TOWN OF SANDWICH
THE OLDEST TOWN ON CAPE COD

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BOARD OF
SELECTMEN

TOWN
MANAGER

BOARD OF SELECTMEN AGENDA
October 20, 2016 – 3:00 P.M.
Sandwich Town Hall – 130 Main Street

1. Convene Open Session in Auditorium

2. Pledge of Allegiance

3. Staff Meeting *(60 Minutes)*

   School Department: Update on Sandwich High School Chillers & Potential Need for Special Town Meeting

   Potential November 2016 Special Town Meeting & Draft List of Warrant Articles

   Update on NRG Canal, LLC Proposed Unit #3 Project

   Other Matters Not Reasonably Anticipated by the Chairman

4. Adjournment

NEXT MEETING: Thursday, 10/27/16, 6:00 P.M., Town Hall – Business Meeting
Thursday, 10/27/16, 7:00 P.M., Town Hall – Summit Workshop

SANDWICH PUBLIC SCHOOLS
Department of Facilities and Grounds
33 Water Street, Sandwich, MA 02563
Phone 508-888-3312
Email: jrnelson@sandwich.k12.ma.us

Date August 8th, 2016

To Dr. Pamela Gould - Superintendent of Schools; Michelle Austin - Director of Finance and Business Operations; Jay McGrail - Chair, Sandwich School Committee

From Jonathan Nelson - Head of Buildings and Grounds

Subject High School Chiller Replacement Options

Purpose

The intent of this document is to outline the options for the Sandwich School district after the catastrophic loss of two compressors on the one functioning chiller at the High School (HS). Due to the loss, the building is experiencing extreme daily temperatures in excess of eighty-five degrees in some areas. Without some type of central cooling available, the learning environment will be severely impacted once school returns to session.

Background

The Chiller plant consists of two, four hundred ton air cooled chillers. Each chiller consists of four separate circuits, each with one screw compressor and related refrigerant components. The chillers contain R22 refrigerant, which is no longer allowed to be manufactured for sale outside equipment manufacturing. The original design called for both chillers to cycle on and off to maintain the proper chill water temperature to the various unit air handlers in order to provide tempered air to the building spaces. The building was designed to operate with this type of central chiller plant, and the operation of this plant is crucial to maintaining building temperature in the mild and hot spring, summer and fall months. While many schools may not have a central chiller plant, or even air conditioning throughout, the architectural design of the HS requires some type of cooling system be installed as numerous interior building spaces (including classrooms) have no windows or any available cooling method.

The chillers themselves are about sixteen years old, and were installed in the 1999/2000 remodel of the high school. It is important to note that air cooled chillers have average life expectancies of fifteen to twenty years. The chiller plant was serviced over the years by ENE, a large HVAC and controls service contractor in Massachusetts. The chillers are labeled as Chiller 1 and Chiller 2. After discussing the past history with ENE and department staff, at some point a few years ago, Chiller 1 had a few compressor failures and suffered large leaks of refrigerant, and was taken offline. The contractor and school at that time decided to cannibalize

Chiller 1 for parts for use on Chiller 2. Chiller 2 was functioning up until spring of this year, when two compressors starting making large noises, tripping electrical safety devices and failed to make temperature setpoints. The service contractor found metal shavings in two compressor's oil filters, most likely indicating that the screws in each chiller were grinding on metal surfaces. The loss of these two compressors meant the other two functioning ones would never meet the needs of the building load, and would most like cause electrical trips or safeties to trip to prevent the compressors from damaging themselves under load. The chiller was shut off at this time.

The long time service tech from ENE reported that Chiller 2 has had numerous problems over the years. Most importantly, large amounts of refrigerant were leaking from the unit. Refrigerant leaks on this type of chiller always include oil leaks as well. The oil circulates with refrigerant in certain parts of the system, primarily in the compressors. Once the chiller was unable to make temperature setpoint due to the loss of refrigerant, the decision was made by the school to add refrigerant back to the chiller. Due to budget constraints none of the major leaks were fixed, and small emergent issues; as well as, routine maintenance were completed to keep the chiller running and making temperature setpoint. Small electrical components and refrigerant valves and driers were replaced when needed or when temperature setpoint was impacted. Over the last few years, over 180 lbs of refrigerant were added to the system. Since the refrigerant type can no longer be manufactured, the refrigerant replacement costs have risen sharply.

It has also been reported that a combined 800 tons of cooling is well oversized for the building load, and were most likely over designed at the time of installation. The building has been cooled by one 400 ton chiller for years, however, the chiller plant has continuously failed to make setpoint on high demand days.

Alternatives Considered

In order to find a suitable, cost effective solution for replacement, numerous options were researched and investigated. The options under consideration were:

- Option 1: Do nothing
  - If the district was to do nothing at this point, the school temperatures would be extremely high and uncomfortable on the second floor in both the beginning of the school year and spring time. It is expected that numerous staff, and student issues would develop as the building would be extremely uncomfortable to work and learn in. It has been reported that students in summer camps were getting sick from the high heat, and needed to be sent home to recuperate.
  - Student and parent satisfaction will be negatively impacted by the conditions in the classrooms.

- The chillers would need to be isolated from the building, and a minimal amount of piping work would be needed to accomplish the separation. The refrigerant would need to be recovered from the circuits, and the electrical power could then be isolated from the units. Keeping these units off would reduce the electrical demand of the building during the summer months.

