



## State of Connecticut

# Capitol Area System Thermal Energy Plant Feasibility Study FINAL

**PREPARED FOR:**



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**PREPARED BY:**

**SourceOne, Inc.**

*53 State Street*

*Boston, MA 02109*

*Phone: 800.510.4485*

*[www.sourceone-energy.com](http://www.sourceone-energy.com)*

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## 1. EXECUTIVE SUMMARY

SourceOne was commissioned by AI Engineers, Inc. on behalf of the State of Connecticut (“State of CT” or “State”) to provide a thermal energy plant (TEP) feasibility study aimed at evaluating the technical and financial feasibility of the following three (3) options:

- **OPTION A:** Business as Usual - Capitol District Energy Center Cogeneration Association (CDECCA) contract extension<sup>1</sup> and/or CDECCA to build a new thermal energy plant at their own expense
- **OPTION B:** State of CT to purchase the existing CDECCA plant
- **OPTION C:** State of CT to repurpose 470 Capitol Ave to a thermal energy plant

The purpose of this feasibility study is to provide a technical and financial analysis of the above three (3) options aimed at pinpointing the best approach for owning and/or operating a TEP to serve the Capitol Area System (CAS) thermal distribution network in downtown Hartford, CT beyond the lapse of the existing CDECCA contract in March 2021. The proposed TEP would include hot water boilers, electric chillers, and pumps, all sized to match the existing load of the CAS, as well as provision for future load growth.

Specifically, the feasibility study addresses site, building, budget, schedule/timeline criteria and how they relate to the current lease agreement with CDECCA. Note that the study also encompasses a basic schematic engineering design for Option C. For Options A and B, a basic discussion of existing systems as they relate to existing and future load is provided.

A summary of the results of the study as they relate to each of the following objectives follows:

**Objective 1:** Identify and address specific site and building criteria related to technical feasibility. Identify potential fatal flaws.

**Findings:** Our opinion is that there are no fatal flaws and that Option C is technically feasible. The table below summarizes the relative thermal efficiency for each Option evaluated.

|                 | Heating Efficiency     | Cooling Efficiency <sup>2</sup> |
|-----------------|------------------------|---------------------------------|
| <b>Option A</b> | 49% (billed to State)  | 1.69 kW/ton (billed to State)   |
| <b>Option B</b> | 49% (actual by CDECCA) | 1.39 kW/ton (actual by CDECCA)  |
| <b>Option C</b> | 85% (estimated)        | 1.06 kW/ton (estimated)         |

**Table 1: Option Thermal Efficiency Comparison**

The existing CDECCA infrastructure appears to be adequately sized to serve the existing and currently anticipated future load as defined in Appendix A of this report. A condition assessment of the CDECCA plant was beyond the scope of this study.

<sup>1</sup> Capitol District Energy Center Cogeneration Association (CDECCA) is currently contracted to supply steam and chilled water from their thermal plant, located at 490 Capitol Avenue.

<sup>2</sup> For comparison purposes, includes electricity for hot water pumps and ancillary plant loads.

**Objective 2:** Evaluate the tie-in sequence of Option C to the CAS loop and prepare a milestone schedule outlining timing in regards to the existing CDECCA contract term.

**Findings:** Although Options A and B utilize existing infrastructure, they carry a significant risk due to the potential I-84 project. Option A potentially mitigates this risk, if CDECCA is willing to build a new TEP on behalf of the State of CT [unknown at this time]. Option B- purchasing the existing CDECCA plant, does not mitigate this issue since it will also likely be necessary to construct a new plant to serve the thermal load prior to construction of the I-84 project, expected sometime in 2029. At the same time, it is unclear whether CDECCA is willing to sell the plant to the State of CT upon lapse of the existing thermal supply agreement. From a tie-in and sequencing perspective, Option C mitigates the I-84 highway project risk. However, it does require a ~1 year extension to the CDECCA contract beyond the lapse of the current term (March 31, 2021).

**Objective 3:** Provide an opinion of probable cost for each option.

**Findings:** The table that follows summarizes our opinion of probable capital cost for each of the three options evaluated.

| Option                                                      | Opinion of Probable Capital Cost                                                                                                                                                                     |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A: Business As Usual</b>                                 | N/A; CapEx by CDECCA <sup>3</sup>                                                                                                                                                                    |
| <b>B: State of CT to purchase the existing CDECCA plant</b> | CDECCA plant draft appraisal <sup>4</sup> range:<br>\$5.52-\$13.34 million (by others)<br><b>plus</b><br>Cost to repair and renew infrastructure<br>(Unknown at this time, condition assessment N/A) |
| <b>C: State of CT to build a TEP at 470 Capitol Ave</b>     | \$19.86 million <sup>5</sup>                                                                                                                                                                         |

**Table 2: Opinion of Probable Capital Cost Comparison**

Based on the basic schematic design available at this time, our opinion of probable capital cost for Option C carries an inherent uncertainty with it. Note: A 10% contingency is included in the opinion of probable capital cost for this option.

As a result, we provide a sensitivity analysis of simple payback to capital cost for Option C (see Table 3). The simple payback is calculated using our opinion of capital cost for Option C and the operational cost savings between Option C and the next best alternative (Option A - Business As Usual). The range provided is intended to provide the expected simple payback of Option C: State of CT to build a TEP at 470 Capitol Avenue under a range of capital costs for risk evaluation

<sup>3</sup> Assumption provided by State of CT: The State of CT to continue paying the monthly debt service charge.

<sup>4</sup> As of the date of this report, SourceOne has received two CDECCA draft plant appraisals by Federal Appraisal LLC and Appraisal Economics prepared on behalf of the State of CT.

<sup>5</sup> For comparison, the proposals obtained as part of the Design-Build solicitation of the 410 Capitol Avenue plant in June 2017, ranged from \$23.7 to \$26.6 million.

purposes and is not meant to be reflective of the accuracy of our opinion of probable capital cost.

|                                                    |          |                                |
|----------------------------------------------------|----------|--------------------------------|
| <b>Annual Cost Savings (Option C vs Option A):</b> |          | <b>\$2,607,800<sup>6</sup></b> |
| <b>CapEx Opinion:</b>                              |          | <b>\$19,859,000</b>            |
| CapEx                                              | Change % | Simple Payback (yr)            |
| \$ 13,901,000                                      | -30%     | 5.3                            |
| \$ 16,880,000                                      | -15%     | 6.5                            |
| \$ 19,859,000                                      | 0%       | 7.6                            |
| \$ 22,838,000                                      | 15%      | 8.8                            |
| \$ 25,817,000                                      | 30%      | 9.9                            |

**Table 3: Simple payback sensitivity to Option C capital cost**

**Objective 4:** Estimate the ongoing operational costs associated with each option.

**Findings:** The table that follows summarizes the estimated operational costs (fuel, labor, repairs & maintenance) for each of the three (3) options evaluated. Debt service payments are included for Option A only. The capital cost for Options B and C cost can potentially be amortized by means of State bond financing or similar financing vehicles.

| <b>Option</b>                                        | <b>Operational Cost Estimate (\$K/year)</b> |
|------------------------------------------------------|---------------------------------------------|
| A: Business As Usual                                 | \$4,470                                     |
| B: State of CT to purchase the existing CDECCA plant | \$3,511 <sup>7</sup>                        |
| C: State of CT to build a TEP at 470 Capitol Ave     | \$1,862 <sup>8</sup>                        |

**Table 4: Estimated Operational Cost Comparison**

### Recommendation/Next Steps

The option recommended for the State of CT is Option C. The primary advantages associated with this option include:

- Reduced operational risk by roughly \$2.6 million per year
- Lower life cycle cost for this option, 7.6 year simple payback over Business As Usual- Option A
- Higher efficiency resulting in lower Green House Gas (GHG) emissions
- State of CT is thermally self-reliant

<sup>6</sup> Estimated annual cost savings of what the State of CT is paying CDECCA now vs the operating costs of a new TEP at 470 Capitol Avenue.

<sup>7</sup> Although the heating commodity cost is expected to decrease by \$309K per year, the cooling commodity cost is expected to increase significantly, on the order of \$550K, eliminating any savings. We have assumed that the O&M cost currently charged by CDECCA is to remain the same. Coupled with the fatal flaws and risks identified herein, this option is not deemed feasible.

<sup>8</sup> A capital reserve fund for infrastructure renewal and replacement is not included in the operational cost estimate as to provide a like for like comparison between options evaluated.

- Mitigates risk associated with possible demolition of CDECCA plant and State owned pump house due to the I-84 highway project

Option C will involve a ~1 year extension to the current CDECCA contract for sequencing purposes.

For recommended next steps and a milestone schedule for implementation of Option C refer to Appendix D and Section 7.5.1.

## 2. BACKGROUND

The State of Connecticut (“State of CT” or “State”) owns a thermal energy pumping and distribution piping network which runs throughout downtown Hartford. This piping network, known as the Capitol Area System (CAS), supplies State and private facilities with both hot and chilled water for conditioned air and domestic hot water heating. Capitol District Energy Center Cogeneration Association (CDECCA) is currently contracted to supply steam and chilled water from their existing TEP, located at 490 Capitol Avenue, to the state-owned pump house where two (2) heat exchangers convert steam to hot water and pumps transport hot and chilled water throughout the energy distribution network. The CDECCA thermal plant also supplies thermal energy to the nearby Capitol Avenue Complex (410-474 Capitol Ave) through a separate piping branch from the pump house. Refer to Appendix A for a distribution system schematic.

In the interest of becoming thermally self-reliant, the State has previously considered constructing a TEP which would feed the CAS Loop and Capitol Avenue Complex. In 2017, a schematic design was prepared for this proposed new TEP to be capable of delivering up to<sup>9</sup> 46 MMBTU/hr of hot water and 4,250 Tons of chilled water through its connection to the CAS Loop by way of hot water boilers and electrical chillers. The building at 410 Capitol Avenue, behind which the plant was to be located, was to be a stand-alone structure of approximately 10,000 square feet. This design was prepared by SourceOne (Owner’s Representative), Waldron Engineering (MEP Engineers), Martinez Couch associates (Geotechnical Engineers), and TranSystems (Transportation Infrastructure Consultant).

At the end of June 2019, AI Engineers, Inc. on behalf of the State of CT re-engaged SourceOne to evaluate the technical and financial feasibility of an alternate approach<sup>10</sup>, involving repurposing a building located at 470 Capitol Avenue building to a TEP, capable of delivering up to 45 MMBTU/hr of hot water and 5,400 tons of chilled water to the CAS Loop. Provisions for future load growth are to be included as well. The feasibility study addresses site, building, budget, project schedule/timeline criteria and how they relate to the current lease agreement with CDECCA as well as provides a revised executive summary, and recommendations pertaining to the following three (3) options:

### **OPTION A: BUSINESS AS USUAL**

The Connecticut Department of Transportation (CT DOT) and Federal Highway Administration (FHWA) are evaluating<sup>11</sup> the redesign of interstate highway I-84. The highway, which is presently elevated, may be brought down to grade within the coming decade. A decision on the preferred alternative is expected<sup>12</sup> in 2021 with construction beginning sometime in 2029. The projected locations for the temporary retaining wall and road for staged construction lie within the existing

<sup>9</sup> Optionality to include an additional 20 MMBTU/hr of hot water and 1,875 tons of chilled water capacity was included in the 2017 schematic design.

<sup>10</sup> It is unclear why the previously studied 410 Capitol Avenue location was not chosen for the TEP.

<sup>11</sup> <http://i84hartford.com/alternatives>

<sup>12</sup> <http://i84hartford.com/schedule>

CDECCA TEP and would likely require the removal of the State of CT owned pump house. The State of CT wants to evaluate the option of extending the contract with CDECCA (expires March 31 2021) with the expectation that they will build a new TEP at a different location if/when the I-84 highway project requires demolition of the existing plant. The State of CT expects that a new CDECCA plant would be constructed at CDECCA's expense, with no up-front capital contribution by the State of CT.

**OPTION B: STATE OF CT TO PURCHASE THE EXISTING CDECCA PLANT**

As discussed, the thermal energy supply contract between CDECCA and the State of CT is to expire at the end of March 2021. As the CAS loop is entirely dependent on CDECCA to deliver steam and chilled water to the Pump House for distribution to the CAS customers, the State of CT wants to evaluate the option of purchasing the existing power plant located at 490 Capitol Avenue from CDECCA. In this case, the existing CDECCA plant would supply steam and chilled water to the state owned pump house, or perhaps a new pumping location, where heat exchangers would convert steam to hot water and pumps deliver hot and chilled water throughout the energy distribution network. The expectation is that the State of CT would build a new TEP at a different location if/when the I-84 highway project requires demolition of the existing plant.

**OPTION C: STATE OF CT TO BUILD A TEP AT 470 CAPITOL AVENUE**

With the expiration of the thermal energy supply contract with CDECCA and the possibility of I-84 highway reconstruction, the State of CT also wants to evaluate the option of being proactive and building a TEP at 470 Capitol Avenue, which would deliver hot and chilled water to the CAS Loop and Capitol Avenue Complex, making the State of CT thermally self-reliant. The existing facility at 470 Capitol Avenue is evaluated with respect to existing conditions and all required modifications needed (thermal, electrical, and plant controls components) needed to repurpose it to a TEP. An engineering schematic design is also prepared as part of this study.

### 3. EVALUATION PROCESS

For the purpose of this study, we utilize a series of data provided by the State of CT, field observations and past deliverables submitted over the course of our on-call consulting engagement with the State of CT. A notable example includes the TEP schematic design for 410 Capitol Avenue and subsequent Request for Proposal (RFP) package prepared in 2017.

Specifically, for the evaluation of Options A and B, we utilize CDECCA monthly billing records, existing equipment inventory and historical plant performance data. SourceOne did not have access to the CDECCA plant as part of this evaluation nor did we complete a conditions assessment of existing infrastructure. Our evaluation of options centered around utilization of the existing TEP plant (Options A and B) stem from whether the capacity and configuration of existing equipment have enough capacity to serve the existing and proposed load of the district energy system. At the same time, we highlight financial and scheduling parameters that allow for a comparison with Option C.

To evaluate the feasibility of Option C, SourceOne retained Hallam-ICS as the engineer of record responsible of preparation of a basic schematic design. A structural engineer sub-consultant (MacFarland Johnson Inc) was also retained for this purpose. A walkthrough of the 470 Capitol Avenue facility was performed on August 14, 2019 by SourceOne and Hallam-ICS aimed to document current conditions and gather necessary filed data with a subsequent walkthrough by the structural engineer sub-consultant on August 23, 2019.

We evaluate each option for the following criteria:

- **Site and Building Considerations:** SourceOne did not access the CDECCA plant as part of this study and only provides a high level evaluation of site and building equipment for Options A and B as they relate to sizing and efficiency with respect to serving the existing and future thermal loads. A basic schematic design package coupled with code/permitting review is provided for Option C.
- **Tie-ins and Sequencing:** The tie-in sequence and phasing for each option in regards to the expiration of the CDECCA contract is highlighted. Specifically for Option C, we also provide milestone schedule (refer to Appendix D) and describe how the State of CT will cutover to the use of the new TEP following its construction and the termination of the CDECCA thermal supply. This study does not address the existing distribution system other than discuss tie-in of each Option.
- **Capital Costs:** For Option A (Business as Usual- CDECCA contract extension), it is assumed that there will be no capital cost contribution by the State of CT, if CDECCA is to build a new TEP to replace the existing one due to I-84 project impact/other reasons. To estimate capital costs for Option B (State of CT to purchase the CDECCA plant), the State of CT provided SourceOne with two appraisals. The appraisals are aimed at estimating the fair market value of the CDECCA plant after the expiration of the existing thermal supply contract on March 31, 2021. The appraisals do not include a conditions assessment and as a result the capital requirement to repair or renew the thermal infrastructure of the CDECCA plant remains unclear. Finally, a high level



opinion of capital cost<sup>13</sup> is provided for Option C using quotes for major equipment and industry estimates for trade disciplines. Additional information is available in Section 6.5 and Appendix E.

