executive Summary

System Part Load Value (SPLV):	**PLV**
Combination A-1	0.352 kW/Ton
IPLV or NPLV (ARI 550/590-1998):	
Carrier 1500 Ton VFD	0.296 kW/Ton
Trane 1250	0.354 kW/Ton
Carrier 1500 Ton Constant	0.449 kW/Ton
Trane 650	0.354 kW/Ton

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Combination A-1
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower(2)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1500 Ton Constant	1,500	0.458 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

3. Chiller System Operating Conditions

Bin Temp (F)	Bin MCWB (F)	Building Load (%)	Building Load (Tons)	Chillers On	Chiller Load (%)
97.5	61.5	100	4,900	4	100
92.5	60.5	95	4,667	4	95
87.5	59.5	90	4,433	4	90
82.5	57.9	86	4,200	3	99
77.5	55.9	81	3,967	3	93
72.5	54.2	76	3,734	3	88
67.5	51.9	71	3,500	3	82
62.5	49.5	67	3,267	3	77
57.5	47.1	62	3,034	3	71
52.5	43.8	57	2,800	3	66
47.5	40.4	42	2,067	2	75
42.5	36.9	37	1,834	0	0
37.5	33.4	33	1,601	0	0
32.5	29.4	28	1,367	0	0
27.5	25.1	23	1,134	0	0
22.5	20.8	18	901	0	0
17.5	16.0	14	667	0	0
12.5	11.2	9	434	0	0
7.5	5.9	4	201	0	0

4a. Chiller System Performance

	CH-1				CH-2				CH-3			
Bin Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)
97.5	1,500	0.433	44.00	67.53	1,250	0.413	44.00	67.53	1,500	0.434	44.00	67.53
92.5	1,429	0.411	44.00	66.46	1,190	0.398	44.00	66.46	1,429	0.429	44.00	66.46
87.5	1,357	0.387	44.00	65.37	1,131	0.385	44.00	65.37	1,357	0.425	44.00	65.37
82.5	1,482	0.408	44.00	63.80	1,235	0.379	44.00	63.80	1,482	0.423	44.00	63.80
77.5	1,400	0.377	44.00	61.83	1,167	0.359	44.00	61.83	1,400	0.416	44.00	61.83
72.5	1,318	0.345	44.00	60.09	1,098	0.341	44.00	60.09	1,318	0.411	44.00	60.09
67.5	1,235	0.308	44.00	57.82	1,029	0.337	44.00	57.82	1,235	0.406	44.00	57.82
62.5	1,153	0.268	44.00	55.42	961	0.333	44.00	55.42	1,153	0.403	44.00	55.42
57.5	1,071	0.248	44.00	55.00	892	0.334	44.00	55.00	1,071	0.403	44.00	55.00
52.5	988	0.237	44.00	55.00	824	0.338	44.00	55.00	988	0.405	44.00	55.00
47.5	1,128	0.256	44.00	55.00	940	0.331	44.00	55.00	0	0.000	44.00	n/a
42.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
37.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
32.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
27.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
22.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
17.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
12.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
7.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a

Minimum ECWT condition has been reached for chiller(s): CH-1, CH-2, CH-3
Tower cycling assumed to hold minimum ECWT.

4b. Chiller System Performance

	CH-4				System	
Bin Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Total (kW)	Total (kW/Ton)
97.5	650	0.413	44.00	67.53	2084	0.425
92.5	619	0.398	44.00	66.46	1921	0.412
87.5	588	0.385	44.00	65.37	1762	0.397
82.5	0	0.000	44.00	n/a	1700	0.405
77.5	0	0.000	44.00	n/a	1530	0.386
72.5	0	0.000	44.00	n/a	1370	0.367
67.5	0	0.000	44.00	n/a	1230	0.351
62.5	0	0.000	44.00	n/a	1093	0.334
57.5	0	0.000	44.00	n/a	995	0.328
52.5	0	0.000	44.00	n/a	913	0.326
47.5	0	0.000	44.00	n/a	599	0.290
42.5	0	0.000	44.00	n/a	0	0.000
37.5	0	0.000	44.00	n/a	0	0.000
32.5	0	0.000	44.00	n/a	0	0.000
27.5	0	0.000	44.00	n/a	0	0.000
22.5	0	0.000	44.00	n/a	0	0.000
17.5	0	0.000	44.00	n/a	0	0.000
12.5	0	0.000	44.00	n/a	0	0.000
7.5	0	0.000	44.00	n/a	0	0.000

5. SPLV Worksheet

Bin Temp (F)	Building Load (%)	Building Load (Tons)	Cooling Hours	Cooling (Ton-hrs)	Bin Wgt Factor	System (kW/Ton)	Bin Ratio
97.5	100	4,900	82	401,800	0.0238	0.425	0.0559
92.5	95	4,667	245	1,143,345	0.0677	0.412	0.1645
87.5	90	4,433	263	1,165,992	0.0690	0.397	0.1737
82.5	86	4,200	313	1,314,645	0.0778	0.405	0.1923
77.5	81	3,967	392	1,555,008	0.0921	0.386	0.2388
72.5	76	3,734	517	1,930,256	0.1143	0.367	0.3114
67.5	71	3,500	525	1,837,650	0.1088	0.351	0.3097
62.5	67	3,267	575	1,878,525	0.1112	0.334	0.3326
57.5	62	3,034	721	2,187,308	0.1295	0.328	0.3949
52.5	57	2,800	685	1,918,293	0.1136	0.326	0.3484
47.5	42	2,067	752	1,554,459	0.0920	0.290	0.3175
42.5	37	1,834	776	0	0.0000	0.000	0.0000
37.5	33	1,601	857	0	0.0000	0.000	0.0000
32.5	28	1,367	828	0	0.0000	0.000	0.0000
27.5	23	1,134	671	0	0.0000	0.000	0.0000
22.5	18	901	221	0	0.0000	0.000	0.0000
17.5	14	667	135	0	0.0000	0.000	0.0000
12.5	9	434	70	0	0.0000	0.000	0.0000
7.5	4	201	132	0	0.0000	0.000	0.0000
Total:			5,070	16,887,281	1.0000		2.8398

Bin Wgt Factor = Bin Ton-hrs / Total Ton-hrs
Bin Ratio = [Bin Wgt Factor] / [System kW/Ton]
SPLV = 1 / [sum of Bin Ratios]
SPLV = 1 / [2.8398] = 0.352 kW/Ton

6. Procedure for Calculating IPLV for Chillers

Procedure for Calculating IPLV for Water-Cooled Electric Chillers

Chiller Load (%)	LCHWT (F)	Cond Temp (F)	Wgt Factor	Chiller (kW/Ton)	Bin Ratio
100	44.00	85.00	0.01	A	0.01/A
75	44.00	75.00	0.42	B	0.42/B
50	44.00	65.00	0.45	C	0.45/C
25	44.00	65.00	0.12	D	0.12/D
Total:			1.00		

IPLV = 1 / [sum of Bin Ratios]
IPLV = 1 / [0.10/A + 0.42/B + 0.45/C + 0.12/D]
per ARI Standard 550/590-1998

1. Summary of Custom Weighting Factors and ECWTs

	Custom Weighting Factors				Custom Entering Condenser Temperatures (F)			
Chiller	**25%**	**50%**	**75%**	**100%**	**25%**	**50%**	**75%**	**100%**
CH-1 - Carrier 1500 Ton VFD	0.000	0.000	0.588	0.412	n/a	n/a	55.5	63.1
CH-2 - Trane 1250	0.000	0.000	0.588	0.412	n/a	n/a	55.5	63.1
CH-3 - Carrier 1500 Ton Constant	0.000	0.000	0.522	0.478	n/a	n/a	55.7	63.1
CH-4 - Trane 650	0.000	0.000	0.000	1.000	n/a	n/a	n/a	66.1

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Combination A-1
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower(2)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1500 Ton Constant	1,500	0.458 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

3. Chiller System Operating Conditions

Bin Temp (F)	Bin MCWB (F)	Building Load (%)	Building Load (Tons)	Chillers On	Chiller Load (%)
97.5	61.5	100	4,900	4	100
92.5	60.5	95	4,667	4	95
87.5	59.5	90	4,433	4	90
82.5	57.9	86	4,200	3	99
77.5	55.9	81	3,967	3	93
72.5	54.2	76	3,734	3	88
67.5	51.9	71	3,500	3	82
62.5	49.5	67	3,267	3	77
57.5	47.1	62	3,034	3	71
52.5	43.8	57	2,800	3	66
47.5	40.4	42	2,067	2	75
42.5	36.9	37	1,834	0	0
37.5	33.4	33	1,601	0	0
32.5	29.4	28	1,367	0	0
27.5	25.1	23	1,134	0	0
22.5	20.8	18	901	0	0
17.5	16.0	14	667	0	0
12.5	11.2	9	434	0	0
7.5	5.9	4	201	0	0

4a. Custom PLV Worksheet for CH-1 (Carrier 1500 Ton VFD)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin		50% Bin		75% Bin		100% Bin	
							(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)
97.5	67.5	82	5,537	123,000	1,500	100	0	0	0	0	0	0	5,537	123,000
92.5	66.5	245	16,282	350,004	1,429	95	0	0	0	0	0	0	16,282	350,004
87.5	65.4	263	17,192	356,936	1,357	90	0	0	0	0	0	0	17,192	356,936
82.5	63.8	313	19,968	463,992	1,482	99	0	0	0	0	0	0	19,968	463,992
77.5	61.8	392	24,239	548,826	1,400	93	0	0	0	0	0	0	24,239	548,826
72.5	60.1	517	31,068	681,267	1,318	88	0	0	0	0	0	0	31,068	681,267
67.5	57.8	525	30,355	648,582	1,235	82	0	0	0	0	30,355	648,582	0	0
62.5	55.4	575	31,865	663,009	1,153	77	0	0	0	0	31,865	663,009	0	0
57.5	55.0	721	39,655	771,991	1,071	71	0	0	0	0	39,655	771,991	0	0
52.5	55.0	685	37,675	677,045	988	66	0	0	0	0	37,675	677,045	0	0
47.5	55.0	752	41,360	847,887	1,128	75	0	0	0	0	41,360	847,887	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		5,070	295,197	6,132,540			0	0	0	0	180,910	3,608,514	114,287	2,524,026
Cust Wgt Factors:								0.000		0.000		0.588		0.412
Custom Entering Condenser Temperatures (F):								n/a		n/a		55.5		63.1

4b. Custom PLV Worksheet for CH-2 (Trane 1250)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	67.5	82	5,537	102,500	1,250	100	0	0	0	0	0	0	5,537	102,500
92.5	66.5	245	16,282	291,670	1,190	95	0	0	0	0	0	0	16,282	291,670
87.5	65.4	263	17,192	297,447	1,131	90	0	0	0	0	0	0	17,192	297,447
82.5	63.8	313	19,968	386,660	1,235	99	0	0	0	0	0	0	19,968	386,660
77.5	61.8	392	24,239	457,355	1,167	93	0	0	0	0	0	0	24,239	457,355
72.5	60.1	517	31,068	567,723	1,098	88	0	0	0	0	0	0	31,068	567,723
67.5	57.8	525	30,355	540,485	1,029	82	0	0	0	0	30,355	540,485	0	0
62.5	55.4	575	31,865	552,507	961	77	0	0	0	0	31,865	552,507	0	0
57.5	55.0	721	39,655	643,326	892	71	0	0	0	0	39,655	643,326	0	0
52.5	55.0	685	37,675	564,204	824	66	0	0	0	0	37,675	564,204	0	0
47.5	55.0	752	41,360	706,572	940	75	0	0	0	0	41,360	706,572	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		5,070	295,197	5,110,450			0	0	0	0	180,910	3,007,095	114,287	2,103,355
Cust Wgt Factors:								0.000		0.000		0.588		0.412
Custom Entering Condenser Temperatures (F):								n/a		n/a		55.5		63.1

4c. Custom PLV Worksheet for CH-3 (Carrier 1500 Ton Constant)

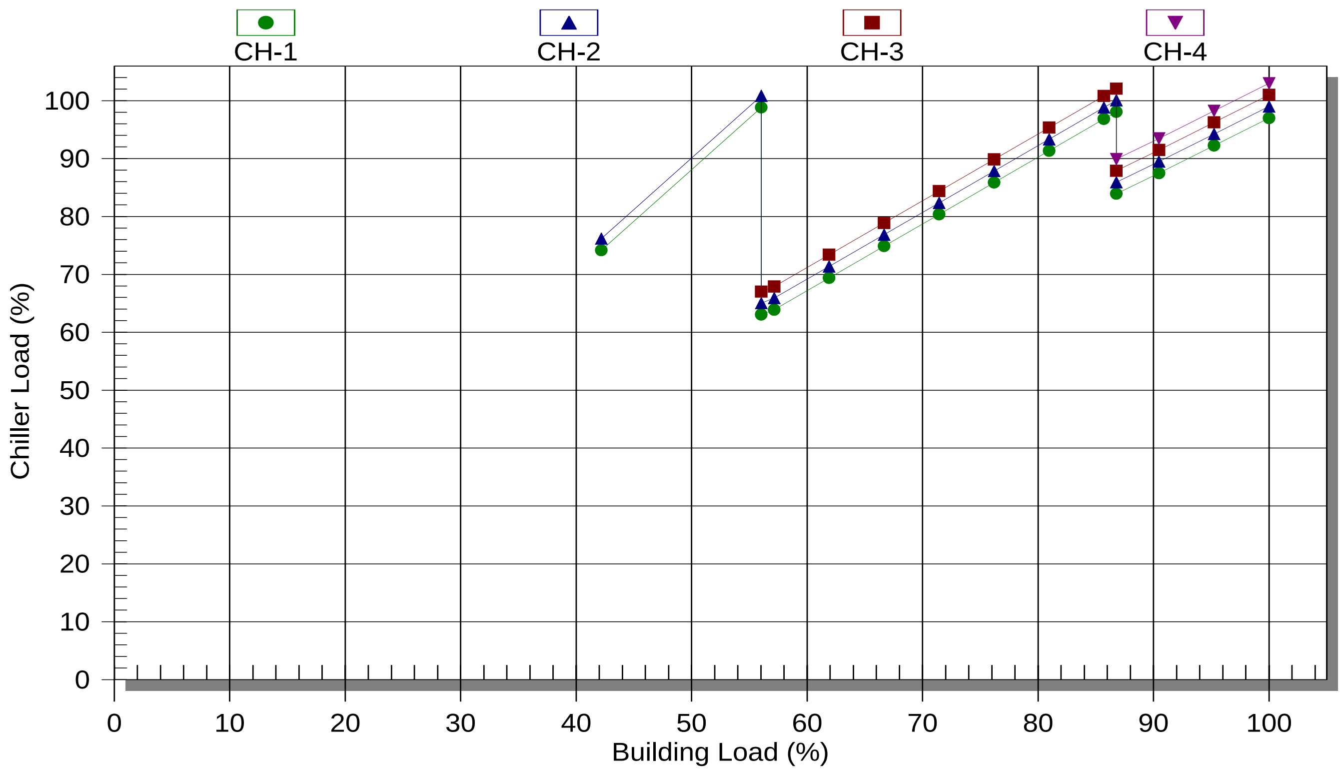
Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	67.5	82	5,537	123,000	1,500	100	0	0	0	0	0	0	5,537	123,000
92.5	66.5	245	16,282	350,004	1,429	95	0	0	0	0	0	0	16,282	350,004
87.5	65.4	263	17,192	356,936	1,357	90	0	0	0	0	0	0	17,192	356,936
82.5	63.8	313	19,968	463,992	1,482	99	0	0	0	0	0	0	19,968	463,992
77.5	61.8	392	24,239	548,826	1,400	93	0	0	0	0	0	0	24,239	548,826
72.5	60.1	517	31,068	681,267	1,318	88	0	0	0	0	0	0	31,068	681,267
67.5	57.8	525	30,355	648,582	1,235	82	0	0	0	0	30,355	648,582	0	0
62.5	55.4	575	31,865	663,009	1,153	77	0	0	0	0	31,865	663,009	0	0
57.5	55.0	721	39,655	771,991	1,071	71	0	0	0	0	39,655	771,991	0	0
52.5	55.0	685	37,675	677,045	988	66	0	0	0	0	37,675	677,045	0	0
47.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		4,318	253,837	5,284,653			0	0	0	0	139,550	2,760,627	114,287	2,524,026
Cust Wgt Factors:								0.000		0.000		0.522		0.478
Custom Entering Condenser Temperatures (F):								n/a		n/a		55.7		63.1