- Option 2A: Replace Chiller 2 with a single air cooled chiller
  - The district would contract to have the existing chillers removed and a new correctly sized chiller installed. This option would also include renting a temporary chiller to provide building cooling during the beginning of the year.
  - The actual replacement will need to be designed and bid (per Chapter 149 requirements). This would require the use of a design engineer, and proper procurement protocol. As with any new equipment purchase of this size, there would be a long lead time of ten to twelve weeks for the manufacturer to produce the unit.
  - Efficiency credits should be available from the Cape Light Compact to install a more efficient chiller unit. Installation of an efficient model will reduce long term operating electrical costs.
  - This option should be carefully designed as a single unit chiller may not meet the actual operating needs of the building and would not allow for any back-up cooling if a chiller were to be taken offline for maintenance issues.
  - This option would have at least a twenty year operating life span with proper maintenance.
- Option 2B: Replace both chillers with two new chillers appropriately sized to the building load
  - The district would contract to have both of the existing chillers removed and replaced with appropriately sized chillers for the building load.
  - This option requires renting a temporary chiller to provide building cooling during the beginning of the year.
  - The actual replacement will need to be designed and bid (per Chapter 149). This would require the use of a design engineer, and proper procurement protocol. As with any new equipment purchase of this size, there would be a long lead time of ten to twelve weeks for the manufacturer to produce.
  - Efficiency credits should be available from the Cape Light Compact to install a more efficient chiller unit. Installation of an efficient model will reduce long term operating electrical costs.
  - This option should have at least a fifteen year operating life span with proper maintenance.

- Option 3: Replace the failed two compressors on Chiller 2 with new, warrantied compressors
    - This option could most likely be procured as an emergency procurement, and could be done by quickly by receiving quotes for replacement.
    - There would be a short lead time associated with this work, of three or four weeks.
    - A contractor would remove/replace both failed compressors on the failed circuits, and then would replace all refrigerant and oil, repair all leaking valves and fittings, flush and inspect internal pipe ways on all circuits.
    - While the two compressors to remain would be inspected for operation and condition, there would be no guarantee they would remain operational for the long term. Also, when the two compressors failed, metal shavings were sent throughout the system. No contractor would fully guarantee that all metal shavings were completely removed from the system, and could cause issues in both the heat exchangers and new compressors. This puts the best case life expectancy of the chiller overall at three to five years.

Alternative Costs

Option 2A (Single Unit Replacement) Cost

Item	Cost	Note
Engineering	$50,000	Estimated at this time, project would need to be designed and bid.
Replacement with single unit	$360,000	Estimates received include:ENE $283,000 for one 400 ton unit; York $328,000 for a 450 ton chiller; BLW Engineers gave a range of $350 to $400 for replacement. Unit would have to be bid, and that could impact final price
Contingency	$102,500	Too many variables at this stage to reduce any further, assumes 25% contingency
Total Cost	**$512,500**	
Rental Unit for August through October	$46,000	Estimate received from Sunbelt Rentals, district to rent direct. Includes $10,000 in ancillary temp services cost (electrical and plumbing). Two month rental
Estimated Rebates from CLC	$20,000.00	Place holder as final rebate is yet to be determined
Estimated Total Real Cost	**$538,500**	

Option 2B (Dual Unit Replacement) Costs

Item	Cost	Note
Engineering	$60,000	Estimated at this time, project would need to be designed and bid.
Replace with two chiller units	$648,000	Increase in price from one unit is estimated to be between 50% and 80%. Number allows for 80%
Contingency	$212,400	Too many variables at this stage to reduce any further, assumes 30% contingency
Total Cost	**$920,400**	
Rental Unit for August through October	$46,000	Estimate received from Sunbelt Rentals, district to rent direct. Includes $10,000 in ancillary temp services cost (electrical and plumbing). Two month rental
Estimated Rebates from CLC	$20,000.00	Place holder as final rebate is yet to be determined

Estimated Total Real Cost	**$946,400**

Option 3 (Compressor Repair)

Item	Cost	Note
Cost to replace two compressors (2&4)	$74,300.00	Replace both bad compressors only
Replacement of 4 new discharge isolation valves	$6,250.00	Replace all leaking valves on unit
Cost to replace 4 TXV valves	$19,000.00	Replace as new to prevent any additional damage or issues
Cost of new refrigerant	$21,660.00	R22 is expensive as it is no longer manufactured
Contingency	$14,932.50	Contingency set at 15%
Total Cost	$136,142.50	
Estimated Rebates from CLC	$0.00	No rebates available

Analysis of the Alternatives

After speaking with numerous contractors, design engineers, and the engineers from the Cape Light Compact; as well as, considering all costs outlined above, some options can be ruled out very quickly. Option 1 would create a very poor indoor environment, and would greatly impact the learning environment of the school. The school was designed to have a central chiller plant, and numerous spaces lack interior windows that allow for free cooling. It would not be unreasonable to think interior space temperatures could reach the upper eighties on hot and humid days. Since the large air handlers provide outside air exchange, shutting the units off is not an option. This is not a viable option.

With an estimated cost of $136,000, Option 3 does not appear to viable. Most reliable engineering associations and publications, including the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) estimate screw chiller **average** life expectancy at twenty years (ASHRAE Life Expectancy chart attached as Attachment A). Properly maintained equipment, especially larger equipment, may be run for an additional three to five years (extending the life expectancy of a chiller out to twenty-three to twenty-five years) if proper maintenance costs including minor capital repairs are performed during the lifetime of the

unit. The overall Chiller 2 unit is sixteen years old, and is within the normal life expectancy for air-cooled chillers. After considering the history of the unit, life-expectancy for the two compressors not replaced in this option will most likely not exceed four or five years, and may be less. The life expectancy of the chiller as a whole may be even less based on the damage that has been done to the system by failed compressors when the age of the units are taken into account. Once metal shavings are found in the compressor oil filter, it is safe to assume metal shavings are distributed throughout the system. No amount of flushing the internal pipe-ways and passages can fully guarantee complete debris removal. These shavings can impact copper tubing and other mechanical components creating leaks or other damage. It would be impossible to guarantee any years of reliable service without additional capital repairs being needed. Even the manufacturer, York, a subsidiary of Johnson Controls, recommended that replacement is the most favorable option. Investing this amount of capital in this machine will not address longer term reliability concerns.