- **Operational Costs:** We utilize June 2018- May 2019 consumption volumes<sup>14</sup>, commodity and capacity rates<sup>15</sup> to perform a comparative analysis of annual operational costs among each option. For plant sizing, we utilize the load letter found in Appendix A as well as guidance by the state of CT on the preferred equipment for the TEP under Option C.

To define the plant efficiency under each Option evaluated, we utilize nameplate performance data for major equipment (Option C) and/or CDECCA contractually stipulated efficiency curves (Option A) or actual CDECCA performance data (Option B).

A pictorial representation of the hourly CDECCA thermal sales for the aforementioned period is provided in the figure that follows. The hourly 8760 data is extracted from monthly CDECCA billing records for steam<sup>16</sup> and chilled water billed to the State of CT.

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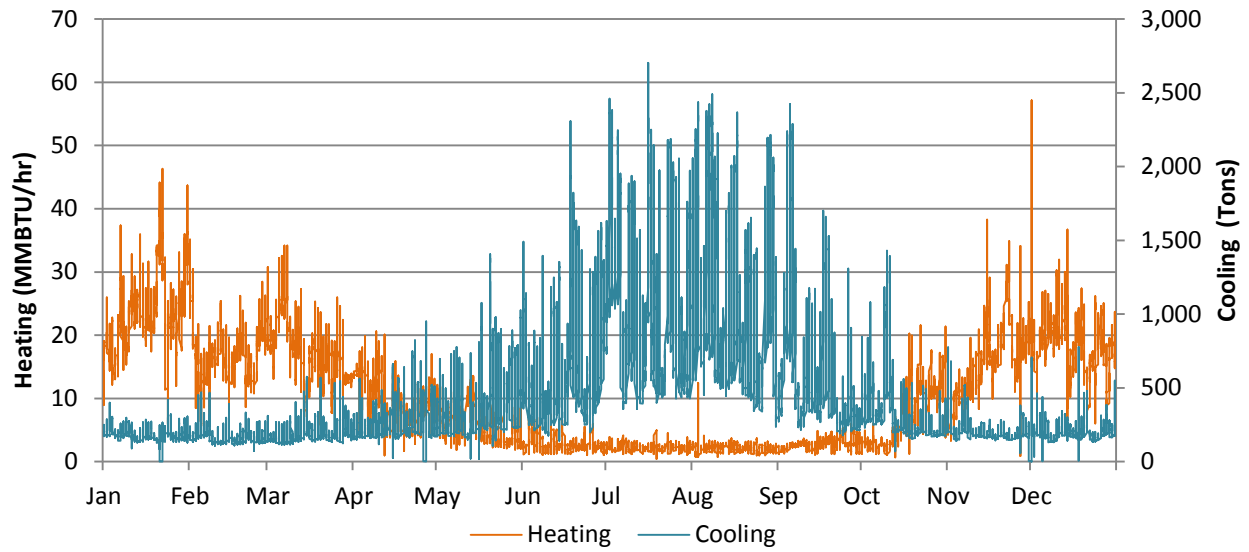
<sup>13</sup> SourceOne did not have access to the contractor proposals received as part of the 410 Capitol Ave TEP in 2017. It is recommended, as a next step, to use the cost estimates from these proposals as a means to further refine our opinion of capital cost.

<sup>14</sup> As of mid-2017, the State of CT noted that the Capitol Avenue Complex steam meter readings were incorrect. A separate steam meter was subsequently installed in the Complex, particularly for billing. A gas fired hot water heater was installed at the cafeteria of the 470 Cap Ave building in 2019 with the meter disconnected mitigating losses during the non-heating period. The load letter on which the TEP capacity analysis is based on (Appendix A) was prepared previous to the discovery of the meter issue- it is unclear when the meter issue first occurred.

<sup>15</sup> We are cognizant of the fact that consumption and rates will vary year on year driven by both weather, market forces and building performance alike but we believe that looking at one full year's worth of recent data will provide an accurate comparative analysis (despite inherent forecasting uncertainties) amongst options.

<sup>16</sup> Steam is currently utilized to generate hot water through two (2) heat exchangers.

Billed steam energy (MMBTU) by CDECCA is based on the supply enthalpy (1,197 BTU/lbs for CAS and 1,162 BTU/lbs for Capitol Avenue Complex) and no credit is provided for condensate return to the plant. As a result, the resulting load after hot water boilers are installed is expected to be lower than the steam energy billed by CDECCA. For the evaluation of Option C, we assume the hot water load will be 10% lower than the billed CDECCA steam volume (conservative).



**Figure 1: Hourly CDECCA Thermal Sales (June 2018-May 2019)**

## 4. OPTION A: BUSINESS AS USUAL

As discussed in Section 2, this Option involves extending the CDECCA contract beyond the lapse of the term of the current amendment (March 31, 2021) with the expectation that CDECCA would build a new TEP<sup>17</sup> in the event that the I-84 project requires demolition of the existing plant. The terms surrounding the contract extension and when/where/if CDECCA will build a new TEP (in response to the I-84 highway project) are unclear at the time this report is prepared.

Note: For the purposes of this analysis, we assume that similar rates to those currently charged by CDECCA would apply under this “Business As Usual” Option. As described in Section 3, we utilize June 2018- May 2019 rates & tariffs as well as thermal sales volumes for our comparative financial analysis.

### 4.1. FACILITY DESCRIPTION

The existing CDECCA facility was constructed in 1989 and is located at 490 Capitol Ave. The plant is a natural gas-fired, dual fuel capable, combined-cycle cogeneration merchant plant with a generation nameplate capacity of 62.1 MW. CDECCA provides peaking energy to the ISO New England power market as well as steam and chilled water to the Hartford Capitol district heating network, through a State of CT owned pump house.

The facility consists of a General Electric model PG 6531 (Frame 6) gas combustion turbine generator (CTG) with an in-line three (3) pressure Heat Recovery Steam Generator (HRSG) with duct-firing capabilities, a 22.5 MW Alstom condensing/extraction steam turbine generator (STG), one (1) 900-ton two-stage absorption chiller (de-rated to 350-400 tons), two (2) 1,800-ton centrifugal chillers<sup>18</sup>, one (1) 900-ton variable speed centrifugal chiller, a diesel starter engine, and two (2) package boilers to provide supplemental and backup steam to the CAS loop and Capitol Ave Complex. The facility is dual fuel capable burning natural gas and fuel oil as needed.

### 4.2. SITE EVALUATION

As part of a potential contract extension, it is assumed CDECCA would make provisions and/or renew equipment as needed to meet its contractual terms. A conditions assessment of the existing CDECCA equipment was not conducted as part of this study; note that the CDECCA plant has been operating since 1989 and will be approximately 32 years old since its original construction when the existing contract expires in March 2021.

Overall, the existing steam and chilled water installed capacity (see Section 4.3) at the CDECCA plant appears to be sufficient to address the existing and future thermal plants described in Appendix A.

<sup>17</sup> We understand that CDECCA has hired Waldron Engineering to evaluate the construction of a new TEP.

<sup>18</sup> Procurement and installation of one (1) 1,800 ton centrifugal chiller (Trane 1800T CVHF 1720) has been paid for (\$1,311,467) by the State of CT. It can be purchased from CDECCA for \$1 at the end of the existing contract term.

### 4.3. MAJOR EQUIPMENT

Existing major equipment<sup>19</sup> at the CDECCA plant is summarized below:

#### COMBUSTION TURBINE & ANCILLARY EQUIPMENT

- General Electric model PG 6531 (Frame 6) gas turbine generator-1 unit
- In-line Low NO<sub>x</sub> duct burner- 1 unit. The duct burner cannot physically operate unless the gas turbine is operating.
- Waste heat boiler/Heat Recovery Steam Generator- 1 unit with a 150,000 lbs/hr capacity.
- Alstom condensing/extraction steam turbine- 1 unit: 22.5 MW
- Diesel starter engine- 1 unit

Over the last 7 years, the electrical capacity factor<sup>20</sup> of the CDECCA plant has been in the range of 5%-20% consistent with peaker merchant plants in the region. All electricity is exported to ISO New England and used to serve plant loads (chillers, pumps, etc.). Due to the plant's low electrical capacity factor, the primary means of heating and cooling for the CAS loop and Capitol Ave Complex are supplemental and back-up boiler and chiller systems (discussed below), with heat recovery from the gas turbine only serving a small part of the thermal load.

| Year | Net Generation (MWh) | Capacity Factor (%) |
|------|----------------------|---------------------|
| 2018 | 53,254               | 10%                 |
| 2017 | 50,173               | 9%                  |
| 2016 | 106,651              | 21%                 |
| 2015 | 84,583               | 17%                 |
| 2014 | 29,564               | 6%                  |
| 2013 | 24,812               | 5%                  |
| 2012 | 24,588               | 5%                  |

**Table 5: CDECCA Plant Electrical Capacity Factor [Source: SNL Energy]**

#### BOILERS

- Cleaver brooks 27,600 lbs/hr – 1 unit. Newest dual-fuel boiler; tuned and inspected annually. Used 8 months of the year, on average.
- Zurn boiler 150,000 lbs/hr (S/N 101087) – 1 unit. 31 years old, burns natural gas only due to the fact that when unit is run on fuel oil it will not meet State of CT emissions. Has 4 repaired economizer tubes. Control parts are obsolete. The unit is oversized for the thermal CAS and Capitol Avenue Complex heating load.

<sup>19</sup> Information from Federal Appraisals LLC, CDECCA contract and publicly available sources.

<sup>20</sup> Ratio of actual net electrical energy output over a year to the maximum possible electrical energy output over the same period.

- Diesel powered boiler feed water pump- 1 unit.

Total boiler capacity: 177,600 lbs/hr saturated steam at 125 psig through two (2) boilers. The resulting installed boiler capacity is significantly higher than current peak demand of the system (35 MMBTU/hr) as well as future load (54.9 MMBTU/hr) per Appendix A. Note that because the existing boiler capacity is oversized for the load, the resulting boiler plant thermal efficiency is much lower than industry benchmarks (refer to Section 4.6.2).

#### STEAM TO HOT WATER HEAT EXCHANGERS

- Each of the two (2) shell and tube steam to hot water heat exchangers located at the 474 Capitol Ave Pump House have a 75,000 lb/hr 150psig steam capacity with a resulting 70.6 MMBTU/hr of heat transfer across to the hot water side.

Total heat exchanger capacity: 141.2 MMBTU/hr. Similarly to boiler installed capacity, the existing heat exchangers are oversized for the current peak demand of the system (35 MMBTU/hr) as well as future load (54.9 MMBTU/hr) per Appendix A.

#### CHILLERS

- Lithium Bromide Chiller – 1 unit: 900 ton steam driven chiller. Setup to run with either aux boiler #1 or #2 or off the steam turbine extraction when the gas turbine is online. The chiller is 31 years old and currently full capacity is 350 to 400 tons, de-rated from the original 900 tons.
- Centrifugal Chillers – 3 units:
  - o Unit #2 is a 900 ton Trane chiller that was installed less than a decade ago, it is VFD driven.
  - o Unit #3 is 1,800 tons and has an updated controls package. This is a Carrier chiller and parts for this unit are obsolete. The unit is dependent on reengineered parts.
  - o Unit #4<sup>21</sup> is an 1,800 ton/hr Trane chiller (Trane 1800T CVHF) installed in 2019. It has a VFD driven 4160 drive.

Total contract chiller nameplate capacity: 5,400 Tons (900 tons Absorption [de-rated to 350-400 tons] and 4500 electric centrifugal). The resulting chilled water capacity appears properly sized for the current peak demand (3,750 tons) and future peak demand (4,440 tons) per Appendix A.

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<sup>21</sup> This chiller has been paid for (\$1,311,467) by the State of CT. It can be purchased from CDECCA for \$1 at the end of the existing contract term.

#### 4.4. TIE-INS AND SEQUENCING

Under this Business As Usual option, it is expected that thermal energy will continue to be delivered by CDECCA to 474 Capitol Ave pump house for distribution to the CAS loop and Capitol Avenue Complex. Changes to the tie in location associated with a new CDECCA plant (in the event the I-84 project requires demolition of the existing plant), are unknown at this time. The same holds true for sequencing and scheduling.

#### 4.5. OPINION OF PROBABLE CAPITAL COST

The State of CT expects that if a new CDECCA plant were to be constructed it would be at CDECCA's expense, with no up-front capital contribution by the State of CT. The State of CT would continue paying the monthly debt service (see Section 4.6.1 below).

#### 4.6. ESTIMATED OPERATIONAL COSTS

A discussion of existing heating and cooling rates follow. Since the applicable rates after the expiration of the existing contract (March 31 2021) are unclear, we assume that the existing CDECCA rates are a good proxy for future rates.

Exhibit C "SERVICE RATES" of the second amendment of the steam and chilled water supply agreement outlines the billing mechanism for thermal utilities applicable to the period analyzed. For the analysis we reference the agreement as well as monthly CDECCA invoices for the period of June 2018 to May 2019 (see Section 3).

##### 4.6.1. Capacity Costs

The capacity cost component (referred to as "demand payment" in invoices) of the thermal cost reflects:

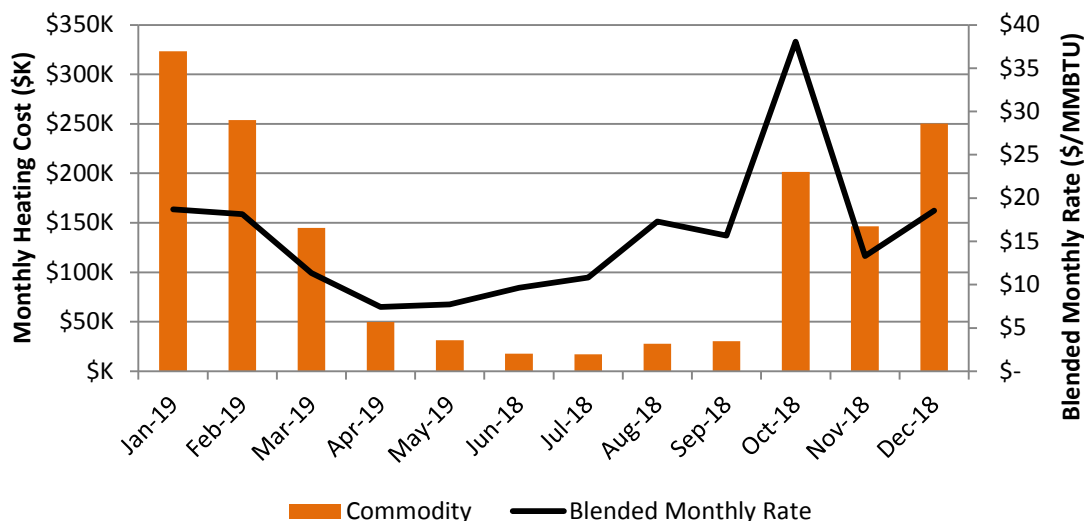
- a) cost to operate, maintain heating and cooling equipment, and;
- b) debt service

For the current term of the agreement the debt service payment is \$100K per month and the operating payment is \$110K per month (adjusted for CPI every October), for a total of approximately \$210K per month. For a full year between June 2018 and May 2019, the total capacity cost amounted to \$2.503 Million.

##### 4.6.2. Heating Commodity Costs

The CDECCA plant generates 125 psig saturated steam to fulfill the heating requirements of the district energy complex. Specifically, steam bought from CDECCA is distributed to a pump house (474 Capitol Ave) that then feeds the Capitol Avenue complex and also feeds two (2) heat exchangers to make hot water that is distributed to the Capitol Area System (CAS) buildings.