4d. Custom PLV Worksheet for CH-4 (Trane 650)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	67.5	82	5,537	53,300	650	100	0	0	0	0	0	0	5,537	53,300
92.5	66.5	245	16,282	151,668	619	95	0	0	0	0	0	0	16,282	151,668
87.5	65.4	263	17,192	154,672	588	90	0	0	0	0	0	0	17,192	154,672
82.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
77.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
72.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
67.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
62.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
57.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
52.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
47.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		590	39,012	359,641			0	0	0	0	0	0	39,012	359,641
Cust Wgt Factors:								0.000		0.000		0.000		1.000
Custom Entering Condenser Temperatures (F):								n/a		n/a		n/a		66.1

KEY for Custom PLV Worksheet table(s):

[Avg DB] = Midpoint temperature for bin.
[Cond Temp] = Entering condenser temperature for bin. Entering water temperature for water-cooled chillers. Entering air temperature for air-cooled chillers.
[Tot Hrs] = Hours of operation in bin.
[CWH] = Condenser temperature hours. [Tot Hrs] times [Cond Temp]. Later used to derive the four average entering condenser temperature values for the PLV calculation.
[Load] = Chiller load for bin.
[Load (%)] = Chiller load as a percentage of full load capacity.
[Total (Ton-hrs)] = Chiller [Load] times [Tot Hrs]. Later used to derive the four weighting factors for the PLV calculation.
[Bin (CWH)] = [CWH] values separated into the four PLV bins: 25%, 50%, 75% and 100% load according to chiller load for each bin.
[Bin (Ton-hrs)] = Values separated into the four PLV bins: 25%, 50%, 75% and 100% load according to the chiller load for each bin.
[Cust Wgt Factor] = The four custom PLV weighting factors. [Total (Ton-hrs)] for PLV Bin divided by [Total (Ton-hrs)] for the chiller.
[Cust Ent Cond Temps] = The four custom condenser temperature values for the PLV calculation = [Total (CWH)] for PLV bin divided by [Tot Hrs] in the PLV bin.



Note: Individual chiller curves in this graph have been adjusted up or down so the number of chillers operating at each point can be seen. If the curves had not been adjusted, all curves would lie on top of each other. Because of the adjustment each chiller load shown on the graph is only accurate to within a few percentage points plus or minus of the original calculated values.

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

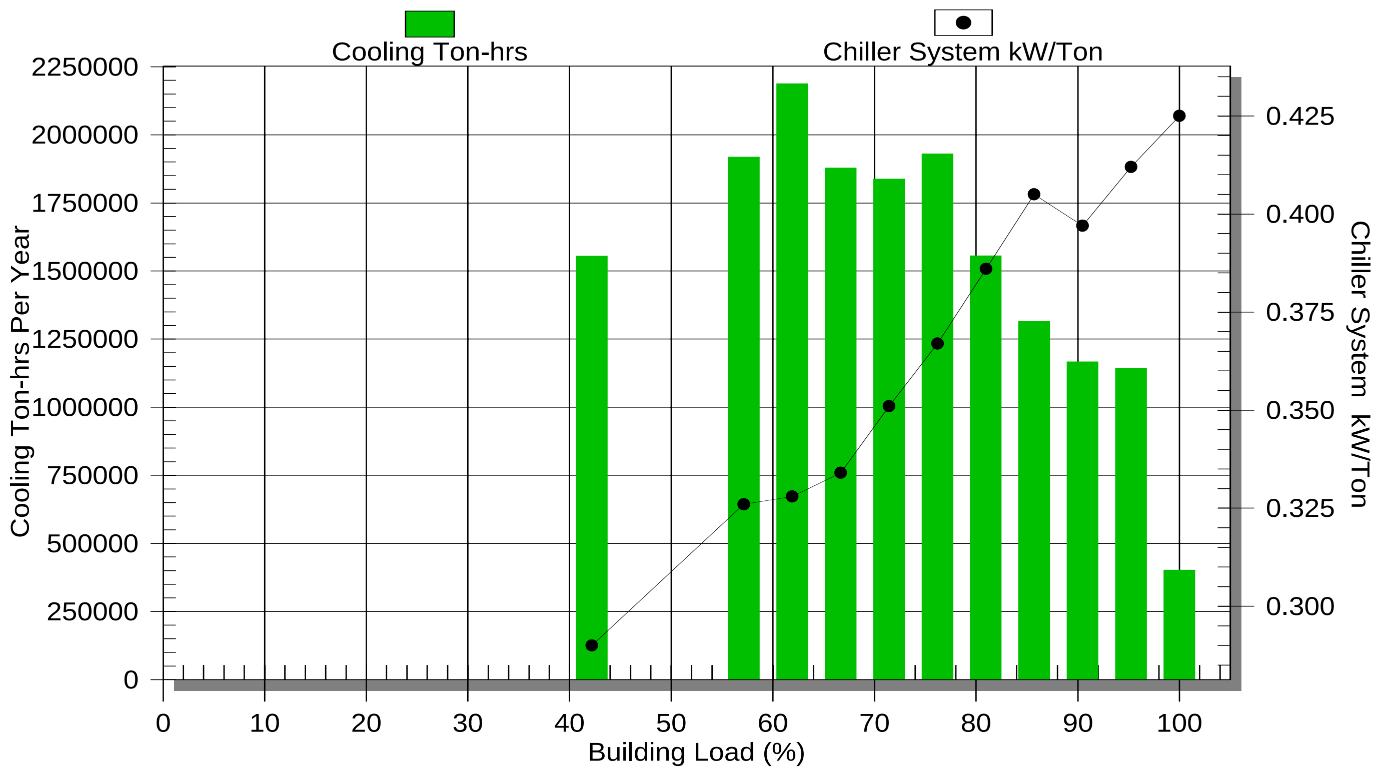
Loads

User-Defined Load Profile

Chiller System

Name .... Combination A-1
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower(2)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1500 Ton Constant	1,500	0.458 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton



2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Combination A-1
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower(2)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1500 Ton VFD	1,500	0.482 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1500 Ton Constant	1,500	0.458 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

5 Year Constant Dollar Cost Model

Chiller Combination F
Two new 1700 with vfds

Approximate Energy Cost

	Chilled Water		Condenser Water		Tons	KW/Ton	KW	Hours	kWH	Demand Cost	Energy Use Cost
	LWT ˚F	EWT ˚F	EWT ˚F	LWT ˚F						$8.78/kW/month	$0.0286340/kWH
	44	54	80		3647	0.4	1458.8	82	119621.6	$25,616.53	$3,425.24
	44	54	75		3282	0.382	1253.84	245	307190.5		$8,796.09
	44	54	80		2954	0.363	1072.33	263	282022.1	$18,830.07	$8,075.42
	44	54	75		2659	0.371	986.364	313	308731.9		$8,840.23
	44	54	75		2393	0.345	825.515	392	323601.8	$7,248.02	$9,266.01
	44	54	70		2154	0.319	686.972	517	355164.5		$10,169.78
	44	54	75		1938	0.287	556.253	525	292033.1	$4,883.91	$8,362.07
	44	54	70		1744	0.252	439.576	575	252756.1		$7,237.42
	44	54	70		1570	0.246	386.199	721	278449.4		$7,973.12
	44	54	65		1413	0.245	346.166	685	237123.7		$6,789.80
	44	54	65		1272	0.268	340.797	752	256279.3	$2,992.20	$7,338.30
								5070			

Annual Energy Cost	$145,844.22
5 Year Energy Cost:	$729,221.08
Chiller Purchase Price:	1,197,000
5 Year Life Cycle Evaluation Total:	$1,926,221.08

1. Executive Summary

System Part Load Value (SPLV):	PLV
Combination F	0.293 kW/Ton
IPLV or NPLV (ARI 550/590-1998):	
Carrier 1700 Ton VFD	0.300 kW/Ton
Trane 1250	0.354 kW/Ton
Carrier 1700 Ton VFD	0.300 kW/Ton
Trane 650	0.354 kW/Ton

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Combination F
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower (1)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

3. Chiller System Operating Conditions

Bin Temp (F)	Bin MCWB (F)	Building Load (%)	Building Load (Tons)	Chillers On	Chiller Load (%)
97.5	61.5	100	5,300	4	100
92.5	60.5	95	5,048	4	95
87.5	59.5	90	4,795	4	90
82.5	57.9	86	4,542	3	98
77.5	55.9	81	4,290	3	92
72.5	54.2	76	4,039	3	87
67.5	51.9	71	3,786	3	81
62.5	49.5	67	3,534	3	76
57.5	47.1	62	3,281	3	71
52.5	43.8	57	3,029	3	65
47.5	40.4	42	2,235	2	76
42.5	36.9	37	1,984	0	0
37.5	33.4	33	1,731	0	0
32.5	29.4	28	1,479	0	0
27.5	25.1	23	1,227	0	0
22.5	20.8	17	916	0	0
17.5	16.0	14	750	0	0
12.5	11.2	9	501	0	0
7.5	5.9	4	216	0	0

4a. Chiller System Performance

	CH-1				CH-2				CH-3			
Bin Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)
97.5	1,700	0.399	44.00	66.28	1,250	0.402	44.00	66.28	1,700	0.399	44.00	66.28
92.5	1,619	0.379	44.00	65.20	1,191	0.388	44.00	65.20	1,619	0.379	44.00	65.20
87.5	1,538	0.357	44.00	64.11	1,131	0.375	44.00	64.11	1,538	0.357	44.00	64.11
82.5	1,661	0.373	44.00	62.51	1,221	0.367	44.00	62.51	1,661	0.373	44.00	62.51
77.5	1,568	0.344	44.00	60.51	1,153	0.347	44.00	60.51	1,568	0.344	44.00	60.51
72.5	1,477	0.312	44.00	58.75	1,086	0.340	44.00	58.75	1,477	0.312	44.00	58.75
67.5	1,384	0.269	44.00	56.43	1,018	0.336	44.00	56.43	1,384	0.269	44.00	56.43
62.5	1,292	0.223	44.00	55.00	950	0.332	44.00	55.00	1,292	0.223	44.00	55.00
57.5	1,200	0.214	44.00	55.00	882	0.334	44.00	55.00	1,200	0.214	44.00	55.00
52.5	1,107	0.211	44.00	55.00	814	0.339	44.00	55.00	1,107	0.211	44.00	55.00
47.5	1,288	0.221	44.00	55.00	947	0.332	44.00	55.00	0	0.000	44.00	n/a
42.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
37.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
32.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
27.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
22.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
17.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
12.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
7.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a

Minimum ECWT condition has been reached for chiller(s): CH-1, CH-2, CH-3
Tower cycling assumed to hold minimum ECWT.

4b. Chiller System Performance

	CH-4				System	
Bin Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Total (kW)	Total (kW/Ton)
97.5	650	0.402	44.00	66.28	2119	0.400
92.5	619	0.388	44.00	65.20	1929	0.382
87.5	588	0.375	44.00	64.11	1742	0.363
82.5	0	0.000	44.00	n/a	1687	0.371
77.5	0	0.000	44.00	n/a	1479	0.345
72.5	0	0.000	44.00	n/a	1290	0.319
67.5	0	0.000	44.00	n/a	1086	0.287
62.5	0	0.000	44.00	n/a	892	0.252
57.5	0	0.000	44.00	n/a	808	0.246
52.5	0	0.000	44.00	n/a	742	0.245
47.5	0	0.000	44.00	n/a	599	0.268
42.5	0	0.000	44.00	n/a	0	0.000
37.5	0	0.000	44.00	n/a	0	0.000
32.5	0	0.000	44.00	n/a	0	0.000
27.5	0	0.000	44.00	n/a	0	0.000
22.5	0	0.000	44.00	n/a	0	0.000
17.5	0	0.000	44.00	n/a	0	0.000
12.5	0	0.000	44.00	n/a	0	0.000
7.5	0	0.000	44.00	n/a	0	0.000

5. SPLV Worksheet

Bin Temp (F)	Building Load (%)	Building Load (Tons)	Cooling Hours	Cooling (Ton-hrs)	Bin Wgt Factor	System (kW/Ton)	Bin Ratio
97.5	100	5,300	82	434,600	0.0238	0.400	0.0595
92.5	95	5,048	245	1,236,760	0.0677	0.382	0.1772
87.5	90	4,795	263	1,261,085	0.0690	0.363	0.1901
82.5	86	4,542	313	1,421,646	0.0778	0.371	0.2095
77.5	81	4,290	392	1,681,680	0.0921	0.345	0.2671
72.5	76	4,039	517	2,088,163	0.1143	0.319	0.3580
67.5	71	3,786	525	1,987,650	0.1088	0.287	0.3794
62.5	67	3,534	575	2,032,050	0.1113	0.252	0.4410
57.5	62	3,281	721	2,365,601	0.1295	0.246	0.5262
52.5	57	3,029	685	2,074,865	0.1136	0.245	0.4636
47.5	42	2,235	752	1,680,720	0.0920	0.268	0.3432
42.5	37	1,984	776	0	0.0000	0.000	0.0000
37.5	33	1,731	857	0	0.0000	0.000	0.0000
32.5	28	1,479	828	0	0.0000	0.000	0.0000
27.5	23	1,227	671	0	0.0000	0.000	0.0000
22.5	17	916	221	0	0.0000	0.000	0.0000
17.5	14	750	135	0	0.0000	0.000	0.0000
12.5	9	501	70	0	0.0000	0.000	0.0000
7.5	4	216	132	0	0.0000	0.000	0.0000
Total:			5,070	18,264,820	1.0000		3.4148

Bin Wgt Factor = Bin Ton-hrs / Total Ton-hrs
Bin Ratio = [Bin Wgt Factor] / [System kW/Ton]
SPLV = 1 / [sum of Bin Ratios]
SPLV = 1 / [3.4148] = 0.293 kW/Ton

6. Procedure for Calculating IPLV for Chillers

Procedure for Calculating IPLV for Water-Cooled Electric Chillers

Chiller Load (%)	LCHWT (F)	Cond Temp (F)	Wgt Factor	Chiller (kW/Ton)	Bin Ratio
100	44.00	85.00	0.01	A	0.01/A
75	44.00	75.00	0.42	B	0.42/B
50	44.00	65.00	0.45	C	0.45/C
25	44.00	65.00	0.12	D	0.12/D
Total:			1.00		

IPLV = 1 / [sum of Bin Ratios]
IPLV = 1 / [0.10/A + 0.42/B + 0.45/C + 0.12/D]
per ARI Standard 550/590-1998