Option 2A is an ideal solution for both optimal maintenance downtime and efficient operation. The two smaller chillers would cycle on and off and cycle up and down as needed to meet the needs of the building at any given point. This would most likely provide a more cost effective operating solution in terms electrical costs, however, the original upfront cost is at least fifty percent greater and may be as much as 80% (80% carried in cost estimates above). This solution may incur higher long term maintenance costs than a single chiller option, but will most likely reduce overall long term electrical operating costs.

Proposed Alternative

The most cost effective and efficient alternative at this point is Option 2A; remove and scrap both existing chillers and install one single unit. While this will impact longer term maintenance procedures, it will meet the needs of the district and has a lower upfront capital cost. Hiring an engineer will be necessary to perform proper load calculations, and to appropriately design the modifications needed to make a new efficient chiller work in the existing system. Numerous items must be considered and will have to be evaluated including but not limited to; building load, electrical needs, pump sizes, piping sizes, chiller options and efficiencies, etc.

The project team will work closely with the Cape Light Compact's consulting firm Rise Engineering. Rise can help determine the most efficient design, with the largest credit available. Today's available technology means almost any replacement chiller will be more efficient than the current installed model. It is impossible at this point to place an estimated cost on the rebates available without having more information on proposed system design. A place holder of $20,000.00 has been carried for this in the above budgets.

Further, Rise will help analyze other design options not originally studied in this assessment. Discussions directly with Rise included a design that decentralized the chiller plant, or the

installation of a variable refrigerant flow system. Unfortunately, more time is needed to study these options. Any of these other replacement alternatives should fit within the cost assumptions of Option 2A.

Option 2A includes the cost of a rental chiller. The assumption of including this in the total cost of replacement is that the chiller is essential to HS operations and should have adequate cooling when School returns to session.

Service History

Attached to this document (as Attachment B) is the service history that is readily available on the chiller for the last few years. There are no service contracts or agreements in place for the chiller specifically, as is a trending standard in the industry. The service history included shows a pattern replacing refrigerant as needed, without repairing the leaks due to the high cost and budget constraints.

Summary

Due to the critical failure of two compressors on Chiller 2 of the High School chiller plant, the building environment will be severely impacted by hot temperatures. This chiller provides cooling to the entire building except for a few administrative office areas, and is essential to the operational mission of the school. The existing air cooled chiller plant, consisting of two chillers, is sixteen years old and within the estimated life-expectancy range of air cooled chillers. This current plant provides a total of 800 tons of cooling, and is oversized for the current building load. After evaluating options for replacement or repair, the most favorable option is to replace one single chiller unit with a new efficient unit. There appears to be too much risk in investing capital to repair the chiller where overall unit reliability would still be questionable. The estimated cost for the total option to replace is estimated to be $512,000. During the design phase of the project, the project team will work closely with the Cape Light Compact to determine the most efficient replacement options that fit within the proposed budget. Due to the long lead time of the chiller (on average ten weeks), a rental unit will be provided for the late summer/early fall season, and the project should be bid no later than December 31 2016 in order to have the unit operational for the spring/summer 2017 cooling season. Proper maintenance of installed equipment is key, and maintenance will be properly planned, budgeted and performed in accordance with manufacturer guidelines.

Schedule of Attachments

- Attachment A: American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Equipment Life Expectancy Chart
- Attachment B: Chiller Service History
- Attachment C: Proposals from ENE for options 2A and 3 and York for Option 2A

Chilled Water System
Sandwich High School Natatorium
Sandwich, Massachusetts

2016

Evalulation

Prepared For:

Sandwich Public Schools
260 Quaker Meeting House Road
Sandwich, MA 02537

Prepared By:

BLW Engineers, Inc.
311 Great Road, P.O. Box 1551
Littleton, MA 01460

October 12, 2016

General

The Sandwich High School was constructed in 1974; the school is approximately 248,800 square feet of educational space for approximately 1,054 students according to the MSBA website. The existing chilled water system was installed as part of a 2000 Construction Renovation Project.

Existing Conditions

The existing chilled water system consists of two York model YCA0400EC46, Serial Numbers RHHHM659044 and RHHHM658044, rated for 400 nominal tons of chiller water capacity; two primary pumps, CWP-1 and CWP-2, rated for 730 gpm at 45'TDH and 15 HP; two secondary pumps, CWP-3 and CWP-4, with variable speed drives rated for 730 gpm at 60'TDH and 20 HP; insulated chilled water piping system; insulated condenser water piping system; and Invensys direct digital (DDC) automatic temperature controls.

Each of existing chillers sit adjacent to the building on eight structural piers. The 8" chilled water return is piped from the building load to each of the chillers; from each of the chillers, chilled water supply is piped directly to the primary chilled water circulating pumps, CWP-1 and CWP-2, one pump per chiller with valving to change over from one chiller to another. Each chiller operates to provide 365 tons of chilled water cooling capacity with 54 F inlet water temperature, 42 outlet water temperature for 730 gpm with a 25 percent propylene glycol solution at a 95 F outdoor ambient temperature. From the primary chilled water circulating pumps, CWP-1 and CWP-2, chilled water is pumped either back to the chillers through the 8" decoupler piping or to the building secondary variable speed chilled water pumps, CWP-3 and CWP-4. The secondary chilled water circulating pumps, CWP-1 and CWP-2, operate through their variable speed drives and differential pressure setpoints to provide chilled water to the building chilled water terminal equipment. Building terminal cooling equipment is sized for 42 F inlet water temperature and 54 outlet water temperature with a 25 percent propylene glycol solution

Each chiller is provided with a 500 amp breaker in the existing switchgear.

Evaluation

The existing chilled connected load was analyzed and was found to be 1664.5 gpm or 8,993.7 MBH (749.5 tons); 1340.4 gpm or 7245.7 MBH (603.8 tons); excluding the Cafeteria and Auditorium. The existing chilled water system is sized for 86% of the connected load. The chilled water system is over sized and could be downsized to a more appropriate load based on building diversity.