The commodity cost component of the heating cost is based on the implied fuel cost<sup>22</sup> needed to make steam at the CDECCA plant. Specifically, it is based on the hourly implied energy consumption of CDECCA boilers to serve the steam load of the district energy system and the weighted hourly commodity rate for natural gas/fuel oil used by equipment in the production of steam.



**Figure 2: Monthly CDECCA heating commodity costs**

The table that follows summarizes the CDECCA implied fuel import (natural gas and/or fuel oil) to generate the steam sold to the State of CT. It shows the calculated average boiler efficiency used by CDECCA as well as the resulting natural gas and/or fuel oil commodity cost per month to generate steam for heating. For the full year analyzed, the heating commodity cost amounts to \$1.493 million for a consumption<sup>23</sup> of 91,590 MMBTU, or \$16.31 per MMBTU.

It is noteworthy that CDECCA bills for steam on \$/MMBTU basis without providing a condensate credit to the State of CT.

<sup>22</sup> Note that the implied efficiency for boilers is based on efficiency curves and does not always represent the actual efficiency at the CDECCA plant. Accordingly, the implied natural gas/fuel oil consumption the State is billed for may deviate from what CDECCA actually procured (refer to Section 5.6 for a discussion of actual system efficiencies).

<sup>23</sup> About 21% of consumption is for the Capitol Ave complex (steam) whereas the balance (79%) is to generate hot water for the CAS complex.

| Month        | Heating Sales (MMBTU) | Implied Gas+Oil Volume (MMBTU) | Efficiency | Commodity Cost (\$) | Gas+Oil Rate (\$/MMBTU) | Heating Commodity Cost (\$/MMBTU) |
|--------------|-----------------------|--------------------------------|------------|---------------------|-------------------------|-----------------------------------|
| Jan-19       | 17,305                | 26,715                         | 65%        | \$ 323,218          | \$ 12.10                | \$ 18.68                          |
| Feb-19       | 13,988                | 25,672                         | 54%        | \$ 253,871          | \$ 9.89                 | \$ 18.15                          |
| Mar-19       | 12,767                | 23,993                         | 53%        | \$ 144,799          | \$ 6.04                 | \$ 11.34                          |
| Apr-19       | 6,700                 | 8,497                          | 79%        | \$ 49,597           | \$ 5.84                 | \$ 7.40                           |
| May-19       | 4,074                 | 5,081                          | 80%        | \$ 31,401           | \$ 6.18                 | \$ 7.71                           |
| Jun-18       | 1,837                 | 2,296                          | 80%        | \$ 17,740           | \$ 7.73                 | \$ 9.66                           |
| Jul-18       | 1,581                 | 2,285                          | 69%        | \$ 17,089           | \$ 7.48                 | \$ 10.81                          |
| Aug-18       | 1,609                 | 4,595                          | 35%        | \$ 27,802           | \$ 6.05                 | \$ 17.28                          |
| Sep-18       | 1,938                 | 4,599                          | 42%        | \$ 30,368           | \$ 6.60                 | \$ 15.67                          |
| Oct-18       | 5,291                 | 34,668                         | 15%        | \$ 201,346          | \$ 5.81                 | \$ 38.05                          |
| Nov-18       | 11,019                | 20,671                         | 53%        | \$ 146,494          | \$ 7.09                 | \$ 13.29                          |
| Dec-18       | 13,481                | 26,538                         | 51%        | \$ 250,242          | \$ 9.43                 | \$ 18.56                          |
| <b>Total</b> | <b>91,590</b>         | <b>185,610</b>                 | <b>49%</b> | <b>\$ 1,493,966</b> | <b>\$ 8.05</b>          | <b>\$ 16.31</b>                   |

**Table 6: CDECCA Monthly Heating Commodity Sales and Implied Cost Summary**

The table above was put together using hourly data from CDECCA invoices. Note that the average steam boiler efficiency for the year is very low on the order of 49%. We noted that in several hourly intervals, the calculated boiler efficiency was as low as 2-3% (for one example, refer to the October 2018 utility invoice on 10/12/2018). It appears that due to minimum boiler turndown restrictions (and oversized boilers), the CDECCA plant routinely generates more steam than what is needed to serve the State's thermal load in summer months.

#### 4.6.3. Cooling Commodity Costs

The CDECCA plant also generates chilled water to fulfill the cooling requirements of the district energy complex.

The commodity cost component of the cooling cost is based on the implied fuel (electricity) cost needed to make chilled water at the CDECCA plant. Specifically, it is based on hourly electricity consumption (based on contractually agreed upon performance curves) of CDECCA plant chillers<sup>24</sup> and balance of plant equipment needed to serve the chilled water load of the district energy system and the weighted hourly rate<sup>25</sup> for electricity used by equipment in the production of chilled water.

<sup>24</sup> Includes Chiller 4, a 1,800 ton chiller purchased by the State of CT for the sum of \$1,311,467.

<sup>25</sup> When the GT is running, the hourly Day Ahead Locational Based Marginal price for CDECCA's network node (\$/kWh) or when the GT is not running, CDECCA's estimated billed hourly electricity rate (\$/kWh) by the local utility.



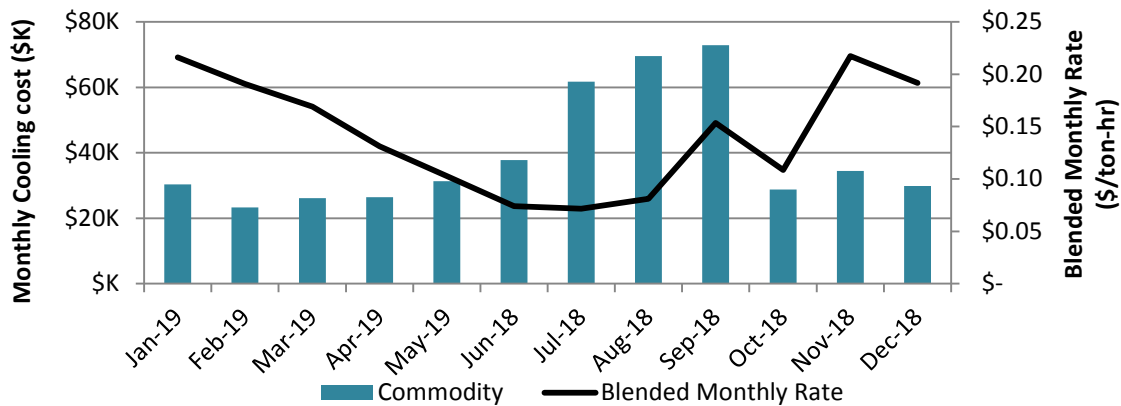


Figure 3: Monthly CDECCA cooling commodity costs

The table that follows shows the CDECCA implied<sup>26</sup> fuel (electricity) import to generate the chilled water sold to the State. It shows the calculated average chiller efficiency used by CDECCA as well as the resulting electricity commodity cost per month to generate chilled water for cooling. For the full year analyzed, the heating commodity cost amounts to \$472K million for a consumption of 4,209 kton-hrs, or \$ 0.112 per ton-hr. Note that the electricity rate charged to the State of CT is very competitive as the CDECCA plant is interconnected at the transmission level and also generates electricity. It is served by Connecticut's Light and Power's Rate 39: Large Interruptible Service rate.

| Month  | Cooling Sales (ton-hrs) | Implied Chiller Electricity (kWh) | Implied Auxiliary Electricity (kWh) | Total Implied Electricity (kWh) | Efficiency (kW/ton) | Commodity Cost (\$) | Electricity Rate (\$/kWh) | Cooling Commodity Cost (\$/ton-hr) |
|--------|-------------------------|-----------------------------------|-------------------------------------|---------------------------------|---------------------|---------------------|---------------------------|------------------------------------|
| Jan-19 | 140,330                 | 158,016                           | 239,868                             | 397,884                         | 2.84                | \$ 30,314           | \$ 0.08                   | \$ 0.216                           |
| Feb-19 | 122,117                 | 137,779                           | 218,890                             | 356,670                         | 2.92                | \$ 23,297           | \$ 0.07                   | \$ 0.191                           |
| Mar-19 | 154,404                 | 175,343                           | 242,672                             | 418,015                         | 2.71                | \$ 26,082           | \$ 0.06                   | \$ 0.169                           |
| Apr-19 | 201,140                 | 222,850                           | 241,440                             | 464,290                         | 2.31                | \$ 26,404           | \$ 0.06                   | \$ 0.131                           |
| May-19 | 304,076                 | 313,323                           | 259,396                             | 572,720                         | 1.88                | \$ 31,263           | \$ 0.05                   | \$ 0.103                           |
| Jun-18 | 511,847                 | 475,767                           | 271,207                             | 746,974                         | 1.46                | \$ 37,798           | \$ 0.05                   | \$ 0.074                           |
| Jul-18 | 861,649                 | 772,764                           | 303,046                             | 1,075,811                       | 1.25                | \$ 61,754           | \$ 0.06                   | \$ 0.072                           |
| Aug-18 | 858,924                 | 767,061                           | 286,568                             | 1,053,628                       | 1.23                | \$ 69,500           | \$ 0.07                   | \$ 0.081                           |
| Sep-18 | 475,126                 | 465,932                           | 245,719                             | 711,651                         | 1.50                | \$ 72,831           | \$ 0.10                   | \$ 0.153                           |
| Oct-18 | 265,210                 | 278,534                           | 204,774                             | 483,308                         | 1.82                | \$ 28,808           | \$ 0.06                   | \$ 0.109                           |
| Nov-18 | 158,544                 | 178,157                           | 237,370                             | 415,528                         | 2.62                | \$ 34,458           | \$ 0.08                   | \$ 0.217                           |
| Dec-18 | 155,827                 | 175,454                           | 242,626                             | 418,080                         | 2.68                | \$ 29,847           | \$ 0.07                   | \$ 0.192                           |
| Total  | 4,209,194               | 4,120,981                         | 2,993,578                           | 7,114,560                       | 1.69                | \$ 472,356          | \$ 0.07                   | \$ 0.112                           |

Table 7: CDECCA Monthly Cooling Commodity Sales and Implied Cost Summary

Table 7 was put together using hourly data from CDECCA invoices. Note that the average chilled water system efficiency<sup>27</sup> charged to the State of CT is 1.69 kW per Ton.

<sup>26</sup> Note that the implied efficiency for chillers is based on efficiency curves and do not always represent the actual efficiency at the CDECCA plant. Accordingly, the implied electricity consumption the State is billed may deviate than what CDECCA actually procured.

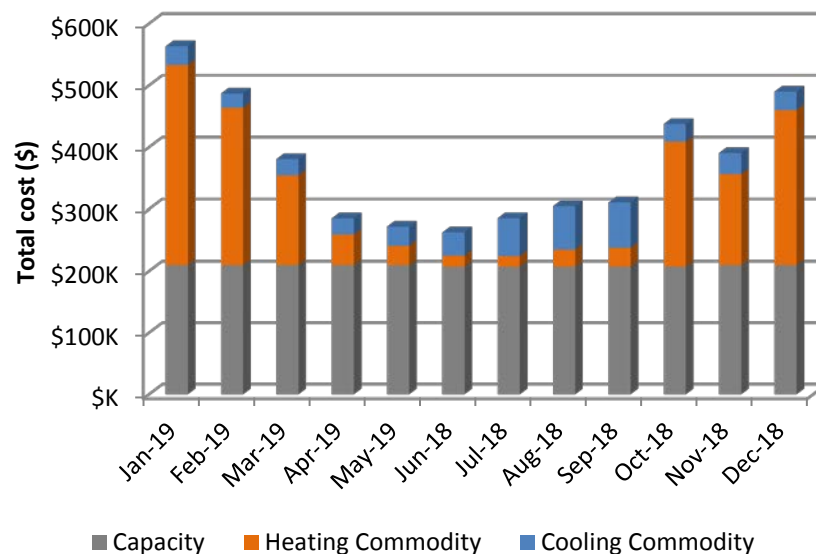
<sup>27</sup> Includes auxiliary electricity consumption for boilers.

#### 4.6.4. Thermal Costs Summary

The following table summarizes the annual thermal consumption and cost for the period between June 2018 and May 2019. The average fuel and conversion efficiency used in calculating commodity costs by CDECCA are also highlighted for comparison to equipment efficiencies and fuel rates applicable to other Options evaluated in this report. For comparison, a similar table is provided for other Options evaluated as part of this study.

| Utility           | Thermal Consumption | Annual Cost        | Blended Rate | CDECCA Avg Fuel Rate    | CDECCA Average Efficiency |
|-------------------|---------------------|--------------------|--------------|-------------------------|---------------------------|
| Heating-Commodity | 91,590 MMBTU/year   | \$1,493,966        | \$ 16.31     | \$8.05 per MMBTU NG/Oil | 49% Boilers               |
| Cooling-Commodity | 4,209 kton-hrs/year | \$472,356          | \$ 0.11      | \$0.066 per kWh         | 1.69 kW/Ton               |
| Capacity          | N/A                 | \$2,503,838        | N/A          | N/A                     | N/A                       |
| <b>Total</b>      |                     | <b>\$4,470,160</b> |              |                         |                           |

**Table 8: Annual CDECCA Thermal Cost Summary**



**Figure 4: Monthly CDECCA billed capacity and commodity cost breakdown**

## 5. OPTION B: STATE OF CT TO PURCHASE THE EXISTING CDECCA PLANT

The State of CT is interested in exploring the possibility of purchasing the existing CDECCA plant located at 490 Capitol Ave in Hartford, CT to serve the thermal energy needs of the facilities tied into the CAS loops. As of the date of this report the CDECCA plant is owned by Maxim Power Inc. which is ultimately owned by Hull Street Energy, LLC. We understand that the State of CT has not held discussions with CDECCA to determine whether they are willing to sell the plant; as a result, our evaluation seeks to determine if there is any merit in doing so prior to any discussions being held. As a separate due diligence effort, the State of CT has commissioned two appraisals of the CDECCA plant by Federal Appraisals LLC and Appraisal Economics.

### 5.1. FACILITY DESCRIPTION

Refer to Section 4.1.

### 5.2. SITE EVALUATION

A detailed site evaluation and condition assessment of the CDECCA plant is outside the scope of this study. The existing heating and cooling equipment are adequately sized to serve the current and future load of the district energy system as identified in Appendix A. As aforementioned, the boilers appear to be significantly oversized, resulting in steam venting over summer months as to be able to comply with boiler minimum turndown restrictions.

At this time, it is unclear whether CDECCA is willing to sell the plant to the State of CT. If CDECCA does not wish to do so and continues operating the plant as a merchant peaking facility to ISO-NE, this constitutes a fatal flaw for this Option.

We understand that if the State of CT were to purchase the CDECCA plant, the electrical generating equipment would either be abandoned in place or removed and sold at salvage value<sup>28</sup>. As a result of such action, it is likely that the facility's Title V air permit would no longer be necessary<sup>29</sup>. Modifications to the sequence of operations/other systems are unlikely since the CDECCA plant currently runs electrical generating equipment for only 5%-20% of the year (see Section 4.3), with the boilers and chillers primarily supporting the thermal load for most of the year. A significant electricity cost increase will likely result due to the abandonment/removal of electrical generating equipment as well as a potential change in the rate applicable to the plant (see Section 5.6.3).

Another potential fatal flaw associated with purchasing the CDECCA plant is the possibility of it and the State of CT owned pump house<sup>30</sup> having to be wholly or partially demolished as part of the I-84

<sup>28</sup> Given the age (30+ years) of most equipment and cost associated to remove them from the building it may prove to be preferable to abandon them in place.

<sup>29</sup> An emissions permitting consultant should be consulted as part of any subsequent design efforts.