1. Summary of Custom Weighting Factors and ECWTs

	Custom Weighting Factors				Custom Entering Condenser Temperatures (F)			
Chiller	**25%**	**50%**	**75%**	**100%**	**25%**	**50%**	**75%**	**100%**
CH-1 - Carrier 1700 Ton VFD	0.000	0.000	0.677	0.323	n/a	n/a	55.8	63.0
CH-2 - Trane 1250	0.000	0.000	0.699	0.301	n/a	n/a	55.7	63.0
CH-3 - Carrier 1700 Ton VFD	0.000	0.000	0.677	0.323	n/a	n/a	55.8	63.0
CH-4 - Trane 650	0.000	0.000	0.000	1.000	n/a	n/a	n/a	64.9

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Combination F
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower (1)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

3. Chiller System Operating Conditions

Bin Temp (F)	Bin MCWB (F)	Building Load (%)	Building Load (Tons)	Chillers On	Chiller Load (%)
97.5	61.5	100	5,300	4	100
92.5	60.5	95	5,048	4	95
87.5	59.5	90	4,795	4	90
82.5	57.9	86	4,542	3	98
77.5	55.9	81	4,290	3	92
72.5	54.2	76	4,039	3	87
67.5	51.9	71	3,786	3	81
62.5	49.5	67	3,534	3	76
57.5	47.1	62	3,281	3	71
52.5	43.8	57	3,029	3	65
47.5	40.4	42	2,235	2	76
42.5	36.9	37	1,984	0	0
37.5	33.4	33	1,731	0	0
32.5	29.4	28	1,479	0	0
27.5	25.1	23	1,227	0	0
22.5	20.8	17	916	0	0
17.5	16.0	14	750	0	0
12.5	11.2	9	501	0	0
7.5	5.9	4	216	0	0

4a. Custom PLV Worksheet for CH-1 (Carrier 1700 Ton VFD)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin		50% Bin		75% Bin		100% Bin	
							(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)
97.5	66.3	82	5,435	139,400	1,700	100	0	0	0	0	0	0	5,435	139,400
92.5	65.2	245	15,974	396,697	1,619	95	0	0	0	0	0	0	15,974	396,697
87.5	64.1	263	16,860	404,499	1,538	90	0	0	0	0	0	0	16,860	404,499
82.5	62.5	313	19,566	519,742	1,661	98	0	0	0	0	0	0	19,566	519,742
77.5	60.5	392	23,720	614,808	1,568	92	0	0	0	0	0	0	23,720	614,808
72.5	58.8	517	30,374	763,414	1,477	87	0	0	0	0	30,374	763,414	0	0
67.5	56.4	525	29,625	726,668	1,384	81	0	0	0	0	29,625	726,668	0	0
62.5	55.0	575	31,625	742,900	1,292	76	0	0	0	0	31,625	742,900	0	0
57.5	55.0	721	39,655	864,843	1,200	71	0	0	0	0	39,655	864,843	0	0
52.5	55.0	685	37,675	758,553	1,107	65	0	0	0	0	37,675	758,553	0	0
47.5	55.0	752	41,360	968,551	1,288	76	0	0	0	0	41,360	968,551	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		5,070	291,869	6,900,074			0	0	0	0	210,315	4,824,929	81,554	2,075,145

4b. Custom PLV Worksheet for CH-2 (Trane 1250)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	66.3	82	5,435	102,500	1,250	100	0	0	0	0	0	0	5,435	102,500
92.5	65.2	245	15,974	291,689	1,191	95	0	0	0	0	0	0	15,974	291,689
87.5	64.1	263	16,860	297,426	1,131	90	0	0	0	0	0	0	16,860	297,426
82.5	62.5	313	19,566	382,163	1,221	98	0	0	0	0	0	0	19,566	382,163
77.5	60.5	392	23,720	452,065	1,153	92	0	0	0	0	0	0	23,720	452,065
72.5	58.8	517	30,374	561,334	1,086	87	0	0	0	0	30,374	561,334	0	0
67.5	56.4	525	29,625	534,315	1,018	81	0	0	0	0	29,625	534,315	0	0
62.5	55.0	575	31,625	546,250	950	76	0	0	0	0	31,625	546,250	0	0
57.5	55.0	721	39,655	635,914	882	71	0	0	0	0	39,655	635,914	0	0
52.5	55.0	685	37,675	557,759	814	65	0	0	0	0	37,675	557,759	0	0
47.5	55.0	752	41,360	712,170	947	76	0	0	0	0	41,360	712,170	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		5,070	291,869	5,073,584			0	0	0	0	210,315	3,547,742	81,554	1,525,842
Cust Wgt Factors:								0.000		0.000		0.699		0.301
Custom Entering Condenser Temperatures (F):								n/a		n/a		55.7		63.0

4c. Custom PLV Worksheet for CH-3 (Carrier 1700 Ton VFD)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin		50% Bin		75% Bin		100% Bin	
							(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)
97.5	66.3	82	5,435	139,400	1,700	100	0	0	0	0	0	0	5,435	139,400
92.5	65.2	245	15,974	396,697	1,619	95	0	0	0	0	0	0	15,974	396,697
87.5	64.1	263	16,860	404,499	1,538	90	0	0	0	0	0	0	16,860	404,499
82.5	62.5	313	19,566	519,742	1,661	98	0	0	0	0	0	0	19,566	519,742
77.5	60.5	392	23,720	614,808	1,568	92	0	0	0	0	0	0	23,720	614,808
72.5	58.8	517	30,374	763,414	1,477	87	0	0	0	0	30,374	763,414	0	0
67.5	56.4	525	29,625	726,668	1,384	81	0	0	0	0	29,625	726,668	0	0
62.5	55.0	575	31,625	742,900	1,292	76	0	0	0	0	31,625	742,900	0	0
57.5	55.0	721	39,655	864,843	1,200	71	0	0	0	0	39,655	864,843	0	0
52.5	55.0	685	37,675	758,553	1,107	65	0	0	0	0	37,675	758,553	0	0
47.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		4,318	250,509	5,931,524			0	0	0	0	168,955	3,856,378	81,554	2,075,145

4d. Custom PLV Worksheet for CH-4 (Trane 650)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	66.3	82	5,435	53,300	650	100	0	0	0	0	0	0	5,435	53,300
92.5	65.2	245	15,974	151,678	619	95	0	0	0	0	0	0	15,974	151,678
87.5	64.1	263	16,860	154,661	588	90	0	0	0	0	0	0	16,860	154,661
82.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
77.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
72.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
67.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
62.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
57.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
52.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
47.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		590	38,269	359,640			0	0	0	0	0	0	38,269	359,640
Cust Wgt Factors:								0.000		0.000		0.000		1.000
Custom Entering Condenser Temperatures (F):								n/a		n/a		n/a		64.9

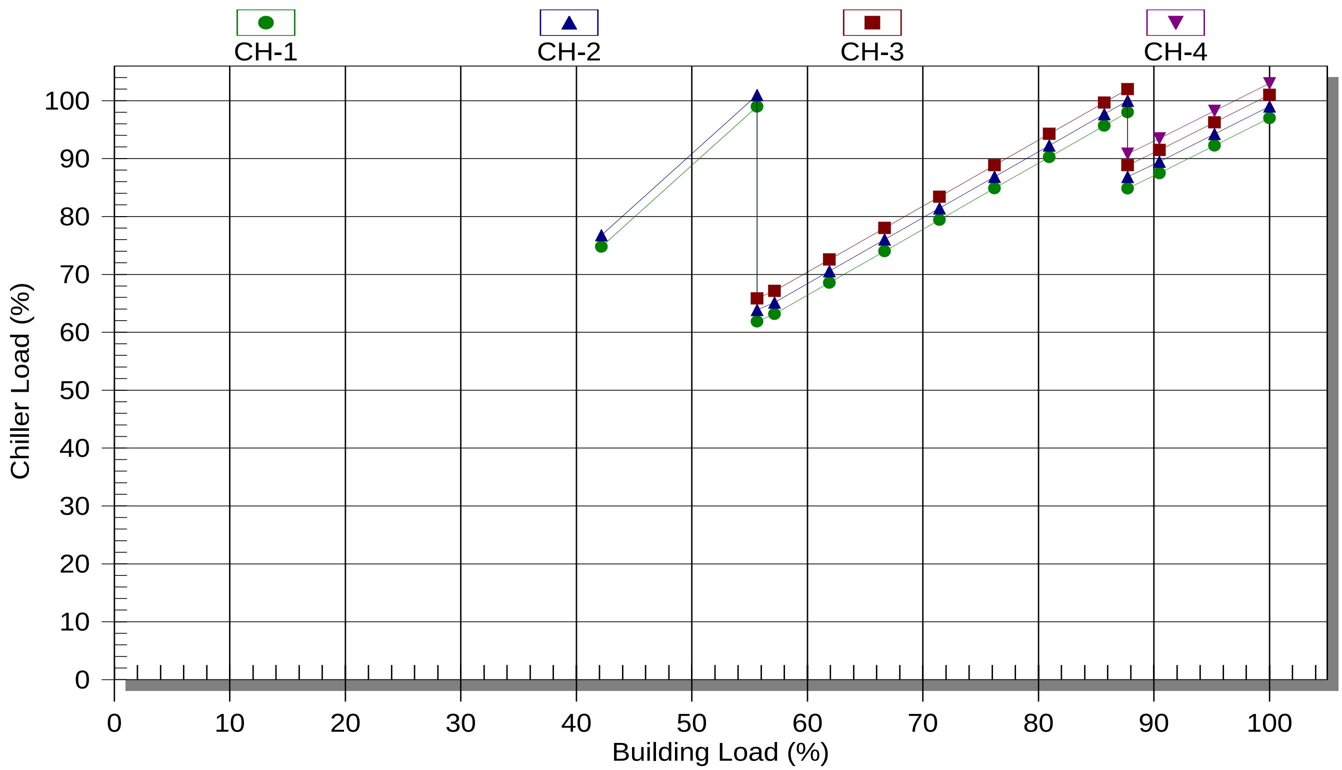
KEY for Custom PLV Worksheet table(s):
[Avg DB] = Midpoint temperature for bin.
[Cond Temp] = Entering condenser temperature for bin. Entering water temperature for water-cooled chillers. Entering air temperature for air-cooled chillers.
[Tot Hrs] = Hours of operation in bin.
[CWH] = Condenser temperature hours. [Tot Hrs] times [Cond Temp]. Later used to derive the four average entering condenser temperature values for the PLV calculation.
[Load] = Chiller load for bin.
[Load (%)] = Chiller load as a percentage of full load capacity.
[Total (Ton-hrs)] = Chiller [Load] times [Tot Hrs]. Later used to derive the four weighting factors for the PLV calculation.
[Bin (CWH)] = [CWH] values separated into the four PLV bins: 25%, 50%, 75% and 100% load according to chiller load for each bin.
[Bin (Ton-hrs)] = Values separated into the four PLV bins: 25%, 50%, 75% and 100% load according to the chiller load for each bin.
[Cust Wgt Factor] = The four custom PLV weighting factors. [Total (Ton-hrs)] for PLV Bin divided by [Total (Ton-hrs)] for the chiller.
[Cust Ent Cond Temps] = The four custom condenser temperature values for the PLV calculation = [Total (CWH)] for PLV bin divided by [Tot Hrs] in the PLV bin.

5a. Average Weighting Factors and Entering Condenser Temperatures (CH-1, CH-3)

	25% Bin			**50% Bin**			**75% Bin**			**100% Bin**		
Chiller	**Hrs**	**CWH**	**Ton-hrs**	**Hrs**	**CWH**	**Ton-hrs**	**Hrs**	**CWH**	**Ton-hrs**	**Hrs**	**CWH**	**Ton-hrs**
CH-1	0	0	0	0	0	0	3,775	210,315	4,824,929	1,295	81,554	2,075,145
CH-3	0	0	0	0	0	0	3,023	168,955	3,856,378	1,295	81,554	2,075,145
Totals:	0	0	0	0	0	0	6,798	379,269	8,681,307	2,590	163,109	4,150,290
Cust Wgt Factor:			0.000			0.000			0.677			0.323
Cust Ent Cond Temps (F):			n/a			n/a			55.8			63.0

Grand Total Ton-hrs = 12,831,597

Average weighting factors and entering condenser temperatures are calculated because the following chillers are all identical: CH-1, CH-3. Over the life of the chiller plant, these chillers will be rotated to operate in each of the CH-1, CH-3 sequencing positions. Therefore, a lifecycle PLV must consider each chiller operating in each of these sequencing positions.



Note: Individual chiller curves in this graph have been adjusted up or down so the number of chillers operating at each point can be seen. If the curves had not been adjusted, all curves would lie on top of each other. Because of the adjustment each chiller load shown on the graph is only accurate to within a few percentage points plus or minus of the original calculated values.

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

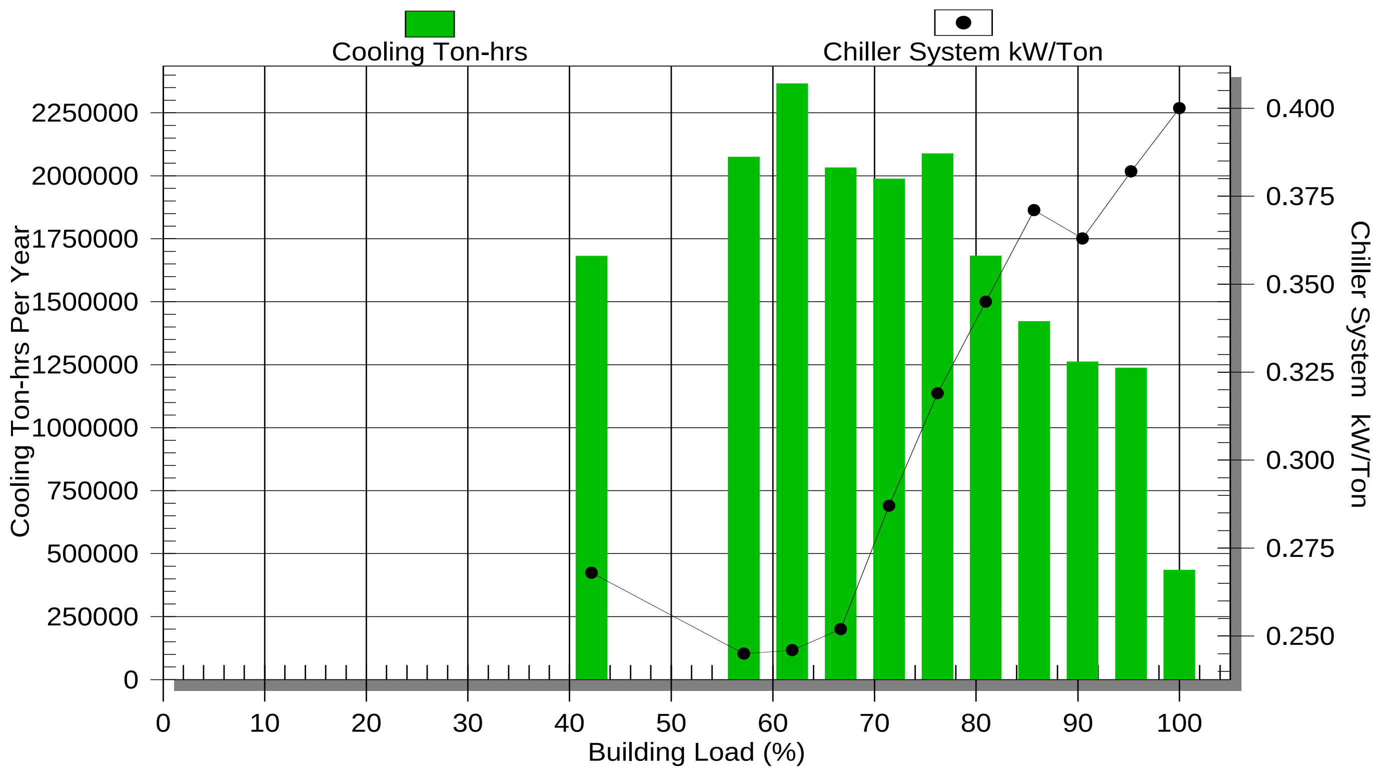
Loads

User-Defined Load Profile

Chiller System

Name .... Combination F
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower (1)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton



2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Combination F
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower (1)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

5 Year Constant Dollar Cost Model

Chiller Combination F-1
One new 1700 with vfd, 1 without

Approximate Energy Cost

	Chilled Water		Condenser Water		Tons	KW/Ton	KW	Hours	kWH	Demand Cost	Energy Use Cost
	LWT ˚F	EWT ˚F	EWT ˚F	LWT ˚F						$8.78/kW/month	$0.0286340/kWH
	44	54	80		3647	0.405	1477.04	82	121116.9	$25,936.73	$3,468.06
	44	54	75		3282	0.393	1289.94	245	316036.3		$9,049.38
	44	54	80		2954	0.38	1122.55	263	295229.8	$19,711.92	$8,453.61
	44	54	75		2659	0.383	1018.27	313	318717.9		$9,126.17
	44	54	75		2393	0.366	875.764	392	343299.3	$7,689.20	$9,830.03
	44	54	70		2154	0.351	755.884	517	390792.3		$11,189.95
	44	54	75		1938	0.334	647.347	525	339857.3	$5,683.71	$9,731.47
	44	54	70		1744	0.317	552.959	575	317951.2		$9,104.21
	44	54	70		1570	0.318	499.233	721	359946.7		$10,306.71
	44	54	65		1413	0.321	453.548	685	310680.5		$8,896.02
	44	54	65		1272	0.268	340.797	752	256279.3	$2,992.20	$7,338.30
								5070			

Annual Energy Cost	$158,507.69
5 Year Energy Cost:	$792,538.44
Chiller Purchase Price:	1,152,000
5 Year Life Cycle Evaluation Total:	$1,944,538.44

1. Executive Summary

System Part Load Value (SPLV):	**PLV**
Combination F-1	0.336 kW/Ton
IPLV or NPLV (ARI 550/590-1998):	
Carrier 1700 Ton VFD	0.300 kW/Ton
Trane 1250	0.354 kW/Ton
Carrier 1700 Ton Constant	0.462 kW/Ton
Trane 650	0.354 kW/Ton

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Combination F-1
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower (2)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1700 Ton Constant	1,732	0.470 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

3. Chiller System Operating Conditions

Bin Temp (F)	Bin MCWB (F)	Building Load (%)	Building Load (Tons)	Chillers On	Chiller Load (%)
97.5	61.5	100	5,300	4	99
92.5	60.5	95	5,048	4	95
87.5	59.5	90	4,795	4	90
82.5	57.9	86	4,542	3	97
77.5	55.9	81	4,290	3	92
72.5	54.2	76	4,039	3	86
67.5	51.9	71	3,786	3	81
62.5	49.5	67	3,534	3	75
57.5	47.1	62	3,281	3	70
52.5	43.8	57	3,029	3	65
47.5	40.4	42	2,235	2	76
42.5	36.9	37	1,984	0	0
37.5	33.4	33	1,731	0	0
32.5	29.4	28	1,479	0	0
27.5	25.1	23	1,227	0	0
22.5	20.8	17	916	0	0
17.5	16.0	14	750	0	0
12.5	11.2	9	501	0	0
7.5	5.9	4	216	0	0

4a. Chiller System Performance

	CH-1				CH-2				CH-3			
Bin Temp (F)	**Load (Tons)**	**(kW/ Ton)**	**Lchwt (F)**	**Cond Temp (F)**	**Load (Tons)**	**(kW/ Ton)**	**Lchwt (F)**	**Cond Temp (F)**	**Load (Tons)**	**(kW/ Ton)**	**Lchwt (F)**	**Cond Temp (F)**
97.5	1,690	0.397	44.00	66.28	1,242	0.401	44.00	66.28	1,722	0.416	44.00	66.28
92.5	1,609	0.377	44.00	65.21	1,183	0.388	44.00	65.21	1,640	0.413	44.00	65.21
87.5	1,529	0.355	44.00	64.13	1,124	0.374	44.00	64.13	1,558	0.411	44.00	64.13
82.5	1,649	0.371	44.00	62.52	1,213	0.367	44.00	62.52	1,680	0.406	44.00	62.52
77.5	1,558	0.342	44.00	60.53	1,145	0.347	44.00	60.53	1,587	0.403	44.00	60.53
72.5	1,467	0.309	44.00	58.78	1,078	0.339	44.00	58.78	1,494	0.401	44.00	58.78
67.5	1,375	0.266	44.00	56.48	1,011	0.336	44.00	56.48	1,401	0.400	44.00	56.48
62.5	1,283	0.219	44.00	55.00	944	0.331	44.00	55.00	1,307	0.403	44.00	55.00
57.5	1,191	0.213	44.00	55.00	876	0.335	44.00	55.00	1,214	0.409	44.00	55.00
52.5	1,100	0.210	44.00	55.00	809	0.339	44.00	55.00	1,121	0.416	44.00	55.00
47.5	1,288	0.221	44.00	55.00	947	0.332	44.00	55.00	0	0.000	44.00	n/a
42.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
37.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
32.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
27.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
22.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
17.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
12.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a
7.5	0	0.000	44.00	n/a	0	0.000	44.00	n/a	0	0.000	44.00	n/a

Minimum ECWT condition has been reached for chiller(s): CH-1, CH-2, CH-3
Tower cycling assumed to hold minimum ECWT.

4b. Chiller System Performance

	CH-4				System	
Bin Temp (F)	Load (Tons)	(kW/ Ton)	Lchwt (F)	Cond Temp (F)	Total (kW)	Total (kW/Ton)
97.5	646	0.401	44.00	66.28	2144	0.405
92.5	615	0.388	44.00	65.21	1982	0.393
87.5	585	0.374	44.00	64.13	1823	0.380
82.5	0	0.000	44.00	n/a	1739	0.383
77.5	0	0.000	44.00	n/a	1569	0.366
72.5	0	0.000	44.00	n/a	1419	0.351
67.5	0	0.000	44.00	n/a	1266	0.334
62.5	0	0.000	44.00	n/a	1121	0.317
57.5	0	0.000	44.00	n/a	1043	0.318
52.5	0	0.000	44.00	n/a	971	0.321
47.5	0	0.000	44.00	n/a	599	0.268
42.5	0	0.000	44.00	n/a	0	0.000
37.5	0	0.000	44.00	n/a	0	0.000
32.5	0	0.000	44.00	n/a	0	0.000
27.5	0	0.000	44.00	n/a	0	0.000
22.5	0	0.000	44.00	n/a	0	0.000
17.5	0	0.000	44.00	n/a	0	0.000
12.5	0	0.000	44.00	n/a	0	0.000
7.5	0	0.000	44.00	n/a	0	0.000

5. SPLV Worksheet

Bin Temp (F)	Building Load (%)	Building Load (Tons)	Cooling Hours	Cooling (Ton-hrs)	Bin Wgt Factor	System (kW/Ton)	Bin Ratio
97.5	100	5,300	82	434,600	0.0238	0.405	0.0588
92.5	95	5,048	245	1,236,760	0.0677	0.393	0.1725
87.5	90	4,795	263	1,261,085	0.0690	0.380	0.1817
82.5	86	4,542	313	1,421,646	0.0778	0.383	0.2033
77.5	81	4,290	392	1,681,680	0.0921	0.366	0.2518
72.5	76	4,039	517	2,088,163	0.1143	0.351	0.3253
67.5	71	3,786	525	1,987,650	0.1088	0.334	0.3255
62.5	67	3,534	575	2,032,050	0.1113	0.317	0.3509
57.5	62	3,281	721	2,365,601	0.1295	0.318	0.4073
52.5	57	3,029	685	2,074,865	0.1136	0.321	0.3542
47.5	42	2,235	752	1,680,720	0.0920	0.268	0.3432
42.5	37	1,984	776	0	0.0000	0.000	0.0000
37.5	33	1,731	857	0	0.0000	0.000	0.0000
32.5	28	1,479	828	0	0.0000	0.000	0.0000
27.5	23	1,227	671	0	0.0000	0.000	0.0000
22.5	17	916	221	0	0.0000	0.000	0.0000
17.5	14	750	135	0	0.0000	0.000	0.0000
12.5	9	501	70	0	0.0000	0.000	0.0000
7.5	4	216	132	0	0.0000	0.000	0.0000
Total:			5,070	18,264,820	1.0000		2.9745

Bin Wgt Factor = Bin Ton-hrs / Total Ton-hrs
Bin Ratio = [Bin Wgt Factor] / [System kW/Ton]
SPLV = 1 / [sum of Bin Ratios]
SPLV = 1 / [2.9745] = 0.336 kW/Ton

6. Procedure for Calculating IPLV for Chillers

Procedure for Calculating IPLV for Water-Cooled Electric Chillers

Chiller Load (%)	LCHWT (F)	Cond Temp (F)	Wgt Factor	Chiller (kW/Ton)	Bin Ratio
100	44.00	85.00	0.01	A	0.01/A
75	44.00	75.00	0.42	B	0.42/B
50	44.00	65.00	0.45	C	0.45/C
25	44.00	65.00	0.12	D	0.12/D
Total:			1.00		

IPLV = 1 / [sum of Bin Ratios]
IPLV = 1 / [0.10/A + 0.42/B + 0.45/C + 0.12/D]
per ARI Standard 550/590-1998

1. Summary of Custom Weighting Factors and ECWTs

	Custom Weighting Factors				Custom Entering Condenser Temperatures (F)			
Chiller	**25%**	**50%**	**75%**	**100%**	**25%**	**50%**	**75%**	**100%**
CH-1 - Carrier 1700 Ton VFD	0.000	0.000	0.699	0.301	n/a	n/a	55.7	63.0
CH-2 - Trane 1250	0.000	0.000	0.699	0.301	n/a	n/a	55.7	63.0
CH-3 - Carrier 1700 Ton Constant	0.000	0.000	0.650	0.350	n/a	n/a	55.9	63.0
CH-4 - Trane 650	0.000	0.000	0.000	1.000	n/a	n/a	n/a	64.9

2. Input Data Summary

Weather
City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads
User-Defined Load Profile

Chiller System
Name .... Combination F-1
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower (2)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1700 Ton Constant	1,732	0.470 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

3. Chiller System Operating Conditions

Bin Temp (F)	Bin MCWB (F)	Building Load (%)	Building Load (Tons)	Chillers On	Chiller Load (%)
97.5	61.5	100	5,300	4	99
92.5	60.5	95	5,048	4	95
87.5	59.5	90	4,795	4	90
82.5	57.9	86	4,542	3	97
77.5	55.9	81	4,290	3	92
72.5	54.2	76	4,039	3	86
67.5	51.9	71	3,786	3	81
62.5	49.5	67	3,534	3	75
57.5	47.1	62	3,281	3	70
52.5	43.8	57	3,029	3	65
47.5	40.4	42	2,235	2	76
42.5	36.9	37	1,984	0	0
37.5	33.4	33	1,731	0	0
32.5	29.4	28	1,479	0	0
27.5	25.1	23	1,227	0	0
22.5	20.8	17	916	0	0
17.5	16.0	14	750	0	0
12.5	11.2	9	501	0	0
7.5	5.9	4	216	0	0

4a. Custom PLV Worksheet for CH-1 (Carrier 1700 Ton VFD)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin		50% Bin		75% Bin		100% Bin	
							(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)	(CWH)	(Ton-hrs)
97.5	66.3	82	5,435	138,563	1,690	99	0	0	0	0	0	0	5,435	138,563
92.5	65.2	245	15,977	394,316	1,609	95	0	0	0	0	0	0	15,977	394,316
87.5	64.1	263	16,865	402,071	1,529	90	0	0	0	0	0	0	16,865	402,071
82.5	62.5	313	19,569	516,189	1,649	97	0	0	0	0	0	0	19,569	516,189
77.5	60.5	392	23,728	610,606	1,558	92	0	0	0	0	0	0	23,728	610,606
72.5	58.8	517	30,392	758,197	1,467	86	0	0	0	0	30,392	758,197	0	0
67.5	56.5	525	29,652	721,701	1,375	81	0	0	0	0	29,652	721,701	0	0
62.5	55.0	575	31,625	737,823	1,283	75	0	0	0	0	31,625	737,823	0	0
57.5	55.0	721	39,655	858,932	1,191	70	0	0	0	0	39,655	858,932	0	0
52.5	55.0	685	37,675	753,368	1,100	65	0	0	0	0	37,675	753,368	0	0
47.5	55.0	752	41,360	968,551	1,288	76	0	0	0	0	41,360	968,551	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		5,070	291,933	6,860,318			0	0	0	0	210,359	4,798,572	81,575	2,061,746
Cust Wgt Factors:								0.000		0.000		0.699		0.301
Custom Entering Condenser Temperatures (F):								n/a		n/a		55.7		63.0

4b. Custom PLV Worksheet for CH-2 (Trane 1250)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	66.3	82	5,435	101,885	1,242	99	0	0	0	0	0	0	5,435	101,885
92.5	65.2	245	15,977	289,938	1,183	95	0	0	0	0	0	0	15,977	289,938
87.5	64.1	263	16,865	295,641	1,124	90	0	0	0	0	0	0	16,865	295,641
82.5	62.5	313	19,569	379,551	1,213	97	0	0	0	0	0	0	19,569	379,551
77.5	60.5	392	23,728	448,975	1,145	92	0	0	0	0	0	0	23,728	448,975
72.5	58.8	517	30,392	557,498	1,078	86	0	0	0	0	30,392	557,498	0	0
67.5	56.5	525	29,652	530,663	1,011	81	0	0	0	0	29,652	530,663	0	0
62.5	55.0	575	31,625	542,517	944	75	0	0	0	0	31,625	542,517	0	0
57.5	55.0	721	39,655	631,568	876	70	0	0	0	0	39,655	631,568	0	0
52.5	55.0	685	37,675	553,947	809	65	0	0	0	0	37,675	553,947	0	0
47.5	55.0	752	41,360	712,170	947	76	0	0	0	0	41,360	712,170	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		5,070	291,933	5,044,351			0	0	0	0	210,359	3,528,362	81,575	1,515,989
Cust Wgt Factors:								0.000		0.000		0.699		0.301
Custom Entering Condenser Temperatures (F):								n/a		n/a		55.7		63.0

4c. Custom PLV Worksheet for CH-3 (Carrier 1700 Ton Constant)