The existing piping arrangement does not conform to the chiller manufacturer's written installation instructions. The existing primary pumps, CWP-1 and CWP-2 are on the supply side of the chiller drawing water through the chiller whereas the chiller manufacturer's written installation instructions show the primary pumps to be positioned on the inlet side of the chillers pushing water through the chiller; and the decoupler piping should be sized for the flow of the largest pump, 730 gpm or 6"

decoupler piping, whereas an 8" decoupler piping has been installed. The current piping configuration would appear to be limiting the efficiency of the chillers and the pumping system.

The existing chilled water secondary pumps appear to be undersized for total dynamic head in the chilled water system and a 25% propylene glycol solution.

Both of the existing chillers are in various stages of disrepair; the chillers are nearing their anticipated operational life of 20 years (ASHRAE). Chiller 1 has completely failed and has been "cannibalized" for parts for Chiller 2; and Chiller 2 has recently started to fail with two of the four compressors in need of replacement. This past fall, neither chiller was operational and a 400 ton chiller was leased to provide cooling to the school on a temporary basis.

The existing chillers use a refrigerant, R22, that is no longer available and is not environmentally friendly.

Recommendations

Option 1 – Repair Existing Chillers

Repair of the existing Chiller 2 including two (2) compressor replacements, four (4) new isolation valves, four (4) new expansion valves, refrigerant replacement, and upgrading automatic controls; and modifying existing piping arrangement to conform to manufacturer's written installation instructions. The existing secondary pumps, CWP-3 and CWP-4, do not need to be upgraded due to the limited chilled water capacity of this option.

It should be noted that this option does provide the school with full cooling capacity on a design day and will only buy the school some time (days, months or a couple years) before chiller replacement will be required due to the age of the existing chiller.

The estimated construction cost for Option 1 is $ 320,000.00 inclusive of engineering costs.

Option 2 – Replace Existing Chiller with Single Chiller

Option 2 consists of replacing one of the existing chillers with a single new 550 ton chiller to better provide the school with full cooling capacity on a design day; replacement of existing primary pumps, CWP-1 and CWP-2, with appropriately sized lead/standby pumps for the new chiller; rebalance flow of the existing secondary pumps, CWP-3 and CWP-4, with for the building chilled water distribution and the 25% propylene glycol solution; upgrading automatic controls; upgrading electrical breaker at the main switchboard and feeder for new power requirements; significant structural support modifications for significant chiller dimensional/weight differences; and modifying existing piping arrangement to conform to manufacturer's written installation instructions.

This option does not allow for system redundancy but provides the school with more cooling capacity and a new 20 year life expectancy on the chilled water system.

It is estimated there will be approximately $20,000.00 in rebates from the local utility for work associated with this option.

The estimated construction cost for Option 3 is $ .00 inclusive of engineering costs.

The estimated construction cost for Option 2 is $ 875,000.00 inclusive of engineering costs.

Option 3 – Replace Existing Chillers with Two Chillers

Option 3 consists of replacing both of the existing chillers with two (2) new 320 ton chillers to provide the school with full cooling capacity on a design day; reuse of existing primary pumps, CWP-1 and CWP-2, with appropriately sized lead/standby pumps for the new chiller; replacement of the existing secondary pumps, CWP-3 and CWP-4, with appropriately sized lead/standby pumps for the building chilled water distribution and the 25% propylene glycol solution; upgrading automatic controls; upgrading electrical breaker at the main switchboard for new power requirements; and modifying existing piping arrangement to conform to manufacturer's written installation instructions.

This option does not allow for system redundancy but provides the school with full cooling capacity and a new 20 year life expectancy on the chilled water system.

This option will require the use of temporary chiller until replacement work is complete.

It is estimated there will be approximately $20,000.00 in rebates from the local utility for work associated with this option.

The estimated construction cost for Option 3 is $ 1,080,000.00 inclusive of engineering costs.

Recommended Option

BLW Engineers recommends Option 3 – Replace existing chiller with two chillers as the best option for the Sandwich Public Schools due to the following:

1. Full building chilled water capacity on a cooling design day;
2. Chilled water system redundancy;
3. Most stages of chilled water operation;
4. New efficient chilled water system operation;
5. Chilled water system 20 year life expectancy; and
6. No stranded investment on a short term solution.

Building Chilled Water Requirements

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Equipment Type	Areas Served	GPM	MBH Cool
Fan Coil Units	only Part A, 1st 2nd & 3rd	237.4	1309.7
	other parts not available		
RTU-1	Part A & Atrium	156	843
RTU-2	Library	41	220
RTU-3	Part C 2nd & 3rd flrs	145	787
RTU-4	Auditorium	179	966
RTU-5	Part D 2nd & 1st flrs	169	913
RTU-6	Part C Cafeteria	145	782
RTU-7	1st & 2nd flr admin, health	139	731
RTU-8	Stage	74	385
	totals:	1281.4	6936.7
	totals w/o Auditorium, Caf:	957.4	5188.7

Also RTUs, 100% OA

HVAC-1	Part A ventilation	148	790
HVAC-2	Part C ventilation	136	734
HVAC-3	Part D ventilation	99	533
	Total:	383	2057

ALL TOTAL RTUs (HVAC&RTU)	1664.4	8993.7
minus caf & Auditorium	1340.4	7245.7

	# of units	MBH Cool
#fcu1	2	22.1
#fcu2	10	156
#fcu3	46	1131.6
#fcu2r	0	0
	Total:	1309.7

Chilled Water Pumps		
		GPM
CHWP - 1&2	Primary	730
CHWP - 3&4	Secondary	730
	Total:	2920