<sup>30</sup> Although the CDECCA plant appears to be partially on the ROW of the I-84 highway project, the thermal distribution and the pump house it feeds appears to be entirely within the project ROW.

highway project. Both buildings are to some extent in the proposed Right of Way (ROW) of the highway project<sup>31</sup> and may need to be partially or wholly demolished before construction begins sometime in 2029 (see Figure 5). To be conservative we assume that under this option, the State of CT would own and operate the plant for ~7.5 years (from April 2021 to ~2029) and that it would also would have to provision for an alternative TEP for service beyond 2029.

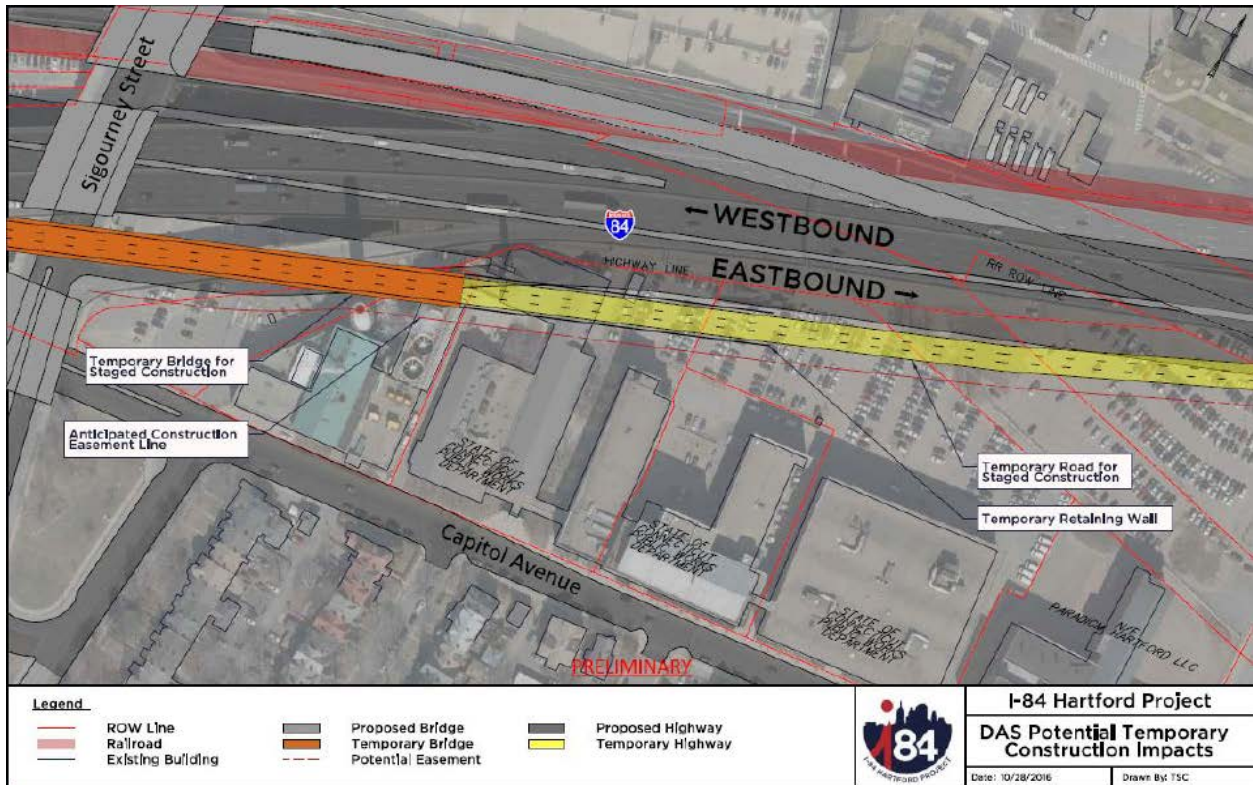


Figure 5: Potential highway construction<sup>32</sup>

Overall, this Option involves a series of potential fatal flaws and a major risk associated with the I-84 highway impact to existing infrastructure. Under a conservative approach, it only delays the need to build a new TEP.

### 5.3. MAJOR EQUIPMENT

Refer to Section 4.3.

<sup>31</sup> SourceOne did not engage in discussions with FHWA and CT DOC as part of this study. If this option is preferred by the State of CT, engaging appropriate stakeholders at the aforementioned agencies is recommended to obtain additional details around the impact to the CDECCA plant and State of CT owner pump house.

<sup>32</sup> Source: Capitol Area System Thermal Plan Project, SOC Project Number: BI-2B-414, Volume II of III: Program of Design, State of Connecticut

Per the State of CT, the combustion turbine and associated ancillary equipment would either be abandoned in place or removed for sale at salvage value.

A short timeline between a potential purchase of the CDECCA plant (March 2021) and the beginning of construction of the highway project (~2029) is expected. In ~2029 it may be necessary to demolish<sup>33</sup> all or part of the CDECCA plant, distribution piping to the State owned pump house and the pump house itself. Given the relatively short timeline (~7.5 years) available to recoup the investment in any properly sized, modern systems installed as part of plant upgrade projects, it is unlikely that it will be operationally and financially feasible to install and commission new systems for this short timeline. Also, at this time there is no guarantee that any investments made at the CDECCA plant could be recovered by the eminent domain appropriation through the I-84 highway project.

#### 5.4. TIE-INS AND SEQUENCING

Under Option B, it is expected that thermal energy will continue to be delivered to the 474 Capitol Ave pump house for distribution to the CAS loop and Capitol Avenue Complex. The major disadvantage with this option is that if the plant is purchased and then, a few years later it has to be demolished as part of the I-84 project, that would leave the State of CT with the need to build a new TEP at either the 470 Capitol Avenue location or some other yet to be defined address.

#### 5.5. OPINION OF PROBABLE CAPITAL COST

Two appraisals of the CDECCA plant have been prepared by Federal Appraisal, LLC and Appraisal Economics on behalf of the State of CT. As of the date of this report, SourceOne has received a draft of the two appraisals. In summary, there is a high uncertainty in regards to the plant fair market value with valuations ranging from \$5.52 to \$13.34 million between appraisers. The capacity factor of peaker plants and their underlying economics, are primarily driven by natural gas and electricity prices [Locational Marginal Pricing (LMP) and ISO-NE capacity market auctions] that are volatile and not easily predictable.

Although, the State of CT has a range of potential costs for the purchase of the CDECCA plant, it is unclear if and to what extent the existing thermal supply infrastructure need to be repaired or replaced. A condition assessment of existing CDECCA infrastructure is also outside the scope of this study.

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<sup>33</sup> It may also prove that demolition is needed to replace existing equipment in the CDECCA plant.

## 5.6. ESTIMATED OPERATIONAL COSTS

A discussion of estimated heating and cooling costs in the event that the State of CT were to purchase the CDECCA plant follows. We assume the existing equipment<sup>34</sup> is to remain and not replaced.

To estimate the heating and cooling commodity costs associated with this Option, we utilize actual hourly generation and efficiency data as provided in monthly CDECCA billing spreadsheets.

### 5.6.1. Capacity Costs

The capacity cost associated with purchasing the CDECCA plant would include fixed/capacity (non- consumption driven) expenses as follows:

- a) cost to operate, maintain heating and cooling equipment, and;
- b) Capital cost/debt service associated with plant purchase and potential equipment/infrastructure repairs & replacement.

To accurately estimate the first cost component related to operations & maintenance we would ideally need access to CDECCA's existing cost accounting. To be conservative, we assume that the existing operating payment to CDECCA [O&M by PureEnergy, LLC] of \$110K per month (adjusted for CPI every October), is reflective of the actual cost to operate and maintain the plant. Note that the plant generates 125 psig steam so it will require 24/7 staffing.

For the purposes of the study, we assume that the existing thermal infrastructure are still in good working condition and will not require a significant investment by the State of CT.

### 5.6.2. Heating Commodity Costs

The commodity cost component of the heating cost under Option B is based on the reported natural gas and fuel oil volumes (in MMBTU) in CDECCA monthly invoices as well as the calculated fuel cost needed to make steam at the plant. CDECCA currently charges the State of CT based on an agreed upon natural gas and fuel oil rate structure, that for natural gas is based on an estimated<sup>35</sup> natural gas commodity cost plus a variable transportation<sup>36</sup> cost.

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<sup>34</sup> As discussed there is only a short timeline between the purchase of the plant and the potential demolition due to the I-84 project (~7.5 years). SourceOne also did not have access to the CDECCA plant nor did we have access to a conditions assessment to estimate the cost to replace existing equipment with properly sized modern alternatives.

<sup>35</sup> We identified some inconsistencies between the published CNG supply rates and CDECCA supply rates and as a result we model the published CNG rates rather than use the CDECCA estimated rates.

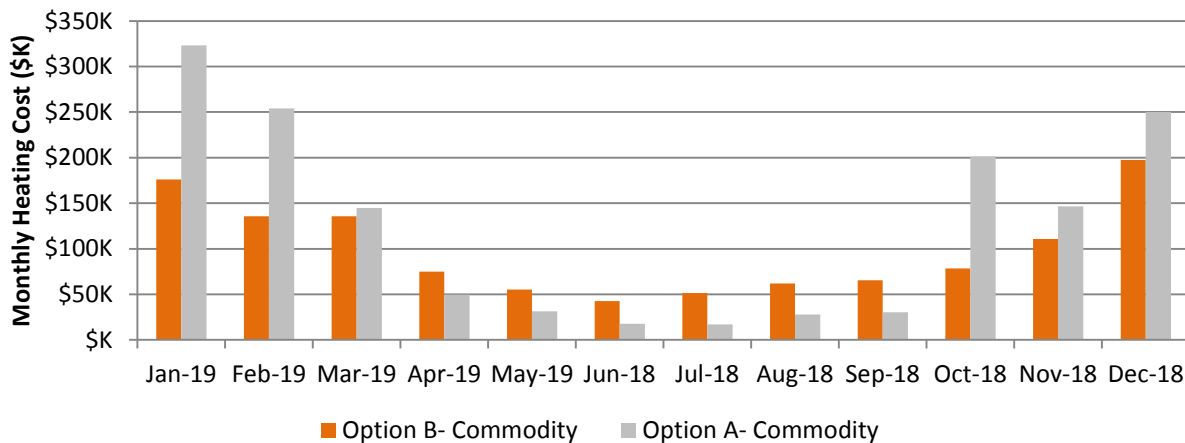
<sup>36</sup> By inspection of CDECCA utility bills, it appears that this cost is calculated using a utility bill for the new auxiliary boiler meter of the plant.



To calculate the heating commodity cost, we assume only natural gas will be used by the plant. We utilize the local utility's (Connecticut Natural Gas) applicable tariff structure for natural gas. The facility would fall into the LGS Customer rate, which is defined as a customer whose anticipated consumption is greater than 30,000 CCF per year. The individual charges for service using this rate as of May 1, 2019 are as follows:

- Customer Service Charge: \$345.00/month
- Daily Demand Meter Charge: \$19.32/month
- Sales Tax: 0.00%
- Demand Charge: \$1.1132/ccf of Billing Demand
- Delivery Charge:
  - o First 5,000 ccf \$0.0155/ccf
  - o All Over 5,000 ccf \$0.0057/ccf
- Conservation Adjustment Mechanism (CAM): \$0.0460/ccf
- DIMP Charge: \$(0.0199)/ccf of Billing Demand
- Decoupling Charge: \$0.0000/ccf
- SER Charge: \$(0.0169)/ccf of Billing Demand
- Sales Services Charge: \$0.4486/ccf of Billing Demand
- Supply Charge: Utility published data for the applicable period

The figure that follows provides a monthly comparison of the calculated heating commodity costs for Option B compared to existing CDECCA- Option A heating commodity costs for the same period. Overall, we calculate a natural gas cost of \$1.185 million for a consumption of 185,591 MMBTU, or \$6.4 per MMBTU of natural gas. The equivalent heating commodity cost charged by CDECCA was \$1.494 million or about \$309K higher. Some of the reasons for the difference may include utilization of fuel oil, contractual terms that vary from actual generation costs and/or a different natural gas third party supplier other than CNG.



**Figure 6: Monthly Option A and Option B heating commodity costs**

The table that follows presents the calculated monthly heating commodity costs to generate steam under Option B. Note that the heating load volume is based on steam without providing a condensate credit for the condensate energy returned to the CDECCA plant. To calculate the actual fuel used by CDECCA we use monthly billing records and adjusted for hour interval when the combustion turbine is operating.

| Month  | Heating Load (MMBTU) | Actual Gas+Oil Volume, exlc. Gas Turbine (MMBTU) | Efficiency | Natural Gas Commodity Cost (\$) | Gas+Oil Rate (\$/MMBTU) | Heating Commodity Cost (\$/MMBTU) |
|--------|----------------------|--------------------------------------------------|------------|---------------------------------|-------------------------|-----------------------------------|
| Jan-19 | 17,305               | 26,711                                           | 65%        | \$ 176,098.6                    | \$ 6.59                 | \$ 10.18                          |
| Feb-19 | 13,988               | 25,672                                           | 54%        | \$ 135,562.6                    | \$ 5.90                 | \$ 9.69                           |
| Mar-19 | 12,767               | 23,993                                           | 53%        | \$ 135,551.8                    | \$ 6.01                 | \$ 10.62                          |
| Apr-19 | 6,700                | 8,497                                            | 79%        | \$ 74,997.5                     | \$ 6.64                 | \$ 11.19                          |
| May-19 | 4,074                | 5,081                                            | 80%        | \$ 55,114.7                     | \$ 6.65                 | \$ 13.53                          |
| Jun-18 | 1,837                | 2,296                                            | 80%        | \$ 42,611.8                     | \$ 8.12                 | \$ 23.20                          |
| Jul-18 | 1,581                | 2,285                                            | 69%        | \$ 51,528.8                     | \$ 6.94                 | \$ 32.59                          |
| Aug-18 | 1,609                | 4,595                                            | 35%        | \$ 61,859.2                     | \$ 7.05                 | \$ 38.45                          |
| Sep-18 | 1,938                | 4,599                                            | 42%        | \$ 65,389.1                     | \$ 6.68                 | \$ 33.74                          |
| Oct-18 | 5,291                | 34,668                                           | 15%        | \$ 78,236.1                     | \$ 6.26                 | \$ 14.79                          |
| Nov-18 | 11,019               | 20,671                                           | 53%        | \$ 110,789.6                    | \$ 5.65                 | \$ 10.05                          |
| Dec-18 | 13,481               | 26,538                                           | 51%        | \$ 197,382.9                    | \$ 6.50                 | \$ 14.64                          |
| Total  | 91,590               | 185,606                                          | 49%        | \$ 1,185,123                    | \$ 6.39                 | \$ 12.94                          |

Table 9: Option B Monthly Heating Commodity Cost Summary

The figure that follows provides a pictorial representation of the monthly boiler efficiency that CDECCA uses to bill the State of CT (Option A shown in gray) and the actual CDECCA plant boiler efficiency (shown in red) applicable to Option B of this study. Although there are variations of a month to month basis, they seem to align at around 49% over the course of the year studied.