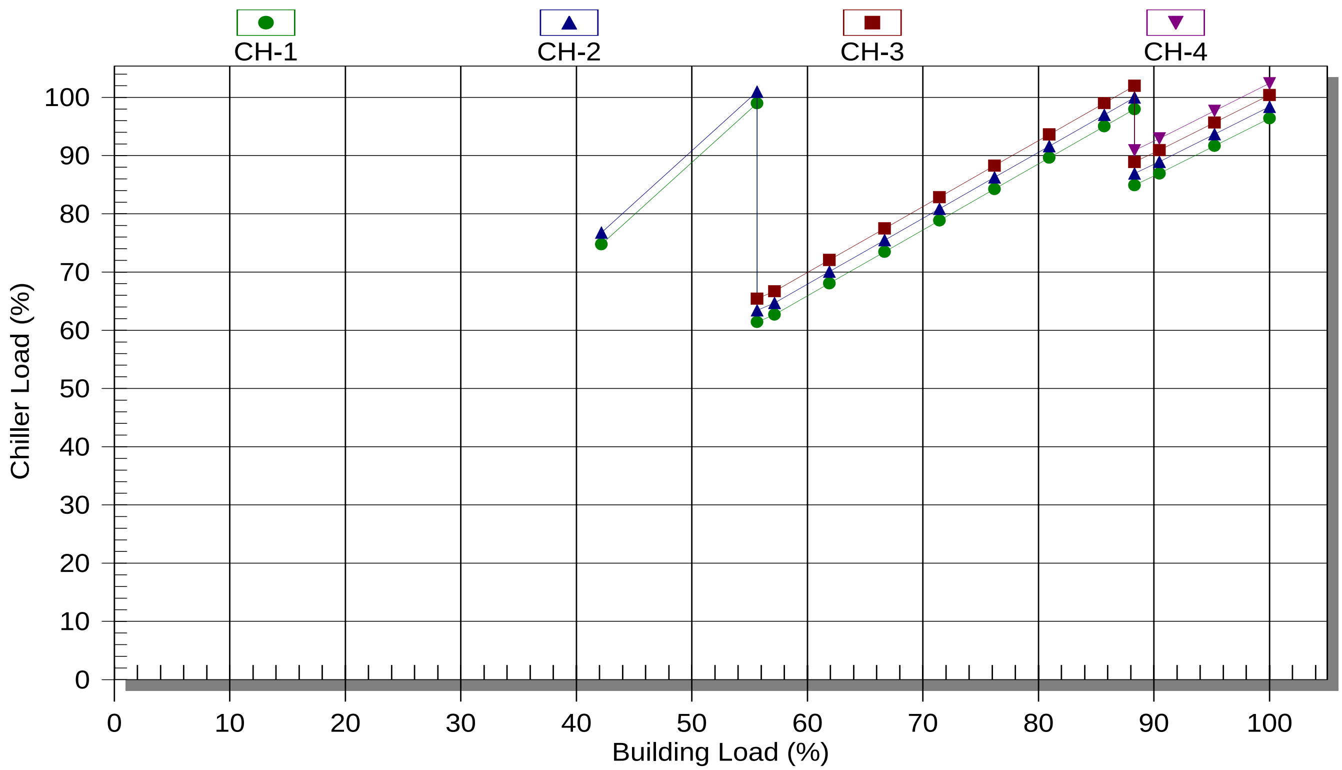
Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	66.3	82	5,435	141,172	1,722	99	0	0	0	0	0	0	5,435	141,172
92.5	65.2	245	15,977	401,738	1,640	95	0	0	0	0	0	0	15,977	401,738
87.5	64.1	263	16,865	409,640	1,558	90	0	0	0	0	0	0	16,865	409,640
82.5	62.5	313	19,569	525,906	1,680	97	0	0	0	0	0	0	19,569	525,906
77.5	60.5	392	23,728	622,100	1,587	92	0	0	0	0	0	0	23,728	622,100
72.5	58.8	517	30,392	772,469	1,494	86	0	0	0	0	30,392	772,469	0	0
67.5	56.5	525	29,652	735,286	1,401	81	0	0	0	0	29,652	735,286	0	0
62.5	55.0	575	31,625	751,711	1,307	75	0	0	0	0	31,625	751,711	0	0
57.5	55.0	721	39,655	875,101	1,214	70	0	0	0	0	39,655	875,101	0	0
52.5	55.0	685	37,675	767,549	1,121	65	0	0	0	0	37,675	767,549	0	0
47.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		4,318	250,573	6,002,671			0	0	0	0	168,999	3,902,116	81,575	2,100,555
Cust Wgt Factors:								0.000		0.000		0.650		0.350
Custom Entering Condenser Temperatures (F):								n/a		n/a		55.9		63.0

4d. Custom PLV Worksheet for CH-4 (Trane 650)

Avg DB (F)	Cond Temp (F)	Total (Hrs)	CWH	Total (Ton-hrs)	Load (Tons)	Load (%)	25% Bin (CWH)	25% Bin (Ton-hrs)	50% Bin (CWH)	50% Bin (Ton-hrs)	75% Bin (CWH)	75% Bin (Ton-hrs)	100% Bin (CWH)	100% Bin (Ton-hrs)
97.5	66.3	82	5,435	52,980	646	99	0	0	0	0	0	0	5,435	52,980
92.5	65.2	245	15,977	150,768	615	95	0	0	0	0	0	0	15,977	150,768
87.5	64.1	263	16,865	153,733	585	90	0	0	0	0	0	0	16,865	153,733
82.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
77.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
72.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
67.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
62.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
57.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
52.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
47.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
42.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
37.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
32.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
27.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
22.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
17.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5	n/a	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:		590	38,277	357,481			0	0	0	0	0	0	38,277	357,481
Cust Wgt Factors:								0.000		0.000		0.000		1.000
Custom Entering Condenser Temperatures (F):								n/a		n/a		n/a		64.9

KEY for Custom PLV Worksheet table(s):

[Avg DB] = Midpoint temperature for bin.
[Cond Temp] = Entering condenser temperature for bin. Entering water temperature for water-cooled chillers. Entering air temperature for air-cooled chillers.
[Tot Hrs] = Hours of operation in bin.
[CWH] = Condenser temperature hours. [Tot Hrs] times [Cond Temp]. Later used to derive the four average entering condenser temperature values for the PLV calculation.
[Load] = Chiller load for bin.
[Load (%)] = Chiller load as a percentage of full load capacity.
[Total (Ton-hrs)] = Chiller [Load] times [Tot Hrs]. Later used to derive the four weighting factors for the PLV calculation.
[Bin (CWH)] = [CWH] values separated into the four PLV bins: 25%, 50%, 75% and 100% load according to chiller load for each bin.
[Bin (Ton-hrs)] = Values separated into the four PLV bins: 25%, 50%, 75% and 100% load according to the chiller load for each bin.
[Cust Wgt Factor] = The four custom PLV weighting factors. [Total (Ton-hrs)] for PLV Bin divided by [Total (Ton-hrs)] for the chiller.
[Cust Ent Cond Temps] = The four custom condenser temperature values for the PLV calculation = [Total (CWH)] for PLV bin divided by [Tot Hrs] in the PLV bin.



Note: Individual chiller curves in this graph have been adjusted up or down so the number of chillers operating at each point can be seen. If the curves had not been adjusted, all curves would lie on top of each other. Because of the adjustment each chiller load shown on the graph is only accurate to within a few percentage points plus or minus of the original calculated values.

2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

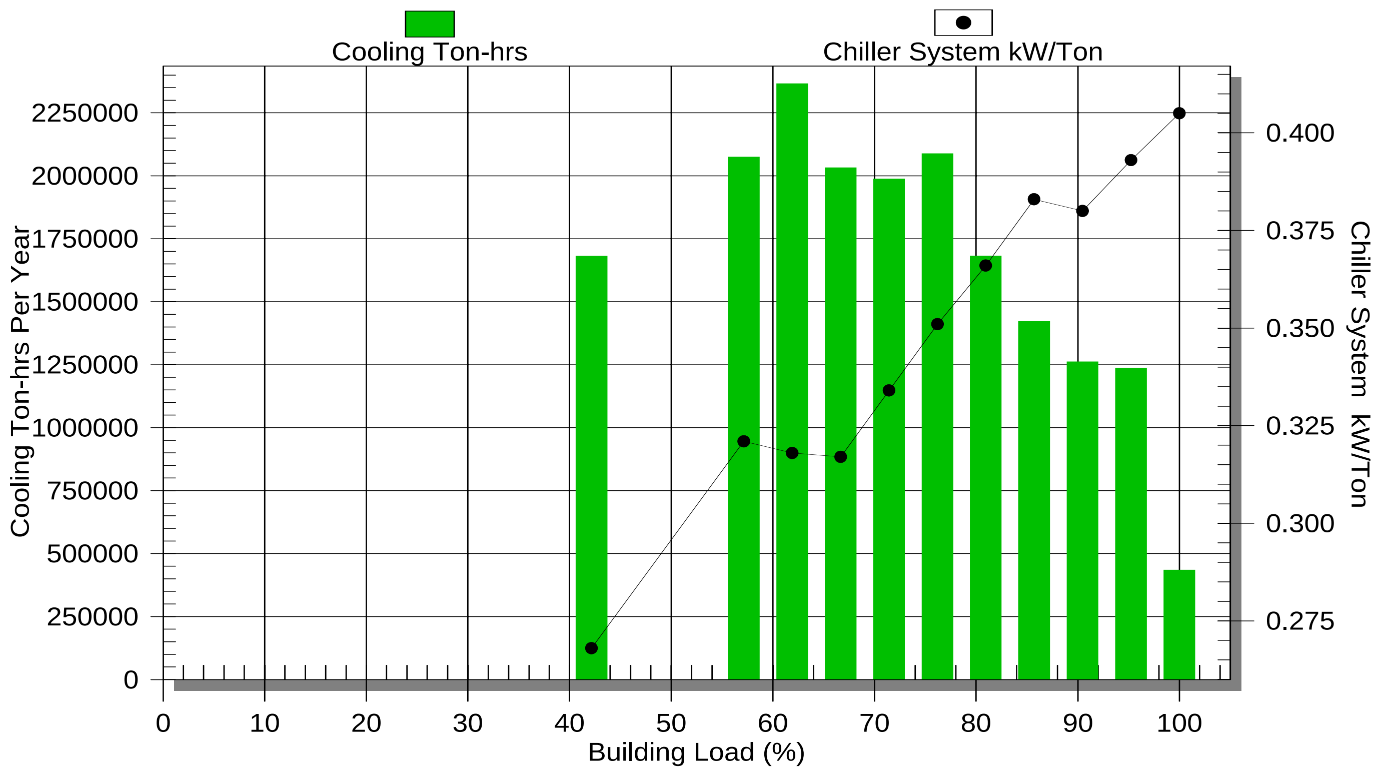
Loads

User-Defined Load Profile

Chiller System

Name .... Combination F-1
Chillers in Plant 4
Plant Control .... Sequenced
Full Load LCHWT .... 44.0 F
Tower Configuration .... One Tower for System
Cooling Tower .... 6 Cell Tower (2)
.... Detailed Cooling Tower Model
Free Cooling .... Plate-Frame Heat Exchanger

Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1700 Ton Constant	1,732	0.470 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton



2. Input Data Summary

Weather

City .... Salt Lake City, Utah
Schedule .... On All Day: Weekday
.... On All Day: Saturday
.... On All Day: Sunday

Loads

User-Defined Load Profile

Chiller System

Name .... Combination F-1
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Sequence	Chiller Name	FL Capacity (Tons)	Full Load Power
CH-1	Carrier 1700 Ton VFD	1,700	0.490 kW/Ton
CH-2	Trane 1250	1,250	0.473 kW/Ton
CH-3	Carrier 1700 Ton Constant	1,732	0.470 kW/Ton
CH-4	Trane 650	650	0.473 kW/Ton

Appendix A.7. Estimates of Service Lives of Various System Components

Equipment Item	Median Years	Equipment Item	Median Years	Equipment Item	Median Years
Air Conditioners		Air Terminals		Air-cooled condensers	20
Window unit	10	Diffusers, grilles, registers . . .	27	Evaporative condensers	20
Residential single or split package	15	Induction and fan-coil units	20	Insulation	
Commercial through-the-wall	15	VAV and double-duct boxes	20	Molded	20
Water cooled package	15	Air Washers	17	Blanket	24
Heat pumps		Ductwork	30	Pumps	
Residential air-to-air	15*	Dampers	20	Base-mounted	20
Commercial air-to-air	15	Fans		Pipe-mounted	10
Commercial water-to-air	19	Centrifugal	25	Sump and well	10
Roof-top air conditioners		Axial	20	Condensate	15
Single-zone	15	Propeller	15	Reciprocating engines	20
Mulitzone	15	Ventilating roof-mounted	20	Steam turbines	30
Boilers steam		Coils		Electric motors	18
Steel water-tube	24 (30)	DX, water, or steam	20	Motor starters	17
Steel fire-tube	25 (25)	Electric	15	Electric transformers	30
Cast iron	35 (30)	Heat Exchangers		Controls	
Electric	15	Shell-and-tube	24	Pneumatic	20
Burners	21	Reciprocating compressors	20	Electric	16
Furnaces		Package chillers		Electronic	15
Gas- or oil-fired	18	Reciprocating	20	Valve actuators	
Unit heaters		Centrifugal	23	Hydraulic	15
Gas or electric	13	Absorption	23	Pneumatic	20
Hot water or steam	20	Cooling towers		Self-contained	10
Radiant heaters		Galvanized metal	20		
Electric	10	Wood	20		
Hot-water or steam	25	Ceramic	34		

Source: Data obtained from a national survey of the United States by ASHRAE Technical Committee TC 1.8 (Akalin 1978). Data updated by TC 1.8 in 1986.
*See Lovvorn and Hiller (1985) and Easton Consultants (1986) for further information.

Gordon Spilker Huber Geotechnical Consultants, Inc.

REPORT
GEOTECHNICAL STUDY
PROPOSED BUILDINGS #1 AND #2
REPLACEMENT BUILDING
WEBER STATE UNIVERSITY CAMPUS
OGDEN, UTAH
DFCM PROJECT NO. 05027810/CONTRACT NO. 067117

Submitted To:

State of Utah
Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

Submitted By:

Gordon Spilker Huber Geotechnical Consultants, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

October 25, 2005

Job No. 0128-001-05

October 25, 2005
Job No. 0128-001-05

State of Utah
Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

Attention: Mr. Bi1l Bowen

Ladies and Gentlemen:

Re: Report
Geotechnical Study
Proposed Buildings #1 and #2 Replacement Building
Weber State University Campus
Ogden, Utah
DFCM Project No. 05027810/Contract No. 067117

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical study performed at the site of the proposed Buildings #1 and #2 Replacement Building located on the Weber State University Campus in Ogden, Utah. The general location of the site with respect to major topographic features and existing facilities, as of 1998, is presented on Figure 1, Vicinity Map. A more detailed layout of the site showing existing roadways and facilities and the approximate location of the proposed replacement building is presented on Figure 2, Site Plan. The locations of the 10 borings drilled in conjunction with this study are also presented on Figure 2.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of the study were planned in discussions between Mr. Blake Court of The State of Utah, Division of Facilities Construction and Management; Mr. Jim Harris of Weber State University; and Mr. Bill Gordon of Gordon Spilker Huber Geotechnical Consultants, Inc. (GSH).

In general, the objectives of this study were to:

1. Define and evaluate the subsurface soil and groundwater conditions across the site.

2. Provide appropriate foundation, earthwork, subdrain, and geoseismic recommendations to be utilized in the design and construction of the proposed facility.

In accomplishing these objectives, our scope has included the following:

1. A field program consisting of the drilling, logging, and sampling of 10 exploration borings.

2. A laboratory testing program.

3. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization was provided under DFCM Contract # 067117 for Project # 05027810.

1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration borings, projected groundwater conditions, and the layout and design data discussed in Section 2., Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, GSH must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices at this time.

2. PROPOSED CONSTRUCTION

The design and layout for the Buildings #1 and #2 Replacement Building have not been finalized. However, preliminary plans indicate that the proposed structure will be irregular in shape and have maximum plan dimensions on the order of approximately 200-feet east-west by 270-feet north-south. The approximate location of the building with respect to existing structures is presented on Figure 2.

The two to three-level building will replace existing Buildings #1 and #2. Due to the site topography, the western portion of the replacement building will walkout to grade. The eastern portion of the replacement building will be approximately 14 feet below grade. The structure will be of steel and concrete construction with the below grade section constructed of reinforced concrete.

The maximum column loads could be in the range of 260 to 390 kips depending upon the final configuration of the columns and number of levels within the proposed structure. Maximum wall loads are projected to be on the order of 7 to 11 kips per lineal foot. At-grade slab loads will be relatively light on the order 200 to 250 pounds per square foot.