Air Cooled Liquid Chiller:		GPM	MBH
ACLC-1&2		728	8395

Manufacturer's Piping Recommendations

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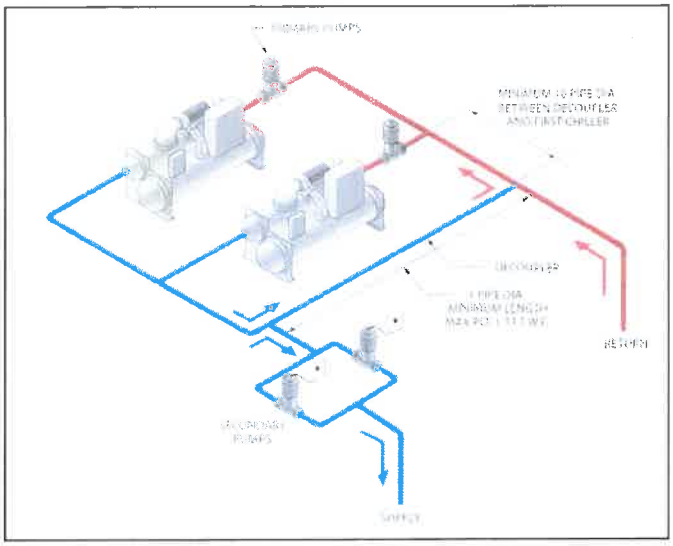
Decoupler Sizing in Primary Secondary Loops

Figure 46 - Decoupler Sizing



Decouplers should be sized for the flow rate of the largest primary pump. This may be more than the design flow rate of the largest chiller if overpumping is being considered. The pressure drop should not exceed 1.5 ft. As the pressure drop through the decoupler increases, it tends to make the primary and secondary pumps behave like they are in series.

To avoid thermal contamination, the decoupler should be at least three pipe diameters in length. Longer decouplers tend to increase the pressure drop. When the secondary return flows straight through in the tee to the primary return, there should be at least 10 pipe diameters to the first chiller. This is to help avoid the possibility of having stratification in the primary return line, which can lead to unmixed water to the first chiller. This can lead to chiller cycling.

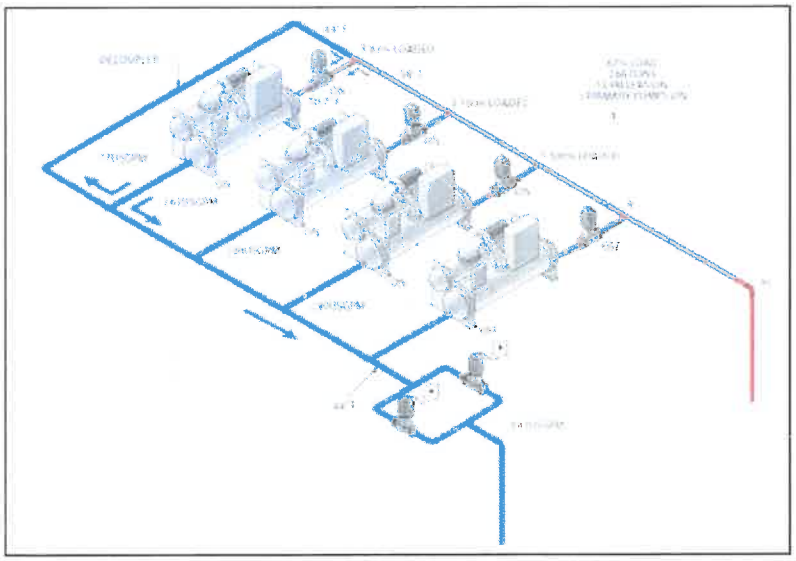
Decoupler Location

The location of the decoupler line will change how the chillers are loaded. **Figure 46** shows the typical layout with the decoupler between the chillers and the load. In this situation, each chiller sees the same return water temperature even at part load conditions.

☺ Tip: In situations where a new chiller is added to an older existing chiller plant, relocating the decoupler can take full advantage of the new chiller's part load performance. Older chiller may operate at 1 kW/ton or more at full load, worse at part load. Relocating the decoupler allows the older chillers to be base loaded (their best operating point) while the new chiller is operated at part load. Consider either a VFD or dual compressor chiller for additional savings.

Figure 47 shows the decoupler line in a different location. Locating the chillers between the secondary loop and the decoupler line causes the return water temperature to each chiller to vary. This is often referred to as "backloading" or "preferentially" loading the chillers. Chiller 2 in **Figure 47** will see close to the secondary loop return water temperature. Chiller 1 will see a mixture of supply water and return water. As a result chiller 2 is more heavily loaded than chiller 1.

Figure 47 - Backloaded Primary Loop Layout



Relocating the decoupler can make sense if one or more of the chillers is a dual compressor model or if there is a VFD on the compressor. These types of chillers have very good part load performance. By locating one of these types of chillers close to the decoupler line, and the better full load chiller furthest away, the strengths of each chiller can be maximized. Another application for backloading chillers is

Estimated Construction Costs

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BLW

BLW ENGINEERS, INC.

311 Great Road, Post Office Box 1551, Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

Construction Cost Estimate

Project phase: Schematic
Trade Specification Section: All
By: KRB **Checked By:** KRB

Project: Chilled Water System Evaluation
Sandwich High School
Sandwich, MA
Project Number: 16247.00

Sheet 1 of 1
Date 10.12.16

Description	Qty	Units	Material		Labor		Total
			Unit Cost	Total	Unit Cost	Total	
Chiller Option 1 - Repair Chiller 2							
Division 01 - General Requirements							
General Conditions	1	LS			75,000	75,000	30,000
Division 02 - Existing Conditions							
Demolition	1	LS			5,000	5,000	2,500
Division 05 - Metals							
Structural Steel	1	LS					0
Division 23 - HVAC							
Replace Compressors	2	EA	25,000	50,000	12,500	25,000	75,000
Replace Isolation Valves	4	EA	1,250	5,000	750	3,000	8,000
Replace TXV	4	EA	4,000	16,000	1,000	4,000	20,000
Recharge Refrigerant	1	LS	20,000	20,000	1,500	1,500	21,500
Modify Existing Piping Arrangement	1	LS	17,500	17,500	35,000	35,000	52,500
Automatic Temperature Controls	1	LS	2,500	2,500	5,000	5,000	7,500
Balancing	1	LS			1,500	1,500	1,500
Commissioning	1	LS			1,500	1,500	1,500
Division 26 - Electrical							
Demolition	1	LS			2,000	2,000	2,000
Mechanical Equipment Power Wiring	1	LS	1,250	1,250	2,500	2,500	3,750
Subtotal				$ 112,250		$ 161,000	$ 225,750
15% Overhead & Profit							$ 33,863
Subtotal							$ 259,613
15% Contingency							$ 38,942
Subtotal							$ 298,554
8% Engineering							$ 20,769
						TOTAL	**$ 319,323**