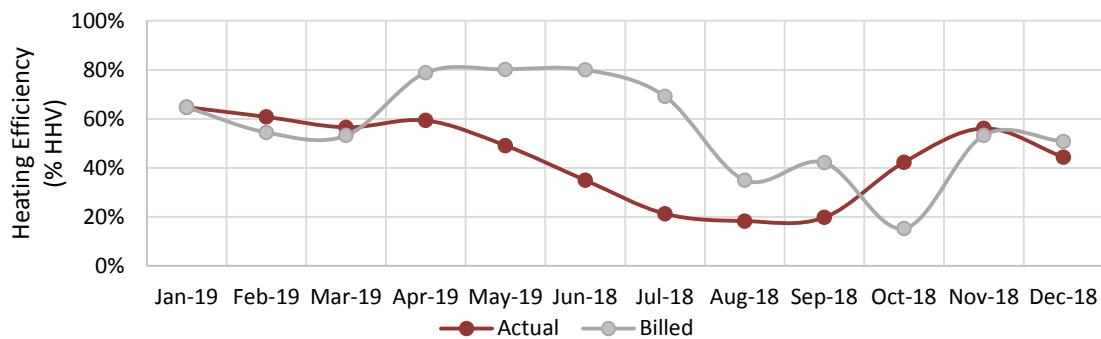


Figure 7: CDECCA billed vs actual boiler plant efficiency by month

Note that the existing boilers are oversized for the existing and future load (see Appendix A) and it appears that steam is vented during summer months as to comply with boiler minimum turndown restrictions.



### 5.6.3. Cooling Commodity Costs

The commodity cost component of the cooling cost for Option B is based on the reported electricity usage in CDECCA monthly invoices as well as the calculated electricity cost for the plant. CDECCA currently charges the State of CT based on the Locational Marginal Pricing (LPM) when the Gas Turbine is operating and an estimated local utility cost<sup>37</sup> when it is not. The existing rate for the plant is Connecticut's Light and Power's Rate 39: Large Interruptible Service. This rate is currently closed (since 2/5/1999) and not available to new customers. It provides for favorable terms compared to alternate rate structures, but requires that the plant be able to interrupt a connected load of at least 2,000 kW. Since the State of CT, plans to not utilize the Gas Turbine for electrical generation<sup>38</sup>, we assume that this power interruption would not be acceptable and that the facility would shift to the Connecticut Light & Power's Large Time-of-Day (Rate 58) tariff which applies to non-manufactures whose demand has previously equaled or exceeded 1,000 kW<sup>39</sup>. The individual charges for this rate as of July 1, 2019 are as follows:

- Customer Charge: \$2,200/month (2,000 kW-5,000 kW)
- Distribution Demand Charge: \$7.41/kVA
- System Improvement Demand Charge: \$0.23/kVA
- Sales Tax: 0.00%
- FMCC Distribution Charge:
  - Peak Hours 1.633¢/kWh
  - Off-Peak Hours 0.349¢/kWh
- Transmission Charge: \$10.07/kVA
- Combined Public Benefits Charge: 0.727¢/kWh
- Revenue Adjustment Mechanism<sup>40</sup>: 0.0¢/kWh
- Supply Charge: Utility published data<sup>41</sup>

The figure below provides a monthly comparison of the calculated electricity costs for Option B compared to existing CDECCA- Option A cooling commodity costs for the same period. Overall, we calculate an electricity cost of \$1,022K for a consumption of 5,849 MWh, or

<sup>37</sup> Estimated by CDECCA using the hourly LMP plus an assumed \$11 per MWh for other fees & charges. Electricity demand/transmission and distribution charges are added on top of the estimated supply rate.

<sup>38</sup> The plant may be able to sustain the favorable rate by installing back-up generators; a discussion with CL&P (Eversource) is recommended, if this option is of interest to the State of CT.

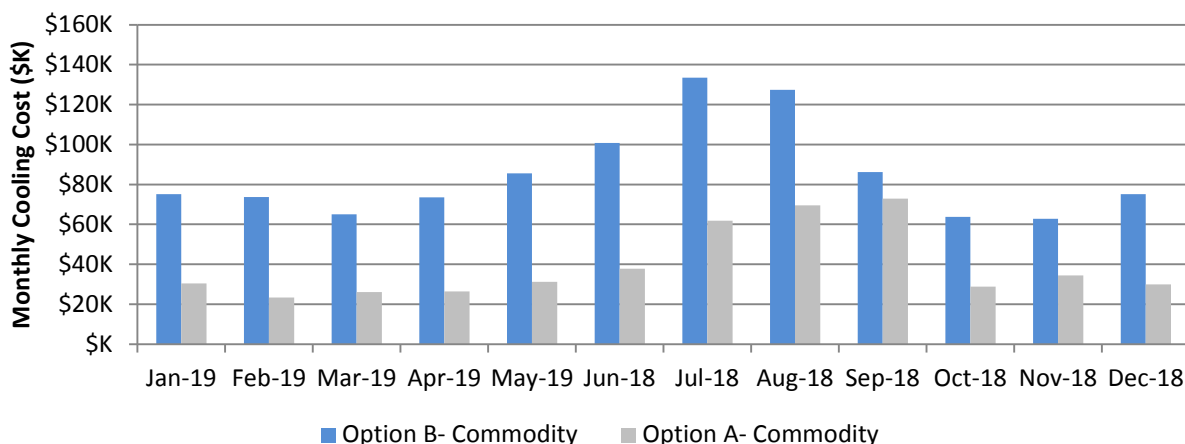
<sup>39</sup> We assume a 0.85 power factor for demand change calculations.

<sup>40</sup> The Revenue Adjustment Mechanism is assumed to be zero as the charges and credits resulting from this mechanism are expected to cancel out over the period of this study (20+ years). Individual years however may results in net positive or negative charges.

<sup>41</sup> It is likely that the State of CT, will choose to utilize the existing third party supply agreement for electricity with Direct Energy (DAS Contract 17PSX0044) instead of default utility supply. We utilize default utility supply as to be conservative.

\$0.175 per kWh (compared to \$0.066 per kWh charged by CDECCA). The equivalent cooling commodity cost charged by CDECCA was \$472K or about \$550K lower.

The primary driver for the significant (2X) electricity cost increase is the beneficial electricity rate that the CDECCA currently charges the State due to its merchant plant status. We assume that the State of CT will remove or abandon in place the gas turbine and ancillary electrical generation equipment.



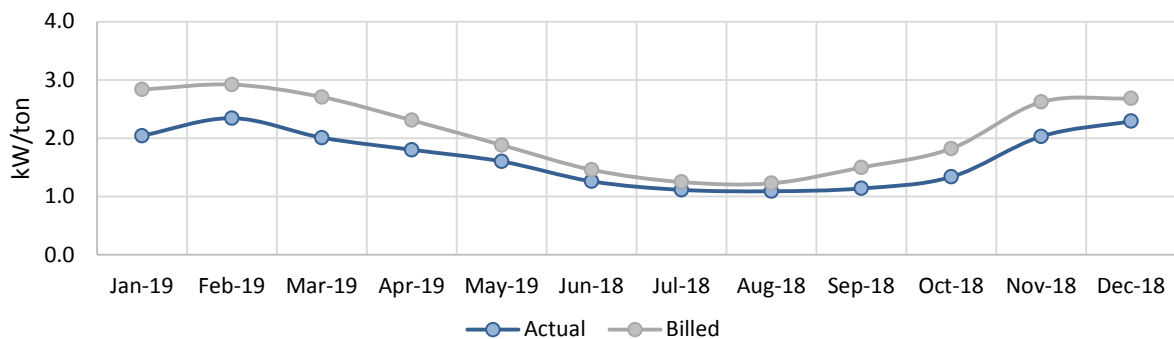
**Figure 8: Monthly Option A and Option B cooling commodity costs**

The table that follows shows the calculated monthly cooling commodity costs to generate chilled water under Option B. Note that the table includes all plant electricity consumption currently billable to the State of CT which partially includes boiler pumps; the reason for this is as to provide a similar comparison among all options evaluated.

| Month        | Cooling Consumption (ton-hrs) | Actual CDECCA Electricity Consumption (kWh) | Efficiency (kW/ton) | Commodity Cost (\$) | Electricity Rate (\$/kWh) | Cooling Commodity Cost (\$/ton-hr) |
|--------------|-------------------------------|---------------------------------------------|---------------------|---------------------|---------------------------|------------------------------------|
| Jan-19       | 140,330                       | 286,822                                     | 2.04                | \$ 75,095           | \$ 0.26                   | \$ 0.535                           |
| Feb-19       | 122,117                       | 286,257                                     | 2.34                | \$ 73,727           | \$ 0.26                   | \$ 0.604                           |
| Mar-19       | 154,404                       | 310,345                                     | 2.01                | \$ 64,949           | \$ 0.21                   | \$ 0.421                           |
| Apr-19       | 201,140                       | 362,528                                     | 1.80                | \$ 73,558           | \$ 0.20                   | \$ 0.366                           |
| May-19       | 304,076                       | 487,170                                     | 1.60                | \$ 85,531           | \$ 0.18                   | \$ 0.281                           |
| Jun-18       | 511,847                       | 645,269                                     | 1.26                | \$ 100,781          | \$ 0.16                   | \$ 0.197                           |
| Jul-18       | 861,649                       | 960,038                                     | 1.11                | \$ 133,456          | \$ 0.14                   | \$ 0.155                           |
| Aug-18       | 858,924                       | 936,554                                     | 1.09                | \$ 127,346          | \$ 0.14                   | \$ 0.148                           |
| Sep-18       | 475,126                       | 541,046                                     | 1.14                | \$ 86,214           | \$ 0.16                   | \$ 0.181                           |
| Oct-18       | 265,210                       | 354,325                                     | 1.34                | \$ 63,679           | \$ 0.18                   | \$ 0.240                           |
| Nov-18       | 158,544                       | 321,944                                     | 2.03                | \$ 62,729           | \$ 0.19                   | \$ 0.396                           |
| Dec-18       | 155,827                       | 357,108                                     | 2.29                | \$ 75,040           | \$ 0.21                   | \$ 0.482                           |
| <b>Total</b> | <b>4,209,194</b>              | <b>5,849,406</b>                            | <b>1.39</b>         | <b>\$ 1,022,105</b> | <b>\$ 0.17</b>            | <b>\$ 0.243</b>                    |

**Table 10: Option B- Monthly Cooling Commodity Cost Summary**

The figure that follows provides a pictorial representation of the monthly chiller plant efficiency (Option A) billed by CDECCA and the actual CDECCA plant efficiency applicable to Option B of this study.



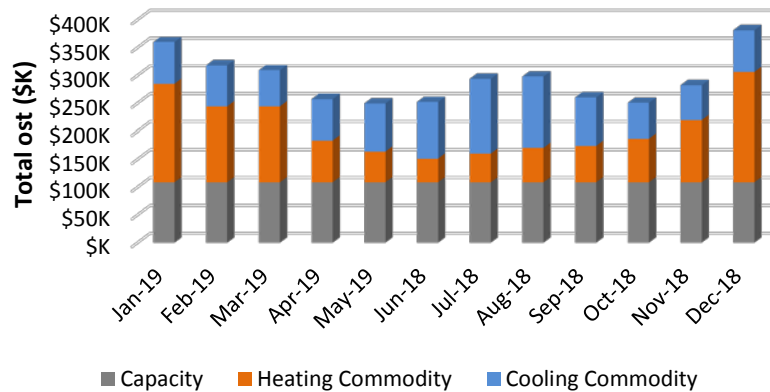
**Figure 9: CDECCA billed vs actual boiler plant efficiency by month**

#### 5.6.4. Thermal Costs Summary

The following table summarizes the annual thermal consumption and cost for the period between June 2018 and May 2019 if the State of CT were to purchase the CDECCA plant.

| Utility           | Thermal Consumption | Annual Cost        | Blended Rate | Plant Avg Fuel Rate | Average Efficiency |
|-------------------|---------------------|--------------------|--------------|---------------------|--------------------|
| Heating-Commodity | 91,590 MMBTU/year   | \$1,185,123        | \$ 12.94     | \$6.39 per MMBTU NG | 49% Boilers        |
| Cooling-Commodity | 4,209 kton-hrs/year | \$1,022,105        | \$ 0.24      | \$0.175 per kWh     | 1.39 kW/Ton        |
| Capacity          | N/A                 | \$1,303,836        | N/A          | N/A                 | N/A                |
| <b>Total</b>      |                     | <b>\$3,511,064</b> |              |                     |                    |

**Table 11: Option B- Annual Thermal Cost Summary**



**Figure 10: Option B- Monthly capacity and commodity cost breakdown**

In summary, although the heating commodity cost is expected to decrease by \$309K per year, the cooling commodity cost is expected to increase significantly in the order of \$550K eliminating any commodity savings. Coupled with the fatal flaws and risks identified earlier, this option is not deemed feasible.

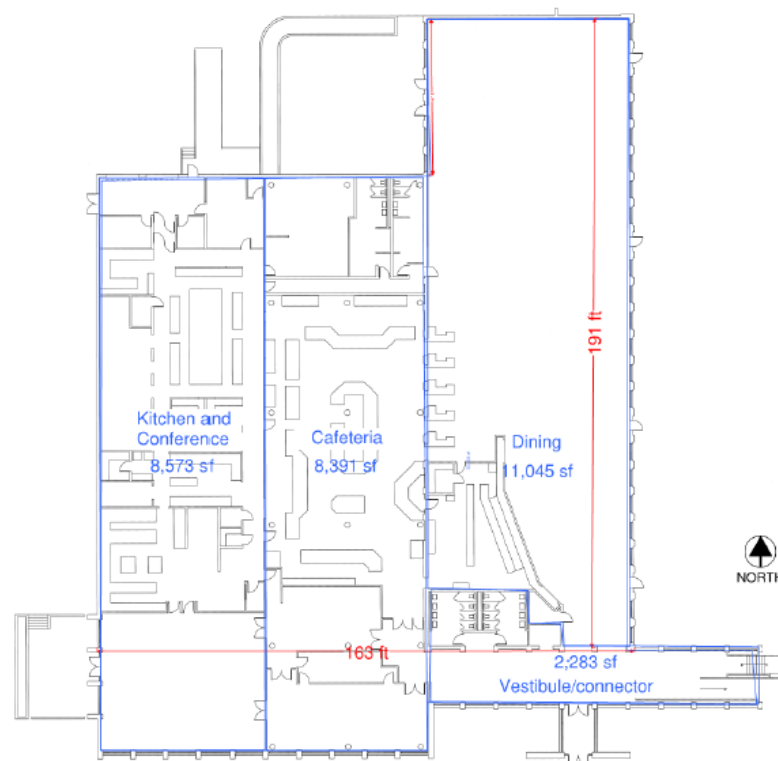
## 6. OPTION C: STATE OF CT TO BUILD A TEP AT 470 CAPITOL AVENUE

With the expiration of the thermal energy supply contract with CDECCA and the possibility of I-84 highway reconstruction, the State of CT also wants to evaluate the option of building a TEP at 470 Capitol Avenue, which would deliver hot and chilled water to the CAS Loop and Capitol Avenue Complex, making the State of CT thermally self-reliant. The existing facility is evaluated with respect to all required infrastructure modifications needed (thermal, electrical, and plant controls components) needed to repurpose it to a TEP. A basic engineering schematic design (see Appendices B and C) is also prepared as part of this study.

### 6.1. FACILITY DESCRIPTION

#### 6.1.1. Current Use of Property

The site at 470 Capitol Avenue consists of a dining area, a cafeteria and a kitchen. Each of these sections consists of forward-facing areas that include hallways and a few conference rooms. The State prefers to maintain the hallways and conference rooms as is.



**Figure 11: Floor plan of existing 470 Capitol Avenue**

The three sections at 470 Capitol Avenue as well as exterior courtyards spaces were investigated for the construction of a TEP- refer to Appendix B. The kitchen is a steel constructed building with a mechanical penthouse. Most of the air handlers in the penthouse

can be removed excluding the ones that are connected to the conference rooms. The dining section is a wood constructed building. The Cafeteria section is a low roof concrete structure that will possibly support the cooling towers.

#### 6.1.2. Proposed Use of Property

The facility at 470 Capitol Avenue, with respect to all required TEP components is accessed in the basic schematic design documents presented in Appendices B and C. In addition to the floor space of the dining area, the TEP will require the courtyard space behind the facility for the installation of two (2) new transformers. The space on the roof of the cafeteria will be needed for the installation of a bank of cooling towers.

