

MEMORANDUM

To: Board of Regents

From: Board Office

Subject: University of Iowa Campus Chilled Water System Review and Proposed Improvements

Date: December 1, 2004

Recommended Actions:

1. Receive the report of the University of Iowa **Campus Chilled Water System Review**.
 2. Approve the requested actions for the chilled water system improvement projects as outlined below in the Executive Summary.
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Executive Summary:

Requested Actions Receive the report of the **Campus Chilled Water System Review**, a study undertaken by Stanley Consultants, Muscatine, Iowa, which outlines a multi-phase approach to meet the long term chilled water cooling needs of the University of Iowa (see page 2).

- A booklet summarizing the Campus Chilled Water System Comprehensive Study is included with the Board's materials.

Authorize permission to proceed with project planning and approve the engineering agreement with Stanley Consultants, Muscatine, Iowa (\$210,000) for the **West Chilled Water Plant Development/Expansion – Phase 1B** (expansion) project which would expand the existing West Campus Chilled Water Plant with the installation of two 4,000 ton chillers within a building addition on the north end of the existing plant (see page 6).

Approve the project description and budget (\$15,700,000) and engineering agreement with Stanley Consultants, Muscatine, Iowa (\$1,054,000) for the **West Chilled Water Plant Development/Expansion – Phase 2A** (renovation) project which would install two 3,000 ton chillers to replace the oldest and least efficient chillers at the West Campus Chilled Water Plant (see page 8).

Authorize permission to proceed with project planning and approve the engineering agreement with Stanley Consultants, Muscatine, Iowa (\$257,000) for the **East Campus Chilled Water Plant** project which would construct a new 8,000 ton chilled water plant on the east side of the Iowa River, adjacent to the University Power Plant (see page 9).

Campus Chilled Water System Review

Project Summary

	<u>Amount</u>	<u>Date</u>	<u>Board Action</u>
Comprehensive Planning Study (Stanley Consultants, Muscatine, IA)	\$ 155,000	Aug. 2004	Approved
Report of Comprehensive Planning Study		Dec. 2004	Receive Report

Background

The University was proceeding with the **West Campus Chilled Water Plant Development/Expansion** project which included construction of an addition to the West Campus Chilled Water Plant (Phase 1) to expand the plant's capacity to meet the growing chilled water needs for the west campus facilities, and an upgrade of the existing chilled water plant equipment, which is beyond or nearing the end of its useful life, following construction of the addition (Phase 2).

The Board approved the Phase 1 project description and budget (\$39,400,000) and received the final evaluation criteria in October 2003. The Phase 1A (utility relocation) construction contract to support the addition, in the amount of \$1,593,000, has been completed.

In August 2004, the University outlined to the Board its concerns relative to the potential noise levels with the expanded chilled water plant and the inability of contractors to meet the specified noise requirements for the new cooling towers. The University further outlined reliability and cost issues associated with the existing west campus steam distribution system, and the lack of interconnection between the University's east and west campus chilled water systems.

Accordingly, the University requested and received Board authorization to proceed with the renovation and modernization of the existing equipment in the West Campus Chilled Water Plant (Phase 2), rather than continuing with construction of an addition to expand the West Campus Chilled Water Plant (Phase 1).

- The modernization of the existing plant components would allow the University to improve reliability and increase chilled water production capacity in a more timely manner to meet immediate demand requirements.

The University indicated its wish to further evaluate alternatives for expansion of the west campus chilled water system, while also focusing on meeting the needs of both the east and west campuses with a possible interconnection of the two chilled water systems.

Report of
Comprehensive
Planning Study

The Board approved a comprehensive planning study to be undertaken by Stanley Consultants to further evaluate alternatives for expansion of the campus chilled water systems, including system improvements and expansion locations.

The University indicated that it would return to the Board with recommendations for proceeding with expansion of the campus chilled water systems at the completion of the study.

A booklet outlining the Comprehensive Study of the campus chilled water system is included with the Board's materials.

Overview

The University of Iowa's main campus facilities are cooled by a central chilled water system consisting of two independent chilled water loops located on each side of the Iowa River.