BLW

BLW ENGINEERS, INC.
311 Great Road, Post Office Box 1551, Littleton, Massachusesetts 01460 tel 978.486.4301 fax 978.428.0067 e-mail Info@blwengineers.com

Construction Cost Estimate

Project phase: Schematic
Trade Specification Section: All
By: KRB **Checked By:** KRB

Project: Chilled Water System Evaluation
Sandwich High School
Sandwich, MA
Project Number: 16247.00

Sheet 1 of 1
Date 10.12.16

Description	Qty	Units	Material		Labor		Total
			Unit Cost	Total	Unit Cost	Total	
Chiller Option 2 - Replace Chiller with Single Chiller							
Division 01 - General Requirements							
General Conditions	1	LS			75,000	75,000	75,000
Division 02 - Existing Conditions							
Demolition	1	LS			5,000	5,000	5,000
Division 05 - Metals							
Structural Steel	1	LS					20,000
Division 23 - HVAC							
New 550 Ton Chiller	1	EA	396,000	396,000	24,000	24,000	420,000
New Primary Pumps	2	EA	5,000	10,000	2,500	5,000	15,000
Modify Existing Piping Arrangement	1	LS	17,500	17,500	35,000	35,000	52,500
Automatic Temperature Controls	1	LS	2,500	2,500	5,000	5,000	7,500
Balancing	1	LS			1,500	1,500	1,500
Commissioning	1	LS			1,500	1,500	1,500
Division 26 - Electrical							
Demolition	1	LS			2,500	2,500	2,500
Mechanical Equipment Power Wiring	1	LS	5,000	5,000	12,500	12,500	17,500
Subtotal				$ 431,000		$ 167,000	$ 618,000
15% Overhead & Profit							$ 92,700
Subtotal							$ 710,700
15% Contingency							$ 106,605
Subtotal							$ 817,305
8% Engineering							$ 56,856
						TOTAL	**$ 874,161**

BLW

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Construction Cost Estimate

Project phase: Schematic
Trade Specification Section: All
By: KRB **Checked By:** KRB

Project: Chilled Water System Evaluation
Sandwich High School
Sandwich, MA
Project Number: 16247.00

Sheet 1 of 1
Date 10.12.16

Description	Qty	Units	Material		Labor		Total
			Unit Cost	Total	Unit Cost	Total	
Chiller Option 3 - Replace Chillers with Two Chillers							
Division 01 - General Requirements							
General Conditions	1	LS			90,000	90,000	90,000
Division 02 - Existing Conditions							
Demolition	1	LS			10,000	10,000	10,000
Division 05 - Metals							
Structural Steel	1	LS					30,000
Division 23 - HVAC							
New 320 Ton Chiller	2	EA	232,000	464,000	24,000	48,000	512,000
New Primary Pumps	2	EA	5,000	10,000	2,500	5,000	15,000
New Secondary Pumps	2	EA	5,000	10,000	2,500	5,000	15,000
Modify Existing Piping Arrangement	1	LS	17,500	17,500	35,000	35,000	52,500
Variable Speed Drives	2	EA	2,500	5,000	1,000	2,000	7,000
Automatic Temperature Controls	1	LS	2,500	2,500	5,000	5,000	7,500
Balancing	1	LS			1,500	1,500	1,500
Commissioning	1	LS			2,500	2,500	2,500
Division 26 - Electrical							
Demolition	1	LS			2,500	2,500	2,500
Mechanical Equipment Power Wiring	1	LS	5,000	5,000	12,500	12,500	17,500
Subtotal				$ 514,000		$ 219,000	$ 763,000
15% Overhead & Profit							$ 114,450
Subtotal							$ 877,450
15% Contingency							$ 131,618
Subtotal							$ 1,009,068
8% Engineering							$ 70,196
					TOTAL		**$ 1,079,264**

ASHRAE Life Expectancy

BLW ENGINEERS, INC.
311 Great Road, Post Office Box 1551, Littleton, Massachusetts 01460
CONSULTANTS
T: 978.486.4301 F: 978.428.0067

ASHRAE Equipment Life Expectancy chart

ASHRAE is the industry organization that sets the standards and guidelines for most all HVAC-R equipment
For additional info about ASHRAE the website is www.ashrae.org .

Equipment Item	Median Years
Air conditioners	
Window unit	10
Residential single or Split	
Package	15
Commercial through-the wall	15
Water-cooled package	15
Heat Pumps	
Residential air-to-air	15
Commercial air-to-air	15
Commercial water-to-air	19
Roof-top air conditioners	
Single-zone	15
Multi-zone	15
Boilers, hot water (steam)	
Steel water-tube	24 (30)
Steel fire-tube	25 (25)
Cast iron	35 (30)
Electric	15
Burners	21
Furnaces	
Gas- or oil-fired	18
Unit heaters	
Gas or electric	13
Hot water or steam	20
Radiant Heaters	
Electric	10
Hot water or steam	25

Equipment Item	Median Years
Air terminals	
Diffusers, grilles, and registers	27
Induction and fan coil units	20
VAV and double-duct boxes	20
Air washers	17
Ductwork	30
Dampers	20
Fans	
Centrifugal	25
Axial	20
Propeller	15
Ventilating roof-mounted	20
Coils	
DX, water, or steam	20
Electric	15
Heat Exchangers	
Shell-and-tube	24
Reciprocating compressors	20
Packaged chillers	
Reciprocating	20
Centrifugal	23
Absorption	23
Cooling towers	
Galvanized metal	20
Wood	20
Ceramic	34