In summary, the 470 Capitol Avenue facility allows sufficient space for the following, as requested by the State of CT:

- Three (3) 15 MMBTU Hot Water Boilers<sup>42</sup>
- Three (3) 1800 Ton Electric Chillers<sup>43</sup>
- Boiler Chemical Treatment
- Electrical Switchgear
- Control Room
- Distribution Pumps
- Basic Building services

Note: Alternate boiler/chiller capacity configurations to be determined for optimized plant performance during any subsequent design efforts.

A state owned pump house, containing chilled water and hot water pumps situated at 474 Capitol Avenue is exactly behind 470 Capitol Avenue. It should be noted that the pump house will most likely have to be demolished as part of the highway relocation project. Refer to Appendices B and C for a site overview and Figure 12 that follows.

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<sup>42</sup> Although the State of CT specified the boiler capacity & sizing, we would like to note that smaller units/ or burner modifications may be necessary to serve loads during summer months due to turndown restrictions.

<sup>43</sup> Although the State of CT specified the chiller capacity & sizing, we would like to note that smaller units may be necessary to serve loads during the winter months due to turndown restrictions.

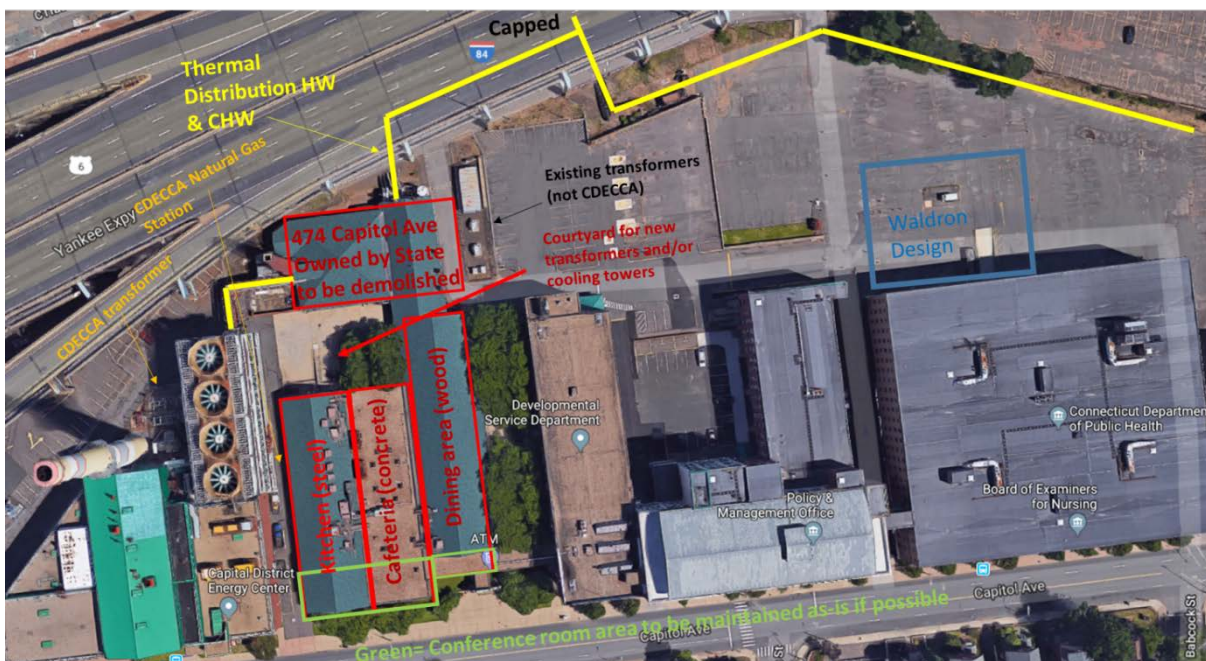


Figure 12: 470 Capitol Avenue Site Overview

## 6.2. SITE EVALUATION

Refer to Appendices B and C for the basic schematic design package inclusive of Basis of Design and drawings.

## 6.3. MAJOR EQUIPMENT

As described in Appendix B, the major equipment selection used for the purposes of this study<sup>44</sup> is as follows:

| Manufacturer/Model                               | Equipment            | Number | Total Capacity | HHV Efficiency                     |
|--------------------------------------------------|----------------------|--------|----------------|------------------------------------|
| Cleaver Brooks CBEX Elite 700-500-125HW          | 16.7 MMBTU/hr Boiler | 3      | 50.1           | 85.0%                              |
| York YKTRSK4-DEG                                 | 1875 RT Chiller      | 2      | 3750           | 0.3486 kW/ton NPLV.IP <sup>1</sup> |
| Trane 1800T CVHF 1720 (Existing at CDECCA plant) | 1800 RT Chiller      | 1      | 1800           | 0.5389 kW/ton NPLV.IP <sup>2</sup> |
| SPX NC8407SCN6                                   | Cooling Towers       | 6      | 11,250 gpm     |                                    |

<sup>1</sup> Full Load: at 0.5506 kW/Ton

<sup>2</sup> Full Load: at 0.6885 kW/Ton

Table 12: 470 Capitol Ave proposed major equipment

At the State of CT's request, we assume that one (1) existing 1,800 ton centrifugal chiller (Trane 1800T CVHF 1720) currently installed at the CDECCA plant will be relocated to the 470 Capitol Avenue TEP. This arrangement will require purchase of two (2) new chillers, instead of three (3). As

<sup>44</sup> The equipment selection used for the purposes of the study may not exactly match that requested by the State of CT, but represent a close representation.



discussed in Section 4.3 the existing 1,800 ton chiller can be purchased from CDECCA for \$1 at the end of the existing term (March 31, 2021). Given the potential reduction in chilled water capacity at the CDECCA plant, as part of the removal of the chiller, we assume rental units will be utilized during construction until the chilled is removed from the CDECCA plant, installed and start-up is completed in the new TEP.

The approximate lead time for major equipment is as follows:

- 20-24 weeks for the chillers.
- 16 weeks for the boilers and cooling towers.
- Approximately 22 weeks for transformers and switchgear.

#### 6.4. TIE-INS AND SEQUENCING

##### 6.4.1. Distribution System

Due to the potential demolition of the pump house, tie-in to the loop will be made via pipe rack to the east of the piping section that is routed under I-84. Tie-in will be conducted during a shoulder season, on a weekend and preferably at night, to minimize impact to the operation of the loop.

During the over-night shutdown, pre-fabricated tees (with both in-line and leg isolation valves) will be installed on each of the four (4) lines [two (2) supply, two (2) return] that feed the Pump House. These valves will allow for isolation of the Pump House if/when it is demolished.

Within the new TEP, after all supporting systems have been checked out, startup of the boilers and chillers will take place. Startup can take place at any season but tuning cannot take place until sufficient load exists; this would be when there is slightly more load than the full capacity of each boiler/chiller unit. The primary pumps will allow for testing of the system at low load for short durations prior to the cut-over to the loop. Following these check-outs and startup, the valves to the system shall be opened to the loop.

Once the system has been tied into the loop, during commissioning of the boilers and chillers, CDECCA shall remain in hot-standby for several weeks to ensure that backup energy supply is available. Note: the tie-in cost is included in our opinion of probable cost for this Option.

Refer to Appendices B and C for more details on the proposed tie-in to the distribution system.

We assume that the existing distribution system currently within the preliminary Right Of Way of the I-84 highway project will not be affected. If that is not the case, a pipe rack will likely be necessary. The tie in location to the pipe rack shall be the north of the new TEP.



#### 6.4.2. TEP Milestone Schedule

A milestone schedule for Option C is provided in Appendix D. In summary, we anticipate that the repurposing of the facility to a TEP will require a ~1 year extension to the CDECCA contract.

Air permitting is not explicitly called out in the milestone schedule and will need to be prepared by a permitting consultant and completed in roughly nine (9) months.

#### 6.4.3. Existing 1,800 Ton Chiller Relocation

Following the purchase of the existing 1,800 ton chiller at the CDECCA plant on or about March 31, 2021 (and subsequent demo and relocation), a rental chiller will likely be needed by CDECCA to address potential chilled water issues and maintain resiliency during construction of the new TEP. The existing chiller startup and tuning is to be provided by the manufacturer.

#### 6.4.4. Steam to Hot Water Conversion

There are four buildings in the Capitol Avenue Complex that will be fed utilities (hot water and chilled water) directly from the new TEP. In each case there are specific building modifications that must be made, outside of the scope of this study, to ensure a working utility system for this campus. A brief description of the requirements at each building is provided below.

Note: The cost and/or feasibility to convert the Capitol Avenue Complex to hot water is not addressed as part this study. This discussion was prepared as part of the previous 410 Capitol Avenue TEP schematic design and is provided herein for reference purposes.

#### 410 Capitol Avenue

- i. At present the building is fed steam and chilled water at separate locations.
- ii. The Design Build Contractor shall be responsible for decommissioning the underground storage tanks currently installed, that serve as part of an existing condenser water loop that serves various water source heat pumps inside the building. The tanks will be removed, and the loop will be closed in the existing mechanical room. According to the State, many of the largest existing heat pumps are no longer in service.
- iii. The Design Build Contractor shall provide two (2) new circulating pumps and a hot water to condenser water heat exchanger in the 410 mechanical room to maintain a functional water source loop.
- iv. During the construction period, when the steam system has been decommissioned, and the new hot water system has yet to be completed, temporary heating utilities will be required for this building. The Design Build Contractor is not responsible for providing these utilities, but is requested to carry a \$25,000 allowance for assistance with tie-ins and temporary facilities to accommodate the temporary boiler that the State will likely require.

- v. Chilled water is supplied to this building through a cross-tie from 450 Capitol Avenue. No work is required with respect to this existing piping connection.

#### 450 Capitol Avenue

- i. Utilities enter this building through a tunnel. At the north end of the tunnel there is a mechanical alcove with a steam to hot water heat exchanger, and a condensate receiver set. Chilled water lines pass through this alcove and down the tunnel, and steam and condensate piping continue down the tunnel as well.
- ii. The steam to hot water heat exchanger will be converted to a hot water to hot water heat exchanger by Others.
- iii. The scope for the Design Build Contractor is to route new hot water lines to the north end of the tunnel and provide isolation valves at that point. The Building side project will continue that hot water piping through the building as required.
- iv. The scope for the Design Build Contractor is to route new chilled water lines to a point just outside the building, where the existing chilled water lines may be intercepted.
- v. Temporary heating provisions at this transition should be readily accomplished, with proper planning, during the cooling season.

#### 460 Capitol Avenue

- i. This building is very similar to the 450 building. Hot water shall be routed to the existing mechanical room in the basement level of 460 by the Design Build Contractor. Building modifications beyond that point are by Others.
- ii. Temporary heating, as needed similar to 450 Capitol Avenue.
- iii. The existing chilled water supply to 460 Capitol Avenue will remain, and will be picked up as indicated on RFP Drawing WP1401<sup>45</sup>.

#### 470 Capitol Avenue

- i. This building is also similar to the 450 building and the 460 building in the sense that hot water piping shall be routed to the Penthouse Mechanical Room by the Design Build Contractor, but building modifications will be made by Others.
- ii. The existing chilled water piping supply and return piping will be picked up outside and thus no other chilled water modifications are required.

### 6.5. OPINION OF PROBABLE CAPITAL COST

Table 13 is a summary of the probable capital expense cost for construction of a new TEP at 470 Capitol Avenue. Refer to Appendix E for a further breakdown of procurement and construct direct

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<sup>45</sup> Refers to 410 Capitol Avenue TEP RFP Package.

costs<sup>46</sup>. Incentives<sup>47</sup> are approximated using February 2017 incentive letters as part of project BI-T-605 CAS. For comparison, the proposals obtained as part of the Design-Build solicitation of the 410 Capitol Avenue plant in June 2017, ranged from \$23.7 to \$26.6 million.

| ITEM NO. | DESCRIPTION                                                                                              | 470 Capitol Avenue   |
|----------|----------------------------------------------------------------------------------------------------------|----------------------|
|          |                                                                                                          | COST                 |
| 1        | Engineering                                                                                              | \$ 900,000           |
| 2        | Procurement                                                                                              | \$ 7,245,000         |
| 3        | Construction Directs                                                                                     | \$ 10,207,000        |
| 4        | Construction Management                                                                                  | \$ 1,125,000         |
| 5        | Commissioning, Training, Testing [2.5% of Engineering, Procurement, Construction Directs and Management] | \$ 489,000           |
| 6        | Building & Trade Permit Allowance                                                                        | \$ 190,000           |
| 7        | Utility Incentives                                                                                       | (\$ 360,000)         |
|          | <b>TOTAL</b>                                                                                             | <b>\$ 19,859,000</b> |

**Table 13: Option C Cost Opinion**

**CLARIFICATIONS:**

- 1 Pricing based on using union contractors (prevailing wages).
- 2 Costs assume free and clear access to the site.
- 3 All work to be accomplished on a "straight" time basis, any shift, weekend, or holiday work is excluded.
- 4 All special insurances and bonds are excluded.
- 5 The identification, removal, and disposal of any hazardous material is excluded.
- 6 Existing systems are of adequate pressure, volume, and size to accommodate the new work.
- 7 A building & trades permitting allowance of \$150,000 is included in the cost estimate.
- 8 State provided Air Permitting estimate of \$40,000.
- 9 No piling or deep foundations are included.
- 10 Total area of concrete pads and equipment footings is ~4300 sq ft.
- 11 Cost assumes existing soil is reusable as backfill.
- 12 Utility incentives per Eversource and CNG incentive letters from early 2017.
- 13 Excavation of major obstructions, blasting, or boulder removal not included.
- 14 Relocation or removal of any utilities not shown on drawings excluded.
- 15 Supply and installation of standby gensets, and all associated work not included.
- 16 Cost includes an allowance of \$206,700 to comply with high-performance building code requirements.
- 17 All other owner's costs, special inspections, insurances, etc. are not included.
- 18 Allowance of \$25,000 for temporary heating support included.

<sup>46</sup> We recommend that the State of CT compare the procurement and construction costs provided in Appendix E to those provided by contractors for the 410 Capitol Avenue TEP, as to further refine the opinion of probable capital cost.

<sup>47</sup> Other incentives may be available for the project other than utility rebates and shall be identified as part of additional project development.

- 19 Price assumes end user has contract for nitrogen bottles for use with HW / CHW exp. tanks.
- 20 Cost of new electrical service from utility to new plant is included.
- 21 Cost of new water, fire main, and gas service from street to plant is included.
- 22 Interconnect fees from all utilities are excluded.
- 23 10% design, procurement and construction contingency as well as 10% contraction overhead & profit included.
- 24 Any additional environmental permitting is not included other than indicated above.
- 25 All values shown in summary table rounded to the nearest \$1,000.

## 6.6. ESTIMATED OPERATIONAL COSTS

Whether the 470 Capitol Ave TEP can provide reduced thermal costs (when compared to the CDECCA contract- Option A or Option B) is based on four parameters:

- Relative capital cost
- Relative ongoing operations & maintenance cost
- Changes in rates & tariffs for natural gas and electricity
- Relative plant thermal conversion efficiencies

Note for this analysis we assume that the hot water volume to be delivered by the 470 Capitol Ave plant is reduced by 10% compared to the June 2018-May 2019 CDECCA thermal sales to the district energy system. Chilled water consumption assumed to remain as is. The reason for the assumed reduction in the new plant hot water generation requirement (when compared to the CDECCA heating sales volume) is to account for heat exchanger gains realized from not having to convert steam to hot water as well as to account for a condensate credit, not being applied in current CDECCA thermal sales calculations (see footnote 16 under Section 3).