3. SITE INVESTIGATIONS

3.1 FIELD PROGRAM

In order to define and evaluate the subsurface soil and groundwater conditions across the site, 10 borings were drilled to depths ranging from 15.0 to 41.5 feet with an all-terrain drill rig equipped with hollow-stem augers. Locations of the borings are presented on Figure 2.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the drilling operations, a continuous log of the subsurface conditions encountered was maintained. In addition, relatively undisturbed samples of the typical soils penetrated were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications were later supplemented by subsequent inspection and testing in our laboratory. Detailed graphical representation of the subsurface conditions encountered during this study is presented on Figures 3A through 3J, Log of Borings. Soils were classified in accordance with the nomenclature described on Figure 4, Unified Soil Classification System.

A 3.25-inch outside diameter, 2.42-inch inside diameter drive (Dames & Moore) sampler was utilized in the subsurface sampling at the site. The blow-counts recorded on the boring logs were those required to drive the sampler 12 inches with a 140-pound hammer dropping 30 inches.

In order to determine if there are near-surface artesian groundwater conditions at the site, an additional boring, Boring B-6, was drilled 10 feet southeast of Boring B-5. Borings B-5 and B-6 were drilled to 30 and 15 feet, respectively. The groundwater readings were similar in both borings indicating there are not artesian conditions to depths drilled. Groundwater was measured in the borings at different elevations during the course of drilling operations.

During the course of drilling operations, representatives of Weber State University requested additional borings be drilled to the east of the Proposed Buildings #1 and #2 replacement structure. The information obtained at those boring locations is presented within this report and will be utilized for future flatwork and regrading work with this and other projects.

Following completion of drilling operations, one and one-quarter-inch diameter slotted PVC pipe was installed in Borings B-2, B-5, B-6, B-9, and B-10 in order to provide a means of monitoring the groundwater fluctuations.

3.2 LABORATORY TESTING

3.2.1 General

In order to provide data necessary for our engineering analyses, a laboratory testing program was performed. The program included moisture and density, partial gradation, consolidation, and chemical tests. The following paragraphs describe the tests and summarize the test data.

3.2.2 Moisture and Density Tests

To aid in classifying the soils and to help correlate other test data, moisture and density tests were performed on selected undisturbed samples. The results of these tests are presented to the right on the boring logs, Figures 3A through 3J.

3.2.3 Partial Gradation Tests

To aid in classifying the soils and to provide data necessary for our liquefaction analysis, a partial gradation test was performed on each of three representative samples. Results of the test are tabulated below:

Boring No.	Depth (feet)	Percent Passing No. 200 Sieve	Soil Classification
B-1	15.5	92.3	CL
B-2	35.5	66.5	CL/SM
B-4	25.0	67.4	CL/SM

3.2.4 Consolidation Tests

To provide data necessary for our settlement analyses, a consolidation test was performed on each of four representative samples of the fine-grained soils encountered in the exploration borings.

Test data available indicates that the near-surface soils are highly over-consolidated. With depth, the soils are moderately over-consolidated. The soils will exhibit relatively low compressibility characteristics when loaded below the preconsolidation pressure. Detailed results of the tests are maintained within our files and can be transmitted to you, at your request.

3.2.5 Chemical Tests

In order to determine if the site soils will react detrimentally with concrete or metal, chemical tests were performed on a representative sample. The results of the chemical tests are tabulated below:

Boring No.	Depth (feet)	pH	Total Water Soluble Sulfate SO_4 (ppm)
B-8	4.5	8.5	<10.0

4. SITE CONDITIONS

4.1 SURFACE

The site is located on the Weber State University campus in Ogden, Utah. The site is currently occupied by Buildings #1 and #2. The two existing buildings are of CMU construction, and slab-on-grade. The Business and Education Buildings bound the site to the west. The site is bounded to the south by the Shepard Student Union. Buildings #3 and #4 bound the site to the east. Passing though and bounding the site are landscaped areas and sidewalks. An asphalt concrete parking lot bounds the site to the north.

The site and adjacent areas to the east and west slope down to the west. Most of the site is terraced. Overall elevation change is projected to be on the order of 15 feet.

The majority of the site is covered with landscaped grass, bushes, and shrubs. A number of 10 to 30-foot trees are also located across the site.

4.2 SUBSURFACE SOIL

Subsurface soils encountered are generally consistent at the boring location. At Boring B-1, pavement section consisting of six inches of Portland cement concrete underlain by six inches of aggregate base was encountered. At Boring B-5, a five-foot layer of silty sand fill was encountered. At the remaining boring locations, a two to five and one-half-foot layer of silty clay fill was encountered. The upper three to six inches of these soils contain major roots and have been classified as topsoil. The upper 6 to 12 inches are loose. The majority of the fill appears to be on-site material that has been used as site grading fill. The fills are variable and can exhibit relatively poor engineering characteristics.

Below the fills and to depths of 7.5 to 22.5 feet natural soils, generally fine-grained, silty clays with occasional to numerous layers up to two-inches of silty fine sand were encountered. These clays are moderately highly over-consolidated in the upper zones and grade moderately consolidated with depth.

Beneath the silty clays, silty fine sand with occasional to numerous seams and up to two-inch layers of silt clay were encountered to depths of 17.5 feet to the depth penetrated, 29.5 feet. The natural granular soils will exhibit relatively high strength and low compressibility characteristics.

When not extending to the depth penetrated, the silty fine sands are underlain by silty clay with numerous layers up to one to two inches of silty sand and then underlain by silty fine sands with occasional to numerous layers up to one to two inches of silty clay.

All of the soils are brown to reddish-brown. Layers within the predominant soils dip normally and show no signs of distortion.

The lines designating the interface between soil types on the boring logs generally represent approximate boundaries. In-situ, the transition between soil types may be gradual.

4.3 GROUNDWATER

Immediately following drilling operations, groundwater was measured at depths ranging from 13.4 to 25.7 feet below existing grade. Two to three weeks following drilling, groundwater was measured at depths ranging from 12.5 to 15.7 feet below existing grade. Water levels in companion borings were at the same depth. This indicates that to the depths penetrated, artesian conditions were not encountered.

Seasonal and longer-term groundwater fluctuations on the order of one to three feet are projected with the highest seasonal levels generally occurring during the late spring and early summer months.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

The most significant geotechnical aspects of the site are the non-engineered fills encountered in nearly all of the borings, and a moderately high groundwater table.

Because of the water table, dewatering will be required during construction. An extensive permanent perimeter foundation/chimney subdrain system will be required around the subgrade portions of the facility. In addition, an under slab subdrain will be required in areas.

The results of this study show that the proposed structure, ranging from the two to three levels, may be supported upon conventional spread and continuous wall foundations. The lighter loaded foundations may be supported directly upon suitable natural soils. For the more heavily loaded foundations, varying thicknesses of replacement granular fill will be required beneath the footings in order to control total and differential settlements.

In the following sections, detailed discussions and recommendations pertaining to earthwork, foundations, lateral resistance and pressures, at-grade floor slabs, dewatering, and the geoseismic setting of the site are provided.

5.2 EARTHWORK

5.2.1 Site Preparation

Preparation of the site for major construction will include demolition of existing structures, including floor slabs and foundations, and pavements and abandonment or relocation of existing utilities running beneath the footprint of the proposed structure. In general, material resulting from demolition of the pavements may be re-used as part of site engineered fill provided that the recycled debris meets the fill requirements described later in this report. All debris and deleterious materials must be removed from the site.

Subsequent to demolition and prior to the placement of floor slabs, structural site grading fills, floor slab, exterior flatwork, and pavements, the exposed subgrade must be proofrolled by passing moderate-weight rubber tire-mounted construction equipment over the surface at least twice. If excessively soft or loose soils are encountered, they must be removed to a maximum depth of two feet, and replaced with structural fill. Existing surface fills meeting the proofrolling test and not containing deleterious material may remain beneath outside flatwork and flexible pavements. All non-engineered fills must be removed from beneath an area extending out at least five feet from the perimeter of the proposed building footprint.

Mass excavation may be initiated subsequent to demolition.

5.2.2 Excavations

The mass excavation for the structure will extend 14 to 15 feet below grade. In Borings B-1, B-2, B-3, B-4, B-5, B-6, and B-10, in the eastern portion of the building footprint, groundwater was encountered at depths of 12.5 to 15.3 feet. The soils in many of the eastern boring to depths of 15.0 to 22.5 feet are silty clays with occasional to numerous up to two-inch layers of silty fine sand. In the other borings, the clays extend to depths of only 7.5 to 8.5 feet. The clays in all cases are underlain by silty fine sand.

Temporary excavations up to four feet in depth in the clays, above or below, the water table can be constructed with near-vertical sideslopes. Deeper excavations in the clays, up to 15 to 16 feet, should be constructed with sideslopes no steeper than one horizontal to one vertical. If the seepage through sand layers in the lower portions of these excavations is extensive a buttress of coarse sand and gravel should be placed with the top one foot above the uppermost seep. Slope of the buttress should be at least one and one-half horizontal to one vertical.

If extensive zones of saturated "running" sands are encountered, the overall slope must be flatten to one and one-half horizontal to one vertical and the portion in the "running" sands buttressed at two horizontal to one vertical.

As an alternate, the portions of the deeper eastern excavation slope below a depth of 10 feet can be retained by driving sheet piles.

Water collected in the excavations should be collected in toe drains and after passing through sediment sumps pumped to outside storm drain. Flow rates must be recorded.

All excavations must be observed periodically by qualified geotechnical personnel. If any signs of instability or excessive sloughing are noted during or following excavation, immediate remedial action must be initiated.

5.2.3 Structural Fill

Structural fill is defined as all fill that will be ultimately subjected to structural loads, such as those imposed by footings, floor slabs, pavements, etc. Structural fill will be required as backfill over foundations and utilities, as site grading fill, and possibly beneath floor slabs and footings. Structural site grading fill is defined as fill placed over relatively large open areas to raise overall grade.

All structural fill must be free of sod, rubbish, construction debris, frozen soil, and other deleterious materials. Structural fill placed below a level one foot above the water table at the time of construction and/or to stabilize soft saturated subgrade conditions should consist of a mixture of clean coarse gravels and cobbles. The subgrade must be free of all loose and disturbed soils. This can best be achieved by using a backhoe with a smooth-lip bucket for excavation.

The maximum particle size within structural site grading fill should generally not exceed four inches. However, occasional larger particles up to six to eight inches in diameter may be incorporated provided that they do not result in "honeycombing" or preclude achieving the desired degree of compaction. In confined area, the maximum particle size should not exceed two and one-half inches.

It should be noted that, from a handling and compaction standpoint, excavated natural sands will be wet and may have relatively high fines content. Use of these materials may require close moisture control during placement and compaction. This will be difficult, if not impossible, during wet and cold periods of the year. Imported fills should be granular. These soils should be well-graded and contain no more than 18 percent fines. The suitability of excavated natural soil for use as structural site grading fill or wall backfill should be evaluated by qualified geotechnical personnel prior to placement.

To limit lateral pressures on subgrade walls and to provide a chimney drain, a "free-draining" granular material, such as one-half to one-inch minus clean gap-graded crushed angular gravel, should be placed around the immediate perimeter of the below-grade portions of the structure. The width of the gravel zone should be at least four feet in slope areas. A geotextile fabric, such as Mirafi 140N or equivalent, must be used to separate the "free-draining" backfill from natural subgrade soils and other backfill materials.

5.2.4 Fill Placement and Compaction

Coarse gravel and cobble mixtures should be end-dumped, spread to a maximum loose lift thickness of 18 inches, and uniformly compacted by running moderate-weight truck-mounted construction equipment uniformly over the surface at least three times. Bank-run and on-site granular structural fill should be placed in lifts not exceeding eight inches in loose lift thickness. Beneath footings or where more than 5 feet thick but less than 10 feet, the fill must be compacted to at least of 95 percent of the maximum dry density as determined by the AASHTO[1] T-180 (ASTM[2] D-1557) test procedures. Fills greater than 5 feet thick must be compacted to at least 98 percent of the above-defined criteria.

The initial lift of the bank-run-type sands and gravel over coarse stabilizing gravels must be appropriately "worked into" the underlying soils so that long-term subsidence and settlement does not occur due to migration of finer-material into the coarser stabilizing gravels. We do not recommend that finer-grained soils be placed over or adjacent to "free-draining" granular material (such as the chimney drain) unless a geotextile fabric is placed between these two materials.

"Free-draining" granular fill utilized in chimney drains along the perimeter of the site structures should be spread to a maximum loose lift thickness of 12 inches and compacted by running a flat-plate hand-operated vibratory compactor over the surface of each lift continuously at least three times.

5.3 DEWATERING

5.3.1 Temporary

Groundwater will be encountered in excavations extending below depths of approximately 12 feet below existing grades. Most significant flows will be in the granular soils and sand layers in cohesive soil. As previously discussed, where groundwater is encountered a buttress of fully drained granular soils must be placed over the seep. Seepage water can then be collected in perimeter ditches constructed at the toe of the excavation slope face and directed to sumps or settling areas established within down-gradient portions of the mass excavation. Once clarified, and with appropriate permits, the water could be pumped and discharged to nearby storm drainage facilities.

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1 American Association of State Highway and Transportation Officials
2 American Society for Testing and Materials

Based on the groundwater readings, we estimate that there should be moderate volume of water entering the excavation (10 to 20 gallons per minute). This inflow will be primarily controlled by saturated granular soil zones. It is essential that during the mass excavation operations, accurate records be maintained of the actual discharge rates at the sumps.

5.3.2 Permanent Subdrain System

5.3.2.1 General

Since the lowest planned level for the structure will be below site static groundwater levels, a permanent subdrain system will be required. The permanent subdrain system should consist of a perimeter foundation/chimney system and an under slab system when the at-grade slabs extend more than eight feet below grade.

5.3.2.2 Perimeter Subdrain

The perimeter subdrain pipe should be a minimum of six-inches in diameter, slotted or perforated, and with the invert established at least two feet below the top of the lowest adjacent slab. The pipe should be encased in a one-half to one-inch minus clean gap-graded crushed gravel extending two inches below, laterally, and up continuously at least 12 inches above the top of the lowest adjacent slab. In all cases, the gravels must be separated from the natural soils or finer-grained backfill with a geotextile, such as Mirafi 140N or equivalent. The slope of the pipe should be at least 0.25 percent to a suitable point of gravity discharge; such as a sump within or outside the perimeter of the below-grade portion of the structure or down-gradient to a storm drain. Extending up from the top of the subdrain to within two feet of final grade should be a chimney drain consisting of one-half to one-inch minus clean gap-graded angular crushed gravel. To reduce lateral pressure the gravel should be at least four feet in width (perpendicular to the wall). The gravels must be separated from other soils by a geotextile fabric. Prior to the placement of the chimney drain materials, the outside subgrade walls should be appropriately waterproofed.

5.3.2.3 Under Slab Subdrain

All at-grade slabs extending more than eight feet below grade must be underlain by a under slab subdrain. This drain should consist of a minimum of six inches of “free-draining” gravel as previously discussed. In addition, trench drains should be established 30-foot centers (east-west). These trench drains should consist of four-inch slotted or perforated pipe with an invert at least 18 inches beneath the top of the lowest adjacent at-grade slab. The pipe must be encased in the “free-draining” gravel extending two inches below and laterally from the pipe. The gravel must extend upward to the gravel underlying the slab.

The pipe should slope at least 0.25 percent to the perimeter foundation subdrain. The base and sides of the trenches must be lined with a geotextile fabric, such as Mirafi 140N or equivalent, before the gravel is placed.