Equipment Item	Median Years
Air-cooled condensers	20
Evaporative condensers	20
Insulation	
Molded	20
Blanket	24
Pumps	
Base-mounted	20
Pipe-mounted	10
Sump and well	10
Condensate 15	
Reciprocating engines	20
Steam turbines	30
Electric motors	18
Motor starters	17
Electric transformers	30
Controls	
Pneumatic	20
Electric	16
Electronic	15
Valve actuators	
Hydraulic	15
Pneumatic	20
Self-contained	10

Dunham, George

From: Dunham, George
Sent: Friday, October 14, 2016 11:36 AM
To: Tom Donaldson (thomas.donaldson@cabotrisk.com)
Cc: Lapp, Doug; Coggeshall, Kathy
Subject: Update on SHS Chillers

Hi Tom,

I wanted to give you an update on what transpired at the Selectmen meeting last night. I gave an overview of my understanding of where things sat with the review of the Sandwich High School chillers, Jon Nelson went through the recently received engineering report, and the engineer who did the report (Ken Beck) provided more details. The School Department is clearly leaning toward Option #2 (replacement of the 2 existing chillers with 1 new chiller) but in the discussions last night, the engineer and Jon Nelson agreed that the proposed 550 ton chiller spelled out in Option #2 should be downsized safely to a 450 ton chiller which will definitely drop the cost estimate. The engineer is going to provide us with a new estimate on this sized equipment.

Late yesterday, Jon also received an e-mail from Travellers (copied below) which outlined what they're considering – potential repair for about $230,000 or replacement for about $270,000. Am I correct in assuming that if Travellers and MIIA approve coverage for any amount, if the Town wants to do something greater, we can supplement the insurance money with Town funds, but would then have to take over public bidding, prevailing wages, etc.? For purely hypothetical purposes, if insurance coverage provides $250,000 and the Town wants to replace the current system with something that might cost $650,000, can we supplement the insurance funds with $400,000 of Town money knowing we'll be responsible for public bidding, etc.?

Lastly, and probably most importantly, rather than making a rash decision last night about scheduling a Special Town Meeting with too little information, the Selectmen are going to have a special meeting next Thursday, 10/20, at 3:00 p.m. Do you think I'll have better insurance coverage estimates by then so I can give the Board clear direction?

Thanks for all your help and advice on this. If you have any questions, please let me know.

- Bud

Here is Travellers' e-mail to Jon Nelson from yesterday:

_____FOR DISCUSSION PURPOSES ONLY – THIS IS NOT TO BE DEEMED A FINAL OR OFFICIAL CLAIM DOCUMENT_____

Jon,

As requested, here is a summary of our investigation to date:

We have a Covered Cause of Loss – Mechanical failure to 2 compressors in the Unit 2 Chiller

We have determined that the Chiller is Covered Equipment.

We are contractually responsible to pay the lessor of the cost to repair or replace, and we are diligently investigating if Unit 2 can be repaired to pre-loss condition. We have not completed that investigation.

Here are the 2 scenarios for the Property Damage coverage:

REPLACEMENT/REPAIR – PROPERTY DAMAGE

1) You have provided 4 replacement proposals for replacement of the unit. The lowest bid is $269,998. After the application of the Policy $1,000.00 deductible our net payment would appear to be $268,998.00

2) We received a repair Proposal from ENE in the amount of $229,874.00. We are assigning an engineer from Engineering Design & Testing, Tom Traubert to review the Proposal and comment on this cost to repair the unit and then apply the $1,000.00 deductible

TEMPORARY RENTAL CHILLER – EXTRA EXPENSE

We continue our review of the Extra Expenses. At the moment, we have $51,954.66 submitted and verified compensable costs of $48,899.66. The reduction is due to the need for the vendor to replace 7 cut cables, which would appear to be vandalism and not a part of this claim.

Brad Wilde, AIC | Senior Technical Specialist

Boiler and Machinery

P.O. Box 1372

Avon, CT 06001

W: 860-756-9125 F: 888-500-4349

W: 800-835-1291, Ext 69125

SHS CHILLERS REPLACEMENT – PRELIMINARY LIST OF FUNDING OPTIONS

1. The FY'17 School Department budget could be used to fund all or a portion of the cost of addressing the HVAC issues at Sandwich High School (SHS). The School could consider how much of the full replacement cost and/or temporary use of portable units could be funded, possibly in combination with other sources of funding outlined below. This would give the respective boards and staff time to determine the most appropriate course of action and how this will be funded. This decision could be made by the School Department.

2. Based on the final FY'17 estimated Cherry Sheet figures released by the Department of Revenue late last week, it appears the School Department will be receiving an additional $162,800 in Ch. 70 funding above level funding. In order to access these funds, a Town Meeting vote would be needed to increase the FY'17 School Department appropriation and the School Department would need to decide to spend the additional funds on this expense. Town Meeting action would need to be taken before the FY'17 tax rate is set in mid-November.

3. Based on the final FY'17 estimated Cherry Sheet figures released by the Department of Revenue late last week, it appears that the Town's discretionary aid will be higher than planned ($160K) and our Sending Tuition assessments will be lower than planned ($180K). The difference between these two amounts and what was voted at Town meeting is roughly $340,000. In order to appropriate these funds for the SHS Chillers, or any other purpose, a Town Meeting vote is required. Town Meeting action would need to be taken before the FY'17 tax rate is set in mid-November.

4. If Options #2 and #3 are combined, the total available funding would equal roughly $502,800. If this combination was chosen, perhaps the FY'17 School Department budget or the FY'17 Reserve Fund could make up the difference. Again, Town Meeting votes and School Department and/or Finance Committee concurrence would be needed for this combination. Town Meeting action would need to be taken before the FY'17 tax rate is set in mid-November.