Chilled water for the west campus facilities is produced by two major plants. The Northwest Campus Chilled Water Plant is located within the Newton Road Parking facility across from the newly constructed Medical Education and Biomedical Research Facility. The West Campus Chilled Water Plant is located within UIHC Parking Ramp Three immediately north of Kinnick Stadium. The combined chilled water generation capacity for the west campus plants is 22,735 tons.

Chilled water for east campus facilities is produced from the North Campus plant located in the North Campus Parking Facility adjacent to the Chemistry Building and Burge Residence Hall. The chilled water generation capacity for the east campus is 7,000 tons.

Chilled water is distributed to the west and east campus facilities through underground piping systems on each side of the Iowa River; there currently is no cross connection between the two systems. A map indicating the location of the major campus chilled water facilities and distribution systems is included as Figure 1 (page 4) in the Comprehensive Study booklet.

According to the study, increased chilled water loads on both the west and east campuses necessitate immediate chilled water plant improvements. Chilled water demand projections for the west and east campuses indicate that production capacity will be exceeded in 2006 and 2007, respectively.

The study explored three main options for the addition of chilled water generation on campus. The recommended option is outlined in the booklet provided to the Board. The complete report provided to the Board Office indicates that the recommended option was selected because it would meet the campus-wide chilled water load growth on both the east and west campuses at the lowest initial capital investment and does not require a river crossing.

The Study outlines a multi-phase program to meet long-term campus chilled water needs. The program provides a solution for increasing chilled water generation and reliability on the west and east campuses through 2011, and identifies future projects to meet campus needs beyond 2011.

Recommendations

The Comprehensive Study recommends a three-phase approach to meeting chilled water cooling capacity demands through 2011 for the west and east campuses:

1. Expanding West Campus Chilled Water Plant Capacity (Phase 1B)

- This project would expand the existing West Campus Chilled Water Plant with the installation of two 4,000 ton chillers within a building addition on the north end of the existing plant, at an estimated cost of \$25 million.
 - The proposed addition would be smaller than the 12,000 ton plant expansion previously approved which had a project budget of \$39.4 million.
- Construction would begin in January 2006, and the chillers would be on line for the 2007 cooling season.

2. Renovating/Modernizing the West Campus Chilled Water Plant (Phase 2A)

- This project would install two 3,000 ton chillers to replace the oldest and least efficient chillers at the West Campus Chilled Water Plant, at an estimated project cost of \$15.7 million.
- Construction would begin in May 2005, and the chillers would be on line for the 2006 cooling season.

3. Constructing New East Campus Chilled Water Plant (Phase 3)

- This project would construct a new 8,000 ton chilled water plant on the east side of the Iowa River, adjacent to the University Power Plant, at an estimated project cost of \$29 million.
- Construction would begin in late 2005, and the chillers would be on line for the 2007 cooling season.

The overall project cost for the three initiatives is estimated at \$71.6 million (including the recently completed Phase 1A project, with a project cost of \$1.9 million, which upgraded and relocated site utilities north of the existing West Campus plant).

The following table summarizes the Comprehensive Study recommendations.

<u>Phase</u>	<u>Estimated Project Cost</u>	<u>Construction Start</u>	<u>Construction Completion (chillers on line)</u>	<u>Expansion/ Replacement Capacity</u>
West Campus 1B	\$25.0 million	Jan. 2006	2007 cooling season	8,000 tons (new)
West Campus 2A	\$15.7 million	May 2005	2006 cooling season	6,000 tons (replacement)
East Campus 3	<u>\$29.0 million</u>	Late 2005	2007 cooling season	8,000 tons (new)
Total Cost	\$69.7 million			

The projects would be funded by Utility System Revenue Bonds. Approximately \$11 million of the proceeds from the sale of Utility System Revenue Bonds in March 2004 would be allocated to these projects. Additional bonds would need to be issued to finance the remainder of the costs.

The University requests Board specific action for each of these items as outlined later in this memorandum.

The Study also identifies future projects to address longer term reliability and capacity issues beyond 2011.

- Included are three additional sub-phases to replace and upgrade a total of 12,000 tons of chilled water capacity in the West Campus Chilled Water Plant as summarized in the following table. Costs and schedules were not established at the time of the study because the projects do not require completion in the immediate future.

	<u>Phase</u>	<u>Replacement Capacity</u>
West Campus	2B	3,000 Tons
West Campus	2C	3,000 Tons
West Campus	2D	6,000 Tons

- Other future identified improvements include construction of north and south Iowa River crossings to link the east and west chilled water piping networks. The river crossing projects would provide increased usable capacity for the entire campus as well as add redundancy to the system.