Based on preliminary design drawings, it appears that an auditorium/lecture hall will extend more than eight feet below grade. This lecture hall will need to have an under slab subdrain and perimeter subdrain behind the east wall.

5.4 SPREAD AND CONTINUOUS WALL FOUNDATIONS

5.4.1 Design Data

Spread foundations can be utilized to support the proposed structure. Lightly loaded footings can be established directly upon suitable natural soil. To control settlements, the more heavily loaded footings will require varying thicknesses of underlying natural granular soils and/or granular structural fill extending to suitable natural soils. For these conditions, the following design parameters are presented:

Minimum Recommended Depth of Embedment for Frost Protection	- 30 inches
Minimum Recommended Depth of Embedment for Non-frost Conditions	- 15 inches
Recommended Minimum Width for Continuous Wall Footings	- 18 inches
Minimum Recommended Width for Isolated Spread Footings	- 24 inches
Recommended Net Bearing Pressure for Real Load Conditions	- 3,000 pounds per square foot
Bearing Pressure Increase for Seismic Loading	- 50 percent*

* Should not be applied to maximum edge pressure during seismic loading.

The term "net bearing pressure" refers to the pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total load includes all dead and live loads, including seismic and wind.

5.4.2 Installation

Under no circumstances should the footings be underlain by loose or disturbed soils, sod, rubbish, construction debris, frozen soil, or other deleterious materials. As previously stated, the lightly loaded footings can be established upon suitable natural soils. More heavily loaded footings must be underlain by a minimum thickness of natural granular soils and/or granular structural fill to control settlements. Width of replacement granular fill should be equal to the width of the footing plus one foot for each foot of fill thickness.

5.4.3 Settlements

Settlements of foundations will be dependent upon the loads imposed and the thickness of replacement granular fill beneath the footings. For various loading conditions, the following projected settlements are provided:

Footing Type	Load	Minimum Thickness of Replacement Granular Fill* (feet)	Projected Settlement (inches)
Spread	up to 150 kips	0	¼ to ⅝
	150+ to 300 kips	1.5	⅜ to ⅝
	300+ to 400 kips	3	½ to ⅝
Wall	0 to 12 kips per lineal foot	0	¼ to ⅝

* This should consist of granular structural site grading fill, replacement fill, or suitable natural in-situ granular soils.

5.5 LATERAL RESISTANCE

Lateral loads imposed upon the foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of 0.45 should be utilized. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of 300 pounds per cubic foot. Below the water table, this granular soil should be considered equivalent to a fluid with a density of 150 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by 1.5.

5.6 LATERAL PRESSURES

The most significant lateral pressures will be imposed by the backfill around the perimeter of the below-grade portions of the building.

If the "free-draining" gravel backfill is used and is placed and compacted as previously discussed, an active equivalent fluid pressure of 45 pounds per cubic foot should be utilized in design of the perimeter walls. For seismic loading, a horizontal pressure at the top of the wall of 420 pounds per square foot and a horizontal pressure at the base of the wall of 180 pounds per squatter foot are recommended. This is a slightly inverted trapezoidal. The pressures are based upon a horizontal acceleration of two-thirds (⅔) the MCE value and that the wall will move out (away from) the backfill during seismic loading.

Lateral loads imposed upon the subgrade wall due to the vertical pressure imposed by footings supporting the southern portion of the structure can be provided once the lateral distance between the subgrade wall and the shallow footings and the loads imposed by the shallow footings have been determined.

5.7 AT-GRADE SLABS

The at-grade slab associated with the structure should be underlain by four inches of one-half to one-inch minus clean gap-graded gravel or the under slab subdrain as previously discussed. The gravel can be placed upon properly proofrolled existing suitable soils and/or structural fill extending to suitable soil.

5.8 CEMENT TYPES

The laboratory tests indicate that the site soils contain negligible amounts of water soluble sulfates. Therefore, all concrete which will be in contact with the site soils should be prepared using Type I or IA cement.

5.9 GEOSEISMIC SETTING

5.9.1 General

Utah municipalities have adopted the International Building Code (IBC) 2003. The IBC 2003 code determines the seismic hazard for a site based upon regional mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class (formerly soil profile type). The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points). In comparison, the former UBC (Uniform Building Code) generally placed the entire Wasatch front into a single seismic zone (Seismic Zone 3).

The structure must be designed in accordance with the procedure presented in Chapter 16 of the IBC 2003 edition.

5.9.2 Faulting

Based upon our review of available literature, no active faults are known to pass through or immediately adjacent to the site. The site is located outside fault investigation zones identified by Weber County. The nearest active fault is the Ogden portion of the Wasatch fault approximately one half mile east of the site. The Wasatch fault zone is considered capable of generating earthquakes as large as magnitude 7.3[3].

5.9.3 Site Class

For dynamic structural analysis, the Site Class "D" as defined in Table 1615.1.1, Site Class Definitions of the 2003 IBC, can be utilized.

5.9.4 Ground Motions

The IBC 2003 code is based on 1997 USGS (United State Geologic Survey) mapping, which provides values of short and long period accelerations for the Site Class "B"-"C" boundary for the 2 percent in 50 year event (2,475 year return period). This Site Class "B"-"C" boundary represents a hypothetical bedrock surface and must be corrected for local soil conditions. The following table summarizes the peak horizontal and short and long period accelerations for a 2 percent in 50-year event and incorporates a soil amplification factor for a Site Class "D" soil profile. Based on the site latitude and longitude (41.1935 north and 111.9441 degrees west, respectively), the values for this site are tabulated below:

Spectral Acceleration Value, T Seconds	**MCE 2% in 50 Yr event (2,475 yr return), % g**
Peak Horizontal Ground Acceleration (0.00 Seconds)	71.8
0.2 Seconds, (Short Period Acceleration, S_S)	179.5
1.0 Seconds (Long Period Acceleration, S_L)	116.9

MCE – Maximum considered earthquake

3 Arabasz, W.J., Pechmann, J.C., and Brown, E.D., 1992, Observational seismology and the evaluation of earthquake hazards and risk in the Wasatch Front area, Utah, in Gori, P.L., and Hays, W.W., eds., Assessment of regional earthquake hazards and risk along the Wasatch Front, Utah: U.S. Geological Survey Professional Paper 1500-D, 36 p.

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The IBC 2003 code site accelerations are based on taking the above short and long period accelerations for the Maximum Considered Earthquake Event, and multiplying by two-thirds (⅔).

5.9.5 Liquefaction

The site is located in an area that has been identified by the Weber County Geologist as having a "moderate" liquefaction potential. Liquefaction is defined as the condition when saturated, loose, finer-grained sand-type soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event.

Analyses indicate isolated zones of the saturated granular soils could liquefy under a major seismic event. Maximum anticipated settlement resulting from the liquefaction would be in the range of one to one and one-half inches. Because of the depth of the potentially liquefiable soils and their limited thickness, analyses indicate that surface ground rupture should not occur.

Potentially liquefiable zones are not continuous. Therefore, lateral spread should not be a concern. The bedding of the soils encountered in the samples show no signs of distortion. This indicates that the soils have not experience laterally spread since deposition. During this period, the site has experienced at least three magnitude 7 or greater earthquakes.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

GSH Geotechnical Consultants, Inc.

Joshua M Whitney, EIT
Staff Engineer

Reviewed by:

William J. Gordon, State of Utah No. 146417
Professional Engineer

JMW/WJG:sn

Encl. Figure 1, Vicinity Map
Figure 2, Site Plan
Figures 3A through 3J, Log of Borings
Figure 4, Unified Soil Classification System

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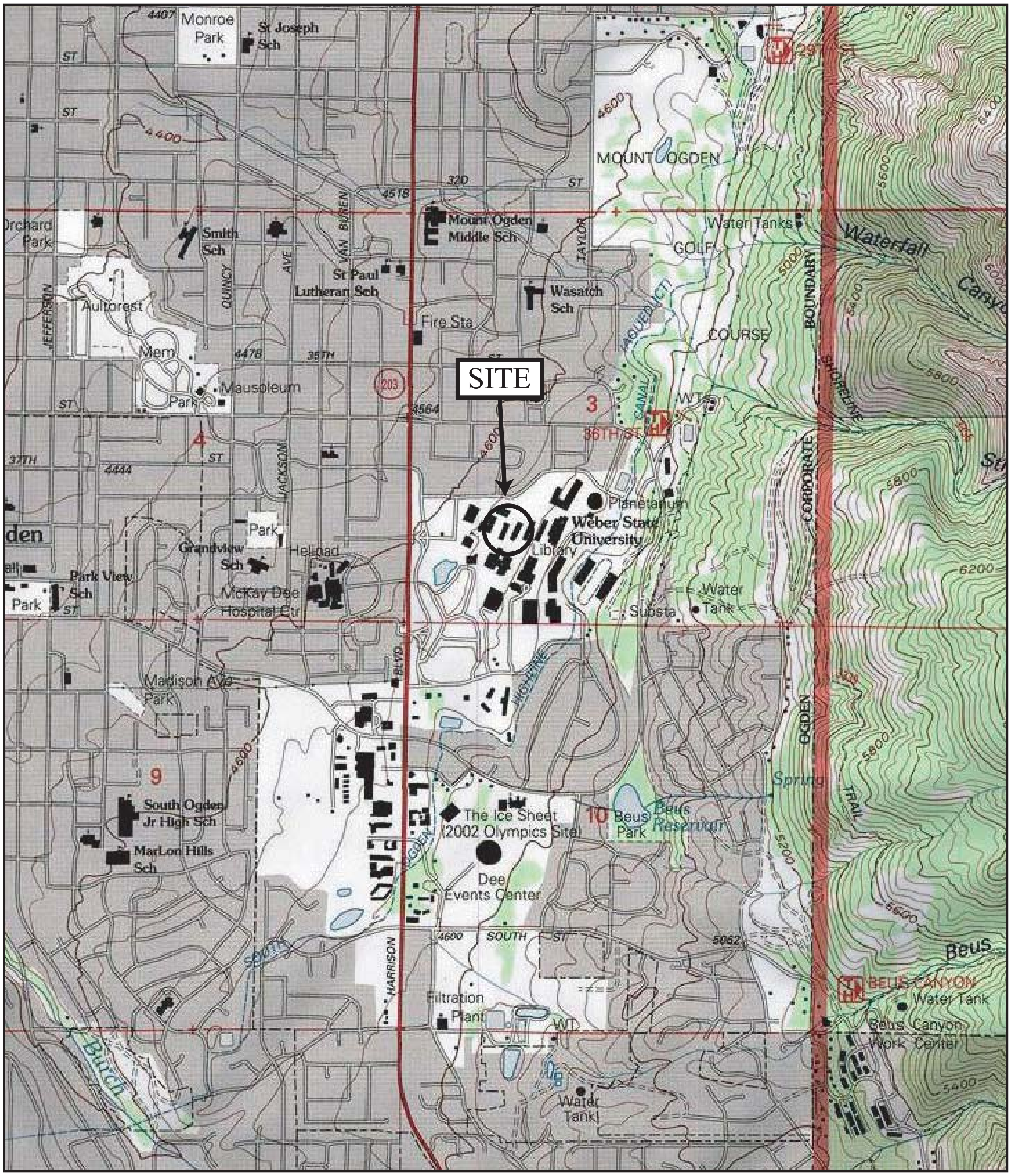
STATE OF UTAH - DFCM
JOB NO. 0128-001-05



SCALE IN FEET
1000 0 1000 2000

FIGURE 1
VICINITY MAP

GSH
Gordon Spilker Huber Geotechnical Consultants, Inc.

REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP
TITLED "OGDEN, UTAH"
DATED 1998

STATE OF UTAH - DFCM
JOB NO. 0128-001-05

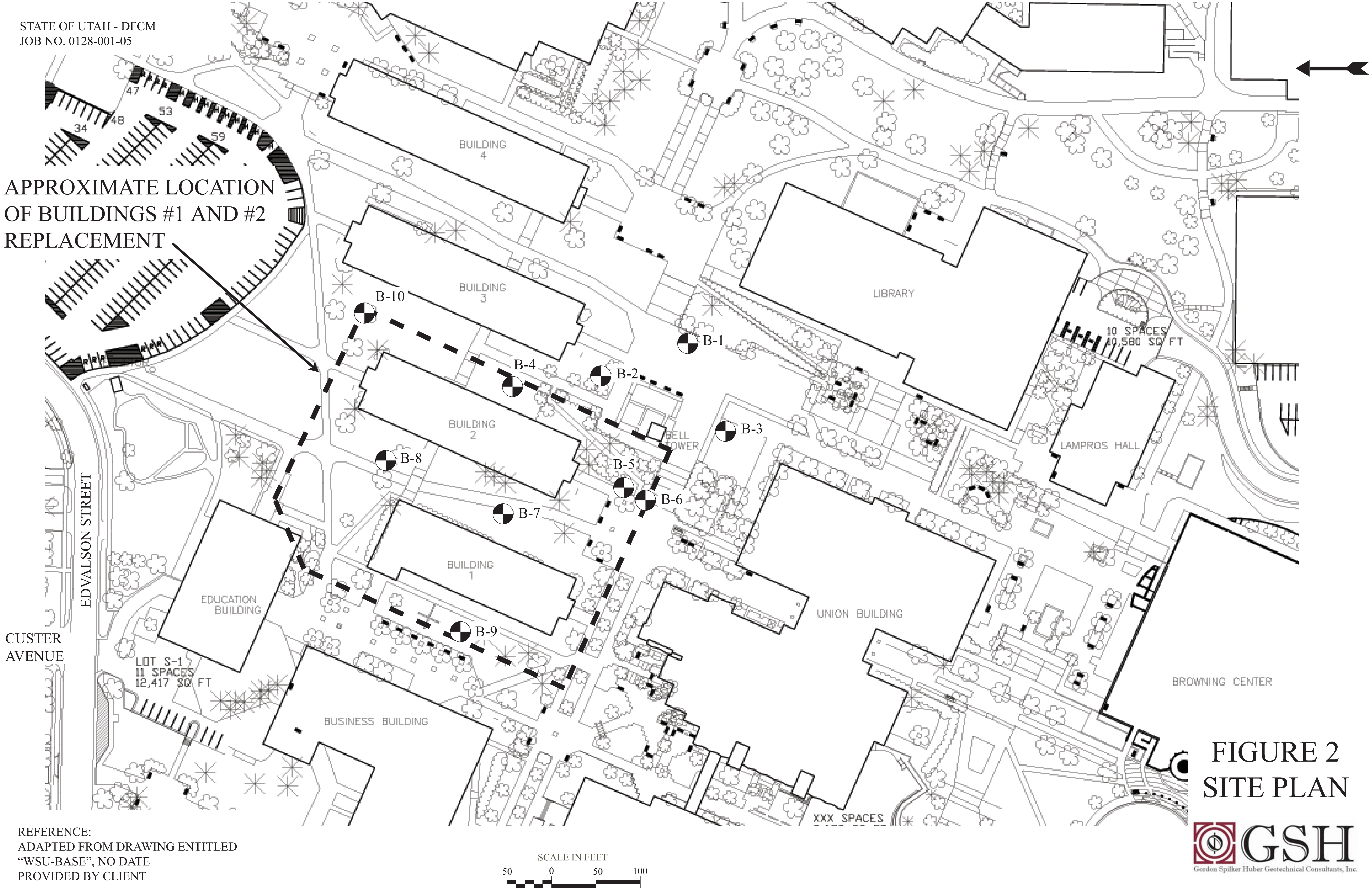


FIGURE 2
SITE PLAN

GSH
Gordon Spilker Huber Geotechnical Consultants, Inc.