5. The Town could delay making a final funding decision until our Free Cash was certified. Typically this occurs in the fall (last year = November 10). Once this certification was known, Town Meeting could vote to spend a portion of the Free Cash on the SHS Chillers. By taking this action, whatever Free Cash funding is appropriated would not be available to assist the FY'18 Budget. If Free Cash is used to fund the project, Town Meeting could vote this action any time after certification was received.

6. The Finance Committee could consider a FY'17 Reserve Fund transfer to pay all or portion of the replacement expense. The total amount available in the Reserve Fund is $500,000, but any funds used for this purpose would take away any balance for future deficits that may occur later in the fiscal year. This option, other than taking funds from the School Department FY'17 budget, is the fastest funding source and would only require the approval of the Finance Committee. Potentially, if funding was approved from the Reserve Fund, a future Town Meeting could vote to add funding to the FY'17 Reserve Fund to replenish the account. The source of funding for this replenishment would dictate when the Town Meeting action would be needed. If the source was Free Cash, Town Meeting could vote any time after certification, including at the May's Annual Town Meeting.

7. A decision could be made to delay permanent repairs or replacement until the regular FY'18 Capital Budget process is followed working toward the 2017 Annual Town Meeting next May. This option would restrict the School Department from doing any permanent repairs or solution until after Town Meeting votes in May. Based on likely HVAC needs next spring and summer, this would increase the amount needed for portable service with the more permanent repair taking place next summer ideally before school commences in September 2017.

8. The Town could decide to fund the expense through a Stabilization Fund transfer. This would require a 2/3 approval at Town Meeting. There is no time restriction on when this vote would have to take place.

9. A capital outlay expenditure exclusion could be placed before the voters to fund the full project. This action would need to be approved by 2/3 of the Board of Selectmen, a majority of Town Meeting, and the majority of voters at a Town-wide ballot question. Timing would fluctuate depending on when the Selectmen wanted to ask the voters, etc.

GHD Comment: Virtually any combination of all these options could be considered and I can think of other funding alternatives, as well. That said, the options listed here are the most realistic to consider. Obviously, no input has been provided yet by the Board of Selectmen, School Committee, or Finance Committee so whatever alternative or combination of alternatives that gets considered could change with a final determination to be made a later date. Each option listed above has its own merits and detriments which I can explain in more detail when the work is discussed. Also, if the Selectmen decide to call a Special Town Meeting this fall before the FY'17 tax rate is approved, I would expect this would be in the mid-October to mid-November timeframe.

GHD Draft - 10/17/2016

LIST OF POTENTIAL STM ARTICLES – November 14, 2016 ???

1. Capital Appropriation for Sandwich High School Chillers - $_____ (Note: Funding would include additional Ch. 70 funds from State)
2. Ambulance Fund Transfer for Equipment for (8) New Fire/EMS Personnel & (3) Replacements – $100,000
3. Sandwich Hollows Enterprise Fund Transfer – Capital Improvements (Mostly Irrigation System) – $50,000
4. CPA Project: Clark-Haddad Memorial Building Restoration
5. Establish Enterprise Fund for Sandwich Marina Effective July 1, 2017
6. Approve NRG Payment-In-Lieu-Of-Tax Agreement (If Ready...)
7.
8.

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BARNSTABLE, MASSACHUSETTS 02630

(508) 362-3828 • Fax (508) 362-3136 • www.capecodcommission.org

CAPE COD COMMISSION

HEARING NOTICE
CAPE COD COMMISSION
Canal Unit 3 (CCC Project #15016)
November 2, 2016

The Cape Cod Commission will conduct a public hearing on **Wednesday, November 2, 2016, 5:30 p.m. at the Cape Cod Commission, 3225 Main Street, Route 6A, Barnstable, MA** for the purpose of conducting Development of Regional Impact (DRI) review for the following project pursuant to Sections 12(i) and 13(b) of the *Cape Cod Commission Act* and Section 2(d) of the Commission's *Enabling Regulations Governing Review of Developments of Regional Impact*. The project is a mandatory DRI pursuant to Section 2(d)(i) of said *Enabling Regulations*, and the Secretary of the Massachusetts Executive Office of Energy and Environmental Affairs has issued a Certificate on the project's Final Environmental Impact Report under the Massachusetts Environmental Policy Act. Because the project is subject to the jurisdiction of the Commonwealth's Energy Facilities Siting Board, the project is subject to the DRI adjudicatory review process set out in Section 7(d) of the Commission's *Enabling Regulations*. This notice is being published pursuant to Section 5 of the *Cape Cod Commission Act*.

Project Name: Canal Unit 3
Project Applicant: NRG Canal 3 Development, LLC
Project Location: 9 Freezer Road, Sandwich, MA
Project Description: Proposed construction of a new, high-efficiency, fast-starting approximately 350-MW peak electric generating unit at the existing 52-acre Canal Generating Station site. The unit includes one simple-cycle combustion turbine that will be equipped with state-of-the-art emission control technologies, including selective catalytic reduction and oxidation catalyst systems, a near-zero liquid discharge design to reduce water demand, and a comprehensive set of noise attenuation measures.

Anyone wishing to testify orally will be welcome to do so. Written comments may also be submitted at the hearing, or delivered or mailed to the Cape Cod Commission, P.O. Box 226, 3225 Main Street, Barnstable, MA 02630 for receipt before the date of the hearing. Project documents may be viewed at the Cape Cod Commission office located at 3225 Main Street, Route 6A, Barnstable, MA between the hours of 8:30 a.m. and 4:30 p.m. For further information or to schedule an appointment, please contact the Commission office at (508) 362-3828. If you are deaf or hard of hearing or are a person with a disability who requires an accommodation, contact the Cape Cod Commission at (508) 362-3828 or TTY (508) 362-5885.

Caso estas informações sejam necessárias em outro idioma, por favor, contate o Coordenador de Título VI da MPO pelo telefone (508)362-3828 or TTY (508)362-5885.