In addition, the University is exploring the implementation of new energy conservation measures in an effort to reduce chilled water consumption in academic, athletic and research facilities, and at UIHC. The efficiency gains may lower anticipated peak chilled water loads and could potentially postpone chilled water system improvements planned for 2011 or later.

Design Services For the **West Chilled Water Plant Development/Expansion – Phase 1B** (expansion) and the **East Campus Chilled Water Plant** projects, the University requests approval to waive provisions of the Board’s Policy Manual which require the selection of an engineering firm for projects of \$1 million or more by an institutional selection committee.

The University requests approval of the selection of Stanley Consultants, Muscatine, Iowa, to provide design services for the projects. Stanley Consultants was previously selected by a University committee and approved by the Board to provide design services for the **West Campus Chilled Water Plant Development/Expansion** project.

Because of the firm’s involvement in all phases of the recent campus chilled water projects and the **Campus Chilled Water System Review**, and the University’s wish for design continuity with future projects, the University would like to continue to utilize Stanley Consultants’ expertise for the chilled water projects.

The firm possesses the necessary experience and technical qualifications, is familiar with all aspects of the projects, and has a good working relationship with the University.

West Chilled Water Plant Development/Expansion – Phase 1B (Expansion)

Project Summary

	<u>Amount</u>	<u>Date</u>	<u>Board Action</u>
Permission to Proceed		Dec. 2004	Requested
Engineering Agreement—Engineering Services Through Schematic Design (Stanley Consultants, Muscatine, IA)	\$ 210,000	Dec. 2004	Requested

Background The expansion of medical, research and academic activities on the west campus has necessitated an increase in chilled water production. In addition, the University has connected existing west campus facilities to the central chilled water system. Expansion of the existing West Campus Chilled Water Plant is necessary to ensure the future availability of adequate chilled water service.

The University completed the Phase 1A (utility relocation) construction contract for the West Campus Chilled Water Plant in preparation for construction of an addition to the Plant (Phase 1B) to expand its capacity to meet the growing chilled water needs for the west campus facilities.

- The planned building addition included the construction of three cooling towers to increase the plant’s chilled water capacity by 12,000 tons, with future expansion capacity for a fourth cooling tower and a total increase of 16,000 tons. As outlined earlier in this memorandum, this project was put on hold subject to completion of the Campus Chilled Water System Review.

Project Scope	<p>Consistent with the Comprehensive Study recommendations, the project would construct an addition to the West Campus Chilled Water Plant.</p> <p>The addition would house two 4,000 ton, steam turbine driven centrifugal chillers and associated support systems, which would increase the Plant's total chilled water capacity by 8,000 tons, with no future expansion capacity.</p> <ul style="list-style-type: none"> • The recommended addition would be smaller than the 12,000 ton plant expansion previously proposed now that development of a new East Campus Chilled Water Plant is also proposed in the Study.
Anticipated Cost/ Funding	Up to \$25 million to be funded by the sale of Utility System Revenue Bonds.
Schedule	The University anticipates beginning construction in January 2006 so that the chillers would be on line for the 2007 cooling season.
Design Services	The agreement with Stanley Consultants would provide engineering services through schematic design for a fee of \$210,000, including reimbursables.
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Evaluation Criteria	Since the project meets the Board's definition of a major capital project, the University has provided the following information in response to the Board's evaluation criteria.
Institutional Mission/Strategic Plan	This project supports the institution's mission and strategic plan by supporting all facilities on the West Campus of the University with an efficient and adequate source of chilled water. Centralized chilled water systems are substantially more efficient than smaller, building-specific cooling equipment. This new (expanded) west campus central chilled water facility will serve increased demand on the west campus.
Other Alternatives Explored	Other alternatives explored included a larger facility and facilities that were placed or configured differently on the project site. This alternative was selected because of its minimal use of the site, and to provide large green space buffers as well as pleasing architecture at an important entrance to the University. This smaller chilled water plant addition fits the requirements of the campus chilled water system comprehensive study requirements and, in conjunction with Phase 2A (existing west plant renovation) and the new East Campus Chilled Water Plant, will efficiently serve increasing chilled water capacity requirements until approximately the year 2011.
Impact on Other Facilities and Square Footage	When this project is complete, no facilities will be abandoned, transferred or demolished. However, the overall reliance on central cooling systems will increase and will continue to replace smaller building-based air conditioning.