### 6.6.1. Capacity Costs

Capacity costs for the new plant include:

- 1) **Capital cost to construct the new TEP:** Refer to section 6.5. This cost can potentially be amortized by means of State bond financing or similar financing vehicles. SourceOne was not provided with a representative amortization period and rate for this study.
- 2) **Operations & Maintenance:** Our preliminary estimate is for \$416K per year. Details follow:
  - a. \$138K fully burdened labor<sup>48</sup> rate for one senior plant operator during normal business hours. We assume remote plant monitoring. Note: No steam generation
  - b. \$75K per year allowance for on call contractor service
  - c. \$30K for boilers repairs & maintenance (estimated at \$0.3 per MMBTU)

<sup>48</sup> An inquiry to the design engineer (Hallam ICS) supporting SourceOne with this study, the State of CT and the existing CDECCA plant operator (PureEnergy, LLC) did not reveal any mandatory stationary engineer requirements for the proposed plant at 470 Capitol Ave. Further due diligence is required as part of design. If it is determined that the plant requires 24/7 staffing, the O&M cost is expected to increased significantly by another ~\$700K.

- d. \$48K for electric chiller repairs & maintenance (estimated at \$0.012 per ton-hour)
- e. \$20K for cooling tower and auxiliary repairs & maintenance (estimated at \$0.005 per ton-hour)
- f. \$16K for make-up water and sewer per year
- g. \$20K for chemicals
- h. Operating budget contingency: 20% or \$72K per year

Note: An additional ~\$596K per year may be added to the budget for a capital reserve fund for Renewal & Replacement (3% of CapEx, signifying a ~33 year asset life) depending on DAS asset depreciation requirements. The purpose of a capital reserve fund is to address plant depreciation by saving an amount each year to be used in the future for plant replacement and renewal (instead of paying for plant renewal and replacement on a lump sum basis). We do not include the capital reserve fund in the operational cost breakdown for Option C as a capital reserve fund is not included in either Options A or B.

#### 6.6.2. Heating Commodity Costs

To determine the heating (hot water) commodity costs, we used the hourly CDECCA plant send out data from June 2018-May 2019, with a 10% reduction (as explained earlier) along with the prescribed natural gas boiler efficiency called out on Table 12. To determine the natural gas cost incurred on a monthly basis we modeled CNG's Large Gas Service (LGS) service rate (with Default Utility Supply) for the same period.

| Month        | Hot Water Consumption<br>Incl. 10% reduction<br>(MMBTU) | Natural Gas Import<br>(MMBTU HHV) | Efficiency<br>(%) | Utility Cost<br>(\$) | Natural Gas Blended Rate<br>(\$/MMBTU HHV) | Heating Commodity Cost<br>(\$/MMBTU) |
|--------------|---------------------------------------------------------|-----------------------------------|-------------------|----------------------|--------------------------------------------|--------------------------------------|
| Jan          | 15,575                                                  | 18,323                            | 85.0%             | \$ 121,834           | \$ 6.65                                    | \$ 7.82                              |
| Feb          | 12,589                                                  | 14,811                            | 85.0%             | \$ 89,227            | \$ 6.02                                    | \$ 7.09                              |
| Mar          | 11,490                                                  | 13,518                            | 85.0%             | \$ 84,048            | \$ 6.22                                    | \$ 7.31                              |
| Apr          | 6,030                                                   | 7,094                             | 85.0%             | \$ 49,375            | \$ 6.96                                    | \$ 8.19                              |
| May          | 3,667                                                   | 4,314                             | 85.0%             | \$ 33,191            | \$ 7.69                                    | \$ 9.05                              |
| Jun          | 1,653                                                   | 1,945                             | 85.0%             | \$ 23,461            | \$ 12.06                                   | \$ 14.19                             |
| Jul          | 1,423                                                   | 1,674                             | 85.0%             | \$ 22,345            | \$ 13.35                                   | \$ 15.70                             |
| Aug          | 1,448                                                   | 1,704                             | 85.0%             | \$ 23,390            | \$ 13.73                                   | \$ 16.15                             |
| Sep          | 1,744                                                   | 2,052                             | 85.0%             | \$ 24,749            | \$ 12.06                                   | \$ 14.19                             |
| Oct          | 4,762                                                   | 5,602                             | 85.0%             | \$ 41,097            | \$ 7.34                                    | \$ 8.63                              |
| Nov          | 9,917                                                   | 11,667                            | 85.0%             | \$ 68,831            | \$ 5.90                                    | \$ 6.94                              |
| Dec          | 12,133                                                  | 14,274                            | 85.0%             | \$ 98,333            | \$ 6.89                                    | \$ 8.10                              |
| <b>Total</b> | <b>82,431</b>                                           | <b>96,978</b>                     | <b>85.0%</b>      | <b>\$ 679,882</b>    | <b>\$ 7.01</b>                             | <b>\$ 8.25</b>                       |

**Table 14: Heating Cost Commodity Summary**

Note that electricity for boiler pumps is included in the chilled water commodity cost in line with the analysis for Option A and B. The capacity cost for this Option includes make-up water, chemicals and other non-fuel related Balance of Plant (BOP) expenses.

### 6.6.3. Cooling Commodity Costs [Incl. BOP electricity]

Similarly, to determine the cooling (chilled water) commodity costs, we used the hourly CDECCA plant send out data from June 2018-May 2019 and the prescribed electric chiller efficiencies for the new plant.

The table below summarizes the part load performance of each of the chillers shown on Table 12.

| Part Load      | 1875 Ton (New) | 1800 Ton (Existing <sup>49</sup> ) |
|----------------|----------------|------------------------------------|
| 100%           | 0.5506         | 0.6885                             |
| 75%            | 0.4068         | 0.5508                             |
| 50%            | 0.3011         | 0.5051                             |
| 25%            | 0.3710         | 0.6395                             |
| <b>NPLV.IP</b> | <b>0.3486</b>  | <b>0.5389</b>                      |

Table 15: Electric Chiller Part Load Performance (kW/TonR)

The figure below presents the chiller plant performance specified under Volume II of the Program of Design of SOC Project NO BI-2B-414.

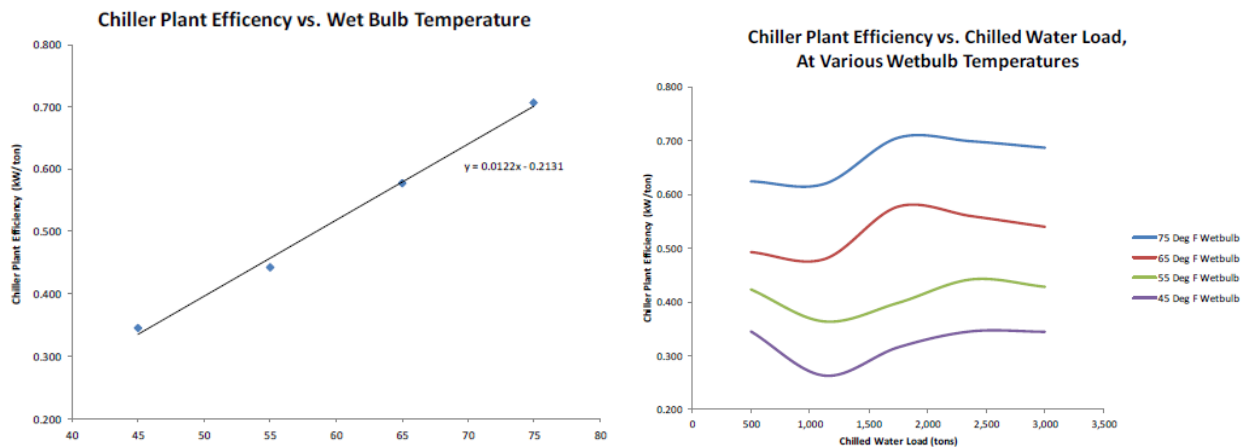


Figure 13: Chiller plant performance<sup>50</sup>

We assume that the balance of plant/auxiliary equipment efficiency results in a chiller plant efficiency of 0.75 kW per Ton of cooling year-round. It is also assumed that the new chillers

<sup>49</sup> The existing 1,800 ton chiller at the CDECCA plant that can be purchased for \$1.00 by the State of CT. Performance data was extracted from a TRANE test target report dated 12/18/2018.

<sup>50</sup> Source: Capitol Area System Thermal Plan Project, SOC Project Number: BI-2B-414, Volume II of III: Program of Design, State of Connecticut

have dispatch priority over the older existing chiller. We have included 150 kW of 24/7 load for boiler pumps and general plant loads in our analysis.

To determine the electricity cost incurred on a monthly basis we modeled Eversource's Rate 58 service rate (with Default Utility Supply<sup>51</sup>) for the same period. A 0.85 power factor is assumed for demand charges. Make-up water is included in the capacity cost to provide a similar comparison to CDECCA rates which only included electricity in chilled water commodity costs.

| Month        | CHW Consumption<br>(Ton-hrs) | Electricity Import<br>(kWh) | Peak Demand<br>(kW) | Efficiency<br>(kW/Ton) | Utility Cost<br>(\$) | Electricity Blended Rate<br>(\$/kWh) | Cooling Commodity Cost<br>(\$/ton-hr) |
|--------------|------------------------------|-----------------------------|---------------------|------------------------|----------------------|--------------------------------------|---------------------------------------|
| Jan          | 140,330                      | 216,306                     | 464                 | 1.54                   | \$ 39,085            | \$ 0.279                             | \$ 0.279                              |
| Feb          | 122,117                      | 192,339                     | 502                 | 1.58                   | \$ 35,473            | \$ 0.290                             | \$ 0.290                              |
| Mar          | 154,404                      | 227,298                     | 582                 | 1.47                   | \$ 36,240            | \$ 0.235                             | \$ 0.235                              |
| Apr          | 201,140                      | 257,695                     | 863                 | 1.28                   | \$ 45,062            | \$ 0.224                             | \$ 0.224                              |
| May          | 304,076                      | 339,138                     | 1,204               | 1.12                   | \$ 59,288            | \$ 0.195                             | \$ 0.195                              |
| Jun          | 511,847                      | 491,631                     | 1,881               | 0.96                   | \$ 89,411            | \$ 0.175                             | \$ 0.175                              |
| Jul          | 861,649                      | 757,983                     | 2,177               | 0.88                   | \$ 125,828           | \$ 0.146                             | \$ 0.146                              |
| Aug          | 858,924                      | 755,859                     | 2,017               | 0.88                   | \$ 121,940           | \$ 0.142                             | \$ 0.142                              |
| Sep          | 475,126                      | 464,325                     | 1,967               | 0.98                   | \$ 85,053            | \$ 0.179                             | \$ 0.179                              |
| Oct          | 265,210                      | 310,567                     | 1,223               | 1.17                   | \$ 54,164            | \$ 0.204                             | \$ 0.204                              |
| Nov          | 158,544                      | 226,712                     | 731                 | 1.43                   | \$ 35,829            | \$ 0.226                             | \$ 0.226                              |
| Dec          | 155,827                      | 227,027                     | 733                 | 1.46                   | \$ 39,066            | \$ 0.251                             | \$ 0.251                              |
| <b>Total</b> | <b>4,209,194</b>             | <b>4,466,877</b>            | <b>2,177</b>        | <b>1.06</b>            | <b>766,436</b>       | <b>\$ 0.191</b>                      | <b>\$ 0.182</b>                       |

**Table 16: Cooling Cost Commodity Summary**

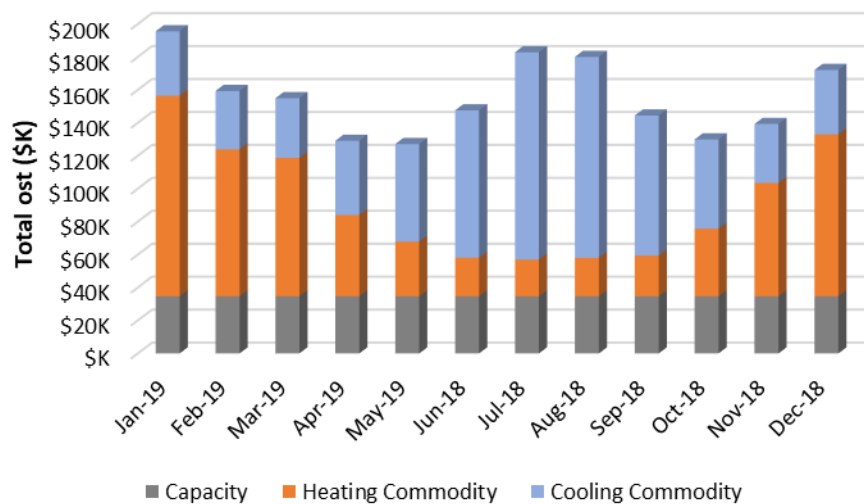
#### 6.6.4. Thermal Costs Summary

The following table summarizes the projected annual thermal consumption and cost for the period between June 2018 and May 2019 for Option C.

| Utility           | Thermal Consumption | Annual Cost        | Blended Rate | Plant Avg Fuel Rate | Average Efficiency |
|-------------------|---------------------|--------------------|--------------|---------------------|--------------------|
| Heating-Commodity | 82,431 MMBTU/year   | \$679,882          | \$ 8.248     | \$7.01 per MMBTU NG | 85% Boilers        |
| Cooling-Commodity | 4,209 kton-hrs/year | \$766,436          | \$ 0.182     | \$0.191 per kWh     | 1.06 kW/Ton        |
| Capacity          | N/A                 | \$ 416,000         | N/A          | N/A                 | N/A                |
| <b>Total</b>      |                     | <b>\$1,862,318</b> |              |                     |                    |

**Table 17: Annual 470 Cap Ave Projected Thermal Cost Summary**

<sup>51</sup> It is likely that the State of CT, will choose to utilize the existing third party supply agreement for electricity with Direct Energy (DAS Contract 17PSX0044) instead of default utility supply. We utilize default utility supply in order to be conservative.



**Figure 14: Monthly 470 Cap Ave plant capacity and commodity cost breakdown**



## 7. OPTIONS COMPARISON: COST BENEFIT ANALYSIS

A summary discussion of the advantages and disadvantages of each of the three (3) Options evaluated as part of this study follows.

### 7.1. SITE AND BUILDING CONSIDERATIONS

Purchasing new equipment for the CDECCA power plant under Option B would not be a concern in the instance of acquiring an existing power plant. The State of CT would have a good idea of operational procedures and historical thermal production of the equipment at the TEP. For this option, it is critical to conduct adequate due diligence which should include a conditions assessment (not part of this study). Decommissioning requirements were not evaluated as part of this study. However, in general, electrical decommissioning consists of de-energization and isolation of equipment.

At the same time, since some of the equipment is likely at the end of its usable life (applicable to Options A and B), there is a stronger probability that many of the parts will have to be replaced in order to prolong the life of the existing plant. These capital costs are not included in the normal O&M budget for the equipment, but are additional costs that must be budgeted for on an annual basis. There is also a higher probability and frequency of equipment failures. These failures can result in forced outages and a reduction in equipment reliability and run-time.

For Option C, our basic schematic design did not identify any fatal flaws. We believe that repurposing 470 Capitol Avenue into a TEP is technically feasible. Refer to Appendices B and C for further details.

### 7.2. TIE-INS AND SEQUENCING

With either Option A or B, the State will not need to consider purchasing, renewing or constructing a building to house the TEP (subject to condition assessment). There would be no construction or transportation expenses. The startup time for thermal generation would reduce severely as the protocols and procedures are already in place and the Staff members are previously trained. Many of the tasks would already be completed by the previous plant owner. Modifications to procedures would very likely not be required should the power generation equipment be decommissioned. The existing boilers and chillers operate exclusive of this equipment for the majority of the time.