REFERENCE:
ADAPTED FROM DRAWING ENTITLED
"WSU-BASE", NO DATE
PROVIDED BY CLIENT

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-25-05
Elevation: 4700' +/-
Water Level: 14.0' (08-25-05)
Remarks:

DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
Ground Surface	0								
6" PORTLAND CEMENT CONCRETE									
6" GRAVEL, FILL fine and coarse gravel, FILL (GP)									moist very stiff
SILTY CLAY with numerous layers to 1" thick of silty fine sand; brown (CL)		29							
grades with numerous layers up to 1/4" thick of silty fine sand	5	34							
SILTY SAND with occasional layers up to 1/2" thick of silty clay; brown (SM)									very moist medium dense
	10	26		31.2		92			
grades with bedding inclines (dipping 10 to 15 degrees)	15	16			92.3				saturated loose (water level at 14.0 ft)
grades silty fine sand with occasional layers to 1" thick of silty clay; brown	20	27							medium dense
	25								

FIGURE 3A

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-25-05
Elevation: 4700' +/-
Water Level: 14.0' (08-25-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
				29							
			30	28							
		Stopped drilling at 29.5'.									
		Stopped sampling at 31.0'.									
			35								
			40								
			45								
			50								

BOREHOLE B-2

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-26-05
Elevation: 4700' +/-
Water Level: 24.9' (08-26-05) 15.3' (09-13-05)
Remarks:

DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
Ground Surface									
SILTY CLAY, FILL with some fine to coarse sand and fine and coarse gravel; major roots (topsoil) to 6"; brown, FILL (CL)	0								loose to 6" to 9" moist very stiff
grades brown with black mottling and with occasional layers up to 2" thick of silty fine sand		48	X						
SILTY CLAY with some fine sand; blocky; reddish-brown (CL)	5	39	X	20.2		108			moist very stiff
SILTY CLAY AND SILTY SAND in alternating layers up to 3" thick; fine sand; 10 to 15 degrees in bedding planes; reddish-brown (CL/SM)									moist to very moist hard/dense
	10	83	X						
	15	68	X						
	20	22	X						very moist stiff/loose
	25		X						saturated

FIGURE 3B

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-26-05
Elevation: 4700' +/-
Water Level: 24.9' (08-26-05) 15.3' (09-13-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		grades with alternating layers up to 3" thick of silty clay; reddish-brown; and silty fine sand; brown, 10 to 15 degrees dip in planes		23		31.7		91			very stiff/loose
			30	21							stiff/loose
		SILTY SAND with occasional layers up to 1/2" thick of silty clay; fine sand; brown (SM)									saturated loose
			35	17			66.5				
		SILTY CLAY with occasional layers up to 1/2" thick of silty fine sand; brown (CL)	40	36		29.9		94			saturated very stiff
		Stopped drilling at 40.0'. Stopped sampling at 41.5'. Installed 1-1/4" slotted PVC pipe to 41.5'.	45								
			50								

FIGURE 3B
(con't)

BOREHOLE B-3

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-26-05
Elevation: 4700' +/-
Water Level: 25.7' (08-26-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface									
		SILTY CLAY, FILL with some fine to coarse sand and fine and coarse gravel; major roots (topsoil) to 3" to 6"; brown, FILL (CL)	0								loose to 9" to 12" moist
		SANDY SILTY CLAY fine sand; brown (CL)									moist very stiff
			5	38							
		SILTY CLAY AND SILTY SAND in alternating layers up to 2" thick; fine sand; brown (CL/SM)									moist to very moist very stiff/medium dense
			10	44							
		grades with 10 to 15 degrees of layered bedding planes	15	41							
			20	33							
			25								stiff/loose

FIGURE 3C

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-26-05
Elevation: 4700' +/-
Water Level: 25.7' (08-26-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
	▼			19							saturated
			30	26		34.5		88			very stiff/medium dense
		Stopped drilling at 29.5'. Stopped sampling at 31.0'.									
			35								
			40								
			45								
			50								

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

BOREHOLE B-4

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-29-05
Elevation: 4700' +/-
Water Level: 13.5' (08-29-05)
Remarks:

DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
Ground Surface									
SILTY CLAY, FILL with some fine sand; major roots (topsoil) to 3" to 6"; brown, FILL (CL)	0								loose 6" to 9" moist hard
		132							
SILTY CLAY with some fine sand; brown (CL)	5	13		22.8		99			moist stiff
grades with numerous layers up to 2" thick of silty fine sand; brown	10	37		28.2		92			very moist very stiff
									saturated
grades with inclined bedding 10 to 15 degrees dip	15	28		31.8		91			
	20	26							
SILTY SAND with numerous layers up to 2" thick of silty clay; fine sand; brown (SM)									saturated loose
	25								

FIGURE 3D

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-29-05
Elevation: 4700' +/-
Water Level: 13.5' (08-29-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
				20			62.4				
			30	22							
		Stopped drilling at 29.5'. Stopped sampling at 31.0'.									
			35								
			40								
			45								
			50								

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-29-05
Elevation: 4700' +/-
Water Level: 14.5' (08-29-05) 12.5' (09-13-05)
Remarks:

DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
Ground Surface									
SAND, FILL with trace silt; major roots (topsoil) to 6"; fine sand; brown, FILL (SP)	0								loose 6" to 9" slightly moist loose
		17							
SILTY CLAY with occasional layers up to 3/4" thick of silty fine sand; brown (CL)	5								moist hard
		66							
	10								
		28							very moist very stiff saturated
	15								
grades with numerous layers up to 2" thick of silty fine sand; brown		47							
	20								
SITLY SAND with numerous layers up to 2" thick of silty clay; fine sand; brown (SM)		33							saturated medium dense
	25								

BOREHOLE B-5

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-29-05
Elevation: 4700' +/-
Water Level: 14.5' (08-29-05) 12.5' (09-13-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		SILTY CLAY with numerous layers up to 2" thick of silty fine sand; brown (CL)		28							saturated very stiff
			30								
		Stopped drilling at 28.5'. Stopped sampling at 30.0'. Installed 1-1/4" slotted PVC pipe to 30.0'.	35								
			40								
			45								
			50								

FIGURE 3E
(con't)

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-29-05
Elevation: 4700' +/-
Water Level: 12.7' (09-13-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface	0								
		SILTY CLAY, FILL with some fine to coarse sand and fine and coarse gravel; major roots (topsoil) to 3" to 6"; brown, FILL (CL)									loose to 9" to 12" moist
		SILTY CLAY with trace fine sand; brown (CL)	5								
		grades with numerous layers up to 2" thick of silty fine sand; brown	10								
											very moist
			15								
		Stopped drilling at 15.0'. Installed 1-1/4" slotted PVC pipe to 15.0'. No groundwater encountered at time of drilling.	20								
			25								

BOREHOLE B-7

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-30-05
Elevation: 4700' +/-
Water Level: 13.4' (08-30-05)
Remarks:

DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
Ground Surface									
SILTY CLAY, FILL with trace fine sand; major roots (topsoil) to 6"; dark brown, FILL (CL)	0								loose to 6" to 9" moist hard
		75		18.9		109			
SILTY CLAY with some fine sand; brown (CL)	5								moist hard
		170							
grades silty clay with numerous layers to 2" thick of silty fine sand; brown	10	82							very moist
(water level)									saturated
	15	50		28.9		94			very stiff
grades with bedding planes dip 10 to 15 degrees	20	35							
SILTY SAND with numerous layers up to 2" thick of silty clay; fine sand; brown (SM)									saturated medium dense
	25								

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-30-05
Elevation: 4700' +/-
Water Level: 13.4' (08-30-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
				54							
			30	42							
		SILTY CLAY with numerous layers up to 2" thick of silty fine sand; brown (CL)									saturated hard
			35	84		30.1		93			
		Stopped drilling at 35.0'. Stopped sampling at 36.5'.	40								
			45								
			50								

FIGURE 3G
(con't)

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-30-05
Elevation: 4700' +/-
Water Level: 13.4' (08-30-05)
Remarks:

DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
Ground Surface	0								
SILTY CLAY, FILL with some fine to coarse sand; major roots (topsoil) to 3" to 6"; trace organics; brown, FILL (CL)		42							loose 9" to 12" moist very stiff
SILTY CLAY with trace fine sand; brown (CL)		40							moist very stiff
	5								
grades with numerous layers up to 1" thick of silty fine sand; brown bedding planes dip 10 to 20 degrees		106							very moist hard
	10								
		54							very moist very stiff saturated
SILTY SAND with numerous layers up to 2" thick of silty clay; fine sand; brown (SM)	15								saturated medium dense
		59							
	20								
		41							
	25								

FIGURE 3H

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-30-05
Elevation: 4700' +/-
Water Level: 13.4' (08-30-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		SILTY CLAY with numerous layers to 1" thick of silty fine sand; brown (CL)									saturated very stiff
				28							
			30								
				31			32.8		90		
		SILTY SAND with occasional layers to 1/2" thick of silty clay; fine sand; brown (SM)	35								saturated loose
				13							
		Stopped drilling at 37.0'. Stopped sampling at 38.5'.	40								
			45								
			50								

FIGURE 3H
(con't)

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building

Project No.: 0128-001-05

Location: Ogden, Utah

Client: State of Utah - DFCM

Drilling Method: 3-3/4" Hollow-Stem Auger

Date Drilled: 08-31-05

Elevation: 4700' +/-

Water Level: 14.5' (08-31-05) 15.7' (09-13-05)

Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface	0								
		SILTY CLAY, FILL with trace fine sand and coarse gravel; major roots (topsoil) to 3" to 6"; brown, FILL (CL)									loose to 6" to 9" moist hard
				83							
			5								
		SILTY CLAY with some fine sand and occasional layers to 1/4" thick of silty fine sand; brown (CL)									moist hard
				172							
			10	95							
		SILTY SAND with occasional layers to 1" thick of silty clay; fine sand; brown (SM)									saturated medium dense
			15	68							
		SILTY CLAY with numerous layers to 1" thick of silty fine sand; brown (CL)									saturated very stiff
			20	48							
		grades brown with bedding planes dipping 15 degrees and with occasional layers to 1" of silty fine sand	25	54		32.1		90			

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-31-05
Elevation: 4700' +/-
Water Level: 14.5' (08-31-05) 15.7' (09-13-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
											saturated medium dense
		SILTY SAND with occasional layers up to 1" thick of silty clay; fine sand; brown (SM)	30	26							
			35	34							
			40	52		29.1		94			
		Stopped drilling at 39.0'. Stopped sampling at 40.5'. Installed 1-1/4" slotted PVC pipe to 40.5'.	45								
			50								

FIGURE 3I
(con't)

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building

Project No.: 0128-001-05

Location: Ogden, Utah

Client: State of Utah - DFCM

Drilling Method: 3-3/4" Hollow-Stem Auger

Date Drilled: 08-31-05

Elevation: 4700' +/-

Water Level: 14.5' (08-31-05) 13.5' (09-13-05)

Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface									
		SILTY CLAY, FILL with trace fine sand; major roots (topsoil) to 3" to 6"; brown, FILL (CL)	0								loose to 9" to 12" moist stiff
				14							
		SILTY CLAY with some fine sand; blocky with some cementation; light brown (CL)	5	72							moist hard
		grades brown with numerous layers to 2" thick of silty fine sand; bedding planes dipping 15 to 20 degrees; brown	10	77		27.6		97			
			15	45							saturated very stiff
		SILTY SAND with numerous layers up to 1" thick of silty clay; fine sand; brown (SM)									saturated medium dense
			20	37		30.7		85			
			25								

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Weber State Buildings 1 & 2 Replacement Building
Project No.: 0128-001-05
Location: Ogden, Utah
Client: State of Utah - DFCM
Drilling Method: 3-3/4" Hollow-Stem Auger
Date Drilled: 08-31-05
Elevation: 4700' +/-
Water Level: 14.5' (08-31-05) 13.5' (09-13-05)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		grades with numerous layers to 2" thick of silty clay;		35							
			30	29							
			35	36							
		Stopped drilling at 35.0'. Stopped sampling at 36.5'. Installed 1-1/4" diameter slotted PVC pipe to 36.5'.	40								
			45								
			50								

UNIFIED SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES				GRAPH SYMBOL	LETTER SYMBOL ⑴	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size. ⑵ (The No. 200 sieve size is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.		GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).		GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.		SW	Well graded sands, gravelly sands, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.		SP	Poorly graded sands, gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		SM	Silty sands, poorly graded sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).		SC	Clayey sands, poorly graded sand-clay mixtures.

		IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE					
		DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size. (The No. 200 sieve size is about the smallest particle visible to the naked eye)	SILTS AND CLAYS Liquid limit less than 50	None to slight	Quick to slow	None		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sand with slight plasticity.
		Medium to high	None to very slow	Medium		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		Slight to medium	Slow	Slight		OL	Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		High to very high	None	High		CH	Inorganic clays of high plasticity, fat clays.
		Medium to high	None to very slow	Slight to medium		OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture.				Pt	Peat and other highly organic soils.

⑴ Boundary classifications:—Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW—GC, well graded gravel—sand mixture with clay binder.
⑵ All sieve sizes on this chart are U.S. standard.

GENERAL NOTES

1. In general, Unified Soil Classification Designations presented on the logs were evaluated by visual methods only. There rore, actual designations (based on laboratory testing) may differ.

2. Lines seperating strata on the logs represent approximate boundaries only Actual transitions may be gradual.

3. Logs represent general soil conditions observed at teh point of exploration onthe date indicated.

4. No warranty is provided as to the continuity of soil conditions between individual sample locations.

FINE - GRAINED SOIL

CONSISTENCY	SPT (blows/ft)	TORVANE UNDRAINED SHEAR STRENGTH (tsf)	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH (tsf)	FIELD TEST
Very Soft	<2	<0.125	<0.25	Easily penetrated several inches by Thumb. Squeezes through fingers.
Soft	2 - 4	0.125 - 0.25	0.25 - 0.5	Easily penetrated 1 " by Thumb . Molded by light finger pressure.
Medium Stiff	4 - 8	0.25 - 0.5	0.5 - 1.0	Penetrated over 1/2 " by Thumb with moerate effort. Molded by strong finger pressure.
Stiff	8 - 15	0.5 - 1.0	1.0 - 2.0	Indented about 1/2 " by Thumb but penetrated only with great effort
Very Stiff	15 - 30	1.0 - 2.0	2.0 - 4.0	Readily indented by Thumbnail
Hard	>30	>2.0	>4.0	Indented with difficulty by Thumbnail

LOG KEY SYMBOLS

Bulk / Bag Sample	Thin Wall
Standard Penetration Split Spoon Sampler	No Recovery
Rock Core	D&M Sampler
Water Level	California Sampler

COARSE -GRAINDE SOIL

APPERENT DENSITY	SPT (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
Very Loose	<4	0 - 15	Easily penetrated with 1/2 " reinforcing rod pushed by hand
Loose	4 - 10	15 - 35	Difficult to penetrated with 1/2 " reinforcing rod pushed by hand
Medium Dense	10 - 30	35 - 65	Easily penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Dense	30 - 50	65 - 85	Difficult to penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Very Dense	>50	85 - 100	Penetrated only a few inches with 1/2 " reinforcing rod driven with 5-lb hammer

STRATIFICATION

DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2 "
LAYER	1/2 - 12 "

DESCRIPTION	THICKNESS
Occasional	One or less per foot of thickness
Frequent	More than on per foot of thickness

CEMENTATION

DESCRIPTION	DESCRIPTION
Weakely	Crumbles or breaks with handling of slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumbles or breaks with finger pressure

MODIFIERS

DESCRIPTION	%
Trace	<5
Some	5 - 12
With	>12

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible water, usually soil below Water Table

FIGURE 4

Gordon Spilker Huber Geotechnical Consultants, Inc.