Financial Resources for Construction Project	The project will be funded by University of Iowa utility revenue bonds. The University of Iowa chilled water utility enterprise fund will provide the cash flow to repay the bonds through the sale of chilled water units (MMBTUs) to the customers of the Utility. The University distributes approximately 1.1 MMBTU of cooling and charges its users \$14.9 million, annually.
Financial Resources for Operations and Maintenance	The source of O&M funds will be the University of Iowa Chilled Water Utility Enterprise which is replenished by collecting revenue from the customers of the utility. The customers include the UIHC, general fund buildings, Athletics, Residence Services, and others.
External Forces	Peak loads on the west campus central chilled water system have reached the limit of system capacity and will continue to increase. Further, some of the existing west campus chilled water production units not being replaced as part of the project Phase 2A (Renovation) can no longer provide the reliability required by a chilled water system operating at maximum capacity to satisfy peak demand load. The new chiller units will significantly improve energy efficiency and will reduce unit O&M costs. In addition, the new chiller units will improve the chilled water supply reliability by providing firm capacity (firm capacity = total capacity minus largest single chiller capacity.)

West Chilled Water Plant Development/Expansion – Phase 2A (Renovation)

Project Summary

	<u>Amount</u>	<u>Date</u>	<u>Board Action</u>
Permission to Proceed—Phase 2 Engineering Agreement—Phase 2 (Stanley Consultants, Muscatine, IA)	\$ 185,000	Aug. 2004 Aug. 2004	Approved Approved
Project Description and Total Budget Engineering Agreement—Schematic Design Through Construction Administration (Stanley Consultants, Muscatine, IA)	15,700,000 1,054,000	Dec. 2004 Dec. 2004	Requested Requested

Background

The existing equipment in the West Campus Chilled Water Plant has exceeded its useful life and is beginning to require accelerated maintenance.

In August 2004, the University received Board approval to proceed with the renovation and modernization of the existing equipment in the West Campus Chilled Water Plant (Phase 2).

- Proceeding with the modernization of the existing plant components would allow the University to improve reliability and increase chilled water production capacity in a more timely manner to meet immediate demand requirements.

Project Scope	<p>This project would install two 3,000 ton electric motor-driven chillers, replace or update existing pumps and cooling towers for the operation of the new chillers, and provide other associated improvements.</p> <ul style="list-style-type: none"> The two chillers would replace an existing steam turbine-driven chiller and two low pressure steam absorption units, and one high pressure steam absorber. <p>The two new chillers would be purchased by the University through the purchase order process.</p>												
Schedule	The University anticipates beginning construction in May 2005 so that the chillers would be on line for the 2006 cooling season.												
Funding	Utility System Revenue Bonds.												
	<u>Project Budget</u>												
	<table border="0" style="width: 100%;"> <tr> <td style="width: 80%;">Construction</td> <td style="text-align: right;">\$ 12,700,000</td> </tr> <tr> <td>Design, Inspection, and Administration</td> <td></td> </tr> <tr> <td> Consultants</td> <td style="text-align: right;">1,150,000</td> </tr> <tr> <td> Design and Construction Services</td> <td style="text-align: right;">580,000</td> </tr> <tr> <td> Contingencies</td> <td style="text-align: right;"><u>1,270,000</u></td> </tr> <tr> <td style="text-align: center;">TOTAL</td> <td style="text-align: right;"><u>\$ 15,700,000</u></td> </tr> </table>	Construction	\$ 12,700,000	Design, Inspection, and Administration		Consultants	1,150,000	Design and Construction Services	580,000	Contingencies	<u>1,270,000</u>	TOTAL	<u>\$ 15,700,000</u>
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TOTAL	<u>\$ 15,700,000</u>												
Design Services	The agreement with Stanley Consultants would provide schematic design through construction administration services for a fee of \$1,054,000, including reimbursables.												