Although Options A and B utilize existing infrastructure, they also carry a significant risk due to the potential I-84 project. Option A potentially mitigates this risk, if CDECCA is willing to build a new TEP on behalf of the State of CT [unknown at this time]. Option B- purchasing the existing CDECCA plant does not mitigate this issue since it will also likely be necessary to construct a new plant to serve the thermal load prior to construction of the I-84 project, expected sometime in 2029. From a tie-in and sequencing perspective, Option C mitigates the I-84 highway project risk. However, it does require a ~ 1 year extension to the CDECCA contract beyond the lapse of the current term (March 31, 2021).

### 7.3. CAPITAL COSTS

The capital cost to the State of CT for Option A is assumed to be zero (State of CT to keep paying CDECCA the ongoing debt service charge). However, given the aged infrastructure and a potential new plant being constructed, it is unclear whether a capital cost contribution would be required by the State of CT above and beyond the debt service charge paid now.

For Option B, the two appraisals commissioned by the State of Ct reveal that there is a high uncertainty in regards to the plant fair market value with valuations ranging from \$5.52 to \$13.34 million between appraisers. At the same time it is unclear if and to what extent the existing thermal supply infrastructure need to be repaired or replaced.

Finally, based on the basic schematic design available at this time, our opinion of probable capital cost for Option C carries a certain uncertainty with it. As a result, we provide a sensitivity analysis of simple payback to capital cost for Option C. The simple payback is calculated using our opinion of capital cost for Option C and the operational cost savings between Option C and the next best alternative (Option A - Business As Usual).

|                                                    |          |                                 |
|----------------------------------------------------|----------|---------------------------------|
| <b>Annual Cost Savings (Option C vs Option A):</b> |          | <b>\$2,607,000<sup>52</sup></b> |
| <b>CapEx Opinion:</b>                              |          | <b>\$19,859,000</b>             |
| CapEx                                              | Change % | Simple Payback (yr)             |
| \$ 13,901,000                                      | -30%     | 5.3                             |
| \$ 16,880,000                                      | -15%     | 6.5                             |
| \$ 19,859,000                                      | 0%       | 7.6                             |
| \$ 22,838,000                                      | 15%      | 8.8                             |
| \$ 25,817,000                                      | 30%      | 9.9                             |

**Table 18: Simple payback sensitivity to Option C capital cost**

### 7.4. OPERATIONAL COSTS

The CDECCA plant has significantly more electrical and thermal equipment capacities, compared to the actual needs of the State, in terms of the CAS loop facilities. Even if the State does not utilize this capacity, they will have to maintain all of the equipment in the facility and staff the plant accordingly. As a result, the O&M costs associated with options involving the CDECCA plant (A & B) are significantly more than that associated with the proposed new central energy plant (Option C). The actual thermal production efficiency (heating and cooling) will be significantly lower than equivalently sized new equipment, unless major equipment upgrades and retrofits have taken place.

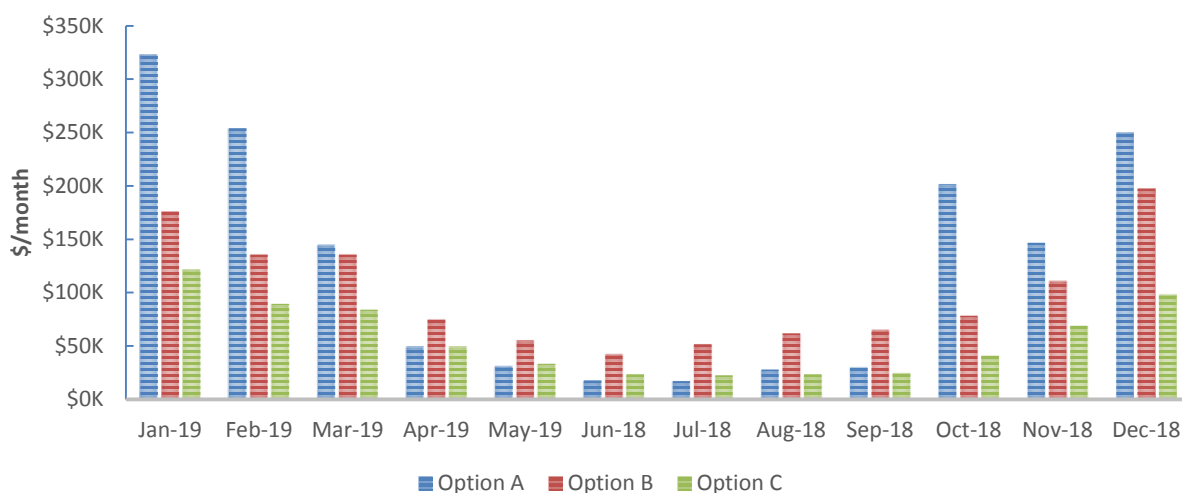
<sup>52</sup> Estimated annual cost savings of what the State of CT is paying CDECCA now vs the operating costs of a new TEP at 470 Capitol Avenue.

These inefficiencies will manifest themselves in the shape of higher fuel and electricity charges, with some exceptions such as the favorable utility electricity rate currently in place at the CDECCA plant. The table that follows provides a comparison of the heating and cooling plant efficiency among the options evaluated.

|                 | Heating Efficiency     | Cooling Efficiency <sup>53</sup> |
|-----------------|------------------------|----------------------------------|
| <b>Option A</b> | 49% (billed to State)  | 1.69 kW/ton (billed to State)    |
| <b>Option B</b> | 49% (actual by CDECCA) | 1.39 kW/ton (actual by CDECCA)   |
| <b>Option C</b> | 85% (estimated)        | 1.06 kW/ton (estimated)          |

**Table 19: Option Thermal Efficiency Comparison**

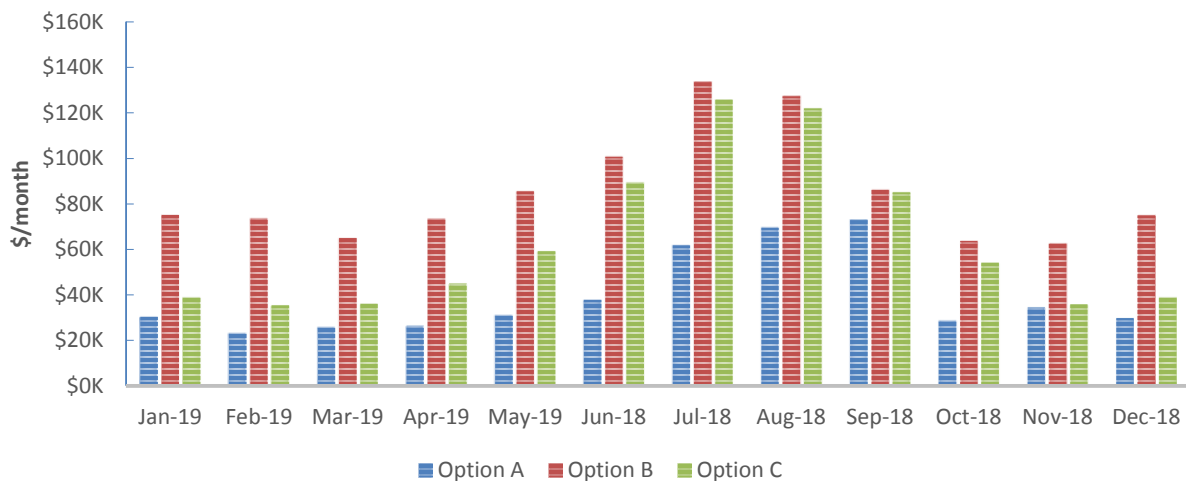
Figure 15 and Figure 16 that follow provide a comparison of heating commodity and cooling commodity costs among each of the three options on a monthly basis.



**Figure 15: Heating commodity cost comparison**

Note that the commodity cost for heating is reduced by about 45% per year between Option C and Option A, due to drastic improvements in efficiency (85% efficiency vs a billed efficiency from CDECCA of 49%) as well as a somewhat reduced natural gas rate.

<sup>53</sup> For comparison purposes, includes electricity for hot water pumps and ancillary plant loads

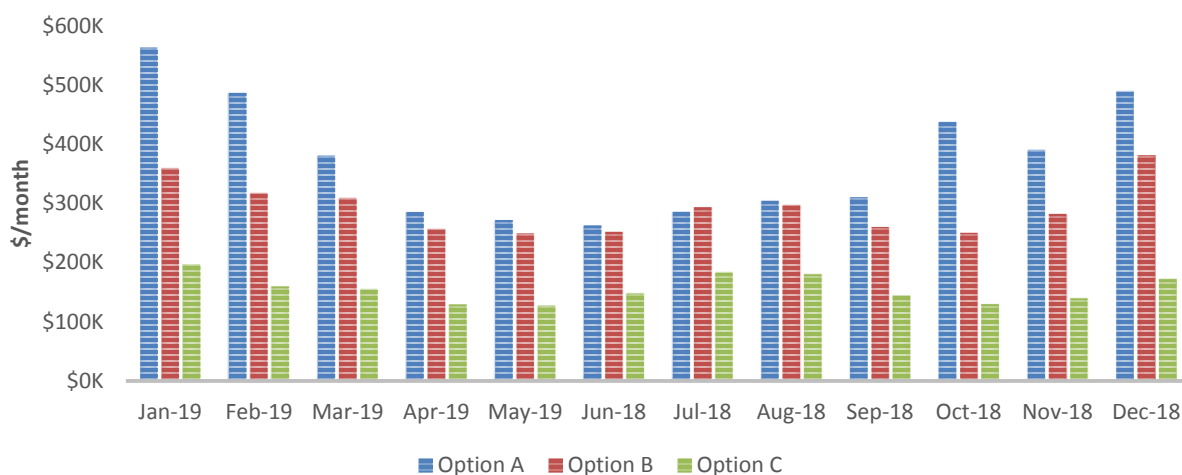


**Figure 16: Chilled water commodity cost comparison**

At the same time, although the chiller plant efficiency (incl. BOP and boiler pumps) of the 470 Capitol Ave plant/ Option C is significantly improved compared to the CDECCA billed efficiency (1.06 kW per Ton vs 1.69 kW per Ton), the new plant is billed using a more expensive retail rate (versus LMP and interruptible rate), resulting in a higher chilled water commodity cost of around \$294K per year when compared to Option A.

In summary, Option C provides for the lowest operational cost driven by a hot water conversion that dramatically reduces inefficiencies associated with the existing oversized steam boilers as well as improved chiller plant efficiency. Due to the adverse effect of the electricity rate change, the proportion of cooling commodity costs compared to overall O&M is expected to increase<sup>54</sup>. Finally, the hot water system design may allow the State of CT to reduce plant staffing to a minimum during normal business hours, decreasing capacity costs. Overall, savings in the order of \$2.6 million per year are calculated for Option C (when compared to Option A).

<sup>54</sup> Note that because of the adverse electric rate, Option B (purchasing the CDECCA plant) is expected to result in similar, or slightly higher O&M costs to that of Option A.



**Figure 17: Total monthly cost comparison (Options B & C shown w/o debt service)**

## 7.5. RECOMMENDATION

In summary, we recommend pursuing Option C, repurposing the dining area of the 470 Capitol Avenue facility into a TEP. This option appears to be both technically and financially feasible demonstrating superior efficiency, sustainability and resiliency compared to other available options. At the same time, Option C mitigates the significant risk associated with the demolition of the CDECCA plant and State owner pump house, while allowing the Stat of CT to be thermally self-reliant. The simple payback of Option C to the next best alternative (Option A) is calculated at 7.6 years.

### 7.5.1. Next Steps

SourceOne recommends the following next steps for advancing project evaluation and development efforts.

#### Develop Project to Go/No Go Decision Point

- ✓ Engage in internal discussions to weigh cost and benefits of the presented options.
- ✓ Decide whether additional project development effort is warranted and to what degree.
- ✓ Develop timeline for additional project development efforts in support of Go/No Go.
- ✓ Determine project delivery structure, form the team and assign roles and responsibilities.
- ✓ Meeting with Utility representatives to discuss both gas and electrical interconnections.

**Procurement Stage**

- ✓ Engage with CDECCA to discuss possible 1 year contract extension to allow sufficient time for TEP construction.
- ✓ Determine if RFP process is required; if so, develop constraints and criteria for inclusion in RFP.
- ✓ Hire engineer to develop schematic design to Issue-For-Bid level of detail.
- ✓ Develop and issue RFP, review and level bids. Conduct interviews and site tours as applicable.
- ✓ Prepare an updated cash flow pro forma for the preferred configuration and stress test results.
- ✓ Award contract(s).
- ✓ Proceed with formal negotiations upon award.

**Implementation Stage**

- ✓ Design Review(s).
- ✓ Construction.
- ✓ Start-up & Commissioning.
- ✓ Commercial Operations.
- ✓ Annual third party measurement & verification/bill auditing.

Refer to Appendix D for a preliminary milestone schedule.

## **APPENDIX A**

October 11, 2016

Thomas Surprenant  
Project Manager  
Division of Construction Services  
165 Capitol Avenue, Room 123  
Hartford, CT 06106

**SUBJECT: State of CT – Department of Administrative Services – Plant Design Load Letter**

Mr. Surprenant,

We are seeking your approval of the thermal loads, interfacing design criteria and proposed major equipment configurations to be used as the basis of design for the new thermal energy plant at 410 Capital Avenue.

The thermal loads are based on temperature, pressure, and flow rate information received from the State of CT. The source of this information originates from Northeast Integration (NEI) (existing hourly load data) and RMF Engineering (district loop data and future load data). These data sources were used to construct the “Summary of CAS System Data” summarized in the tables below and further described and evaluated in the attached.

| Design Criteria                              | Heating                                                             | Cooling                                                             |
|----------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
| Design Load                                  | 60.4 MMBtu/hr                                                       | 4,883 Tons                                                          |
| Min Load                                     | 1.0 MMBtu/hr                                                        | 100 Tons                                                            |
| Hydraulic Delta Pressure <sup>1</sup> (psid) | 30 psid <sup>2</sup> + new plant +external to interconnection point | 25 psid <sup>3</sup> + new plant +external to interconnection point |
| System Delta Temperature (°F)                | 26 °F                                                               | 13 °F                                                               |

**Table 1: Load, Temperature and Pressure Design Criteria**

| Boilers         | Boiler Turndown | Chillers     | Chiller Turndown |
|-----------------|-----------------|--------------|------------------|
| 3 x 30 MMBtu/hr | 20%             | 3 x 2500 ton | 15%              |
| 3 x 3 MMBtu/hr  | 25%             | 2 x 500 ton  | 15%              |

**Table 2: Major Equipment (N+1)**

In order to commence the design process we are requesting your review and approval of the above design criteria for your new thermal plant.

Regards,

*Matt Cinadr*

Matt Cinadr  
Project Manager  
SourceOne

Enclosure  
Summary of CAS System Data, RMF District Loop Data

<sup>1</sup> Total hydraulic pressure differential based on RMF supplied information plus new equipment and piping

<sup>2</sup> Refer to attached RMF Drawing for heating system hydraulic pressure information

<sup>3</sup> Refer to attached RMF Drawing for cooling system hydraulic pressure information



Summary of CAS System Data

Based on the data received, Waldron recommends a design basis for new chilled water plant of the following:

**Max Current Load: 3,750 tons** Based on supplied data

**Total Current Load: 5,522 tons** Per RMF schematic

**Diversity Factor: 67.9%** = Max Load / Total Load

**Future Load: 7,494 tons** Per RMF schematic

**Removed Sigourney Building: 957 tons** Per RMF schematic

**Total Future Load: 6,537 tons**

**Max Future Load: 4,439 tons** = Total Load \* Diversity Factor

**Design Margin: 10%**

**Recommended Design Load: 4,883 tons**

**Min Load: 100 tons**

**Hydraulic dP: 25 psid** Based on supplied data

+ dP internal (new plant)