East Campus Chilled Water Plant

Project Summary

	<u>Amount</u>	<u>Date</u>	<u>Board Action</u>
Initial Review and Consideration of Capital Project Evaluation Criteria		Dec. 2004	Receive Report
Permission to Proceed		Dec. 2004	Requested
Engineering Agreement—Engineering Services Through Schematic Design (Stanley Consultants, Muscatine, IA)	\$ 257,000	Dec. 2004	Requested

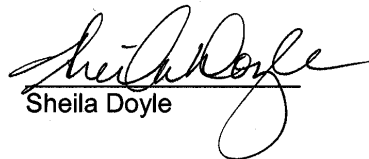
Background The growth in academic and research activities in the east campus facilities has led to a corresponding increase in east campus chilled water demand. In addition, the University has connected many east campus facilities to the central chilled water system.

The overall increase in east campus chilled water demand exceeds the capacity of the existing North Campus plant which serves the entire east campus area.

One recommendation of the Campus Chilled Water System Comprehensive Study is construction of a new East Campus Chilled Water Plant, with a capacity of 8,000 tons, adjacent to the University Power Plant, to meet near and long term east campus chilled water cooling demands.

Project Scope	<p>Consistent with the Comprehensive Study recommendations, the project would construct an 8,000 ton chilled water plant in the southeast quadrant of the university's main campus near the University Power Plant. A map indicating the proposed location for the East Campus Chilled Water Plant is included as Figure 1 (page 4) in the Comprehensive Study booklet.</p> <p>The Chilled Water Plant would be connected to the east campus chilled water distribution system to supplement the chilled water production capacity of the North Campus Chilled Water Plant.</p>
Anticipated Cost/ Funding	\$29 million to be funded by the sale of Utility System Revenue Bonds.
Schedule	The University anticipates beginning construction in late 2005 so that the chillers would be on line for the 2007 cooling season.
Design Services	The agreement with Stanley Consultants would provide engineering services through schematic design for a fee of \$257,000, including reimbursables.
Evaluation Criteria	Since the project meets the Board's definition of a major capital project, the University has provided the following information in response to the Board's evaluation criteria.
Institutional Mission/Strategic Plan	This project supports the institution's mission and strategic plan by supporting facilities on the East Campus of the University with an efficient and adequate source of chilled water. Centralized chilled water systems are substantially more efficient than smaller, building specific cooling equipment. The central chilled water facility on the East Campus is replacing less efficient cooling equipment as they reach the end of their useful lives as well as serving an increased demand on the East side of the Iowa River due to new building projects coming on line.
Other Alternatives Explored	Other alternatives explored included a larger chilled water production facility on the West Campus (with a chilled water pipe river crossing) and adding additional capacity to the existing East side chilled water plant. The first alternative rejection is explained in detail in the Comprehensive Study by Stanley Consultants of which a summary report is included in this submittal. The second alternative was rejected due to inadequate space available. This plan was selected because of its ability to adapt to current campus master planning, balance chilled water production within the East side chilled water distribution system, its close proximity to the existing Main Power Plant (and improved fuel usage/efficiency), and allow more flexibility in dealing with long term chilled water load growth.

Impact on Other Facilities and Square Footage	No facilities will be abandoned, transferred or demolished due to the current location plan of this building (The new East Side Recreational Center will be displacing buildings and functions in this same area). The overall reliance of central chilled water, however, will continue to increase and replace smaller building-based air conditioning on the East Campus.
Financial Resources for Construction Project	The project will be funded by University of Iowa utility revenue bonds. The chilled water usage charges as a part of the overall University of Iowa Utility Enterprise will provide the cash flow to repay the bonds through the sale of chilled water units (MMBTU's) to the customer of the utility. The University distributes approximately 1.1 MMBTU of cooling water and charges its users \$14.9 million. \$25 Million in bonds have been issued in partial support of this project, with the balance to be provided through the Regents bond issue scheduling process.
Financial Resources for Operations and Maintenance	The source of O&M funds will be the University of Iowa chilled water utility enterprise which is replenished by collecting revenue from the customers of the utility. The customers include the UIHC, general fund buildings, athletics, Residence Halls, and others.
External Forces	Peak loads on the East Campus central chilled water system have reached the limit of system capacity and will continue to increase. The new chiller plant will provide significant energy efficiency improvements when existing buildings are connected to the central chilled water loop as well as capacity for new buildings being brought on line.


Sheila Doyle

Approved: 
Gregory S. Nichols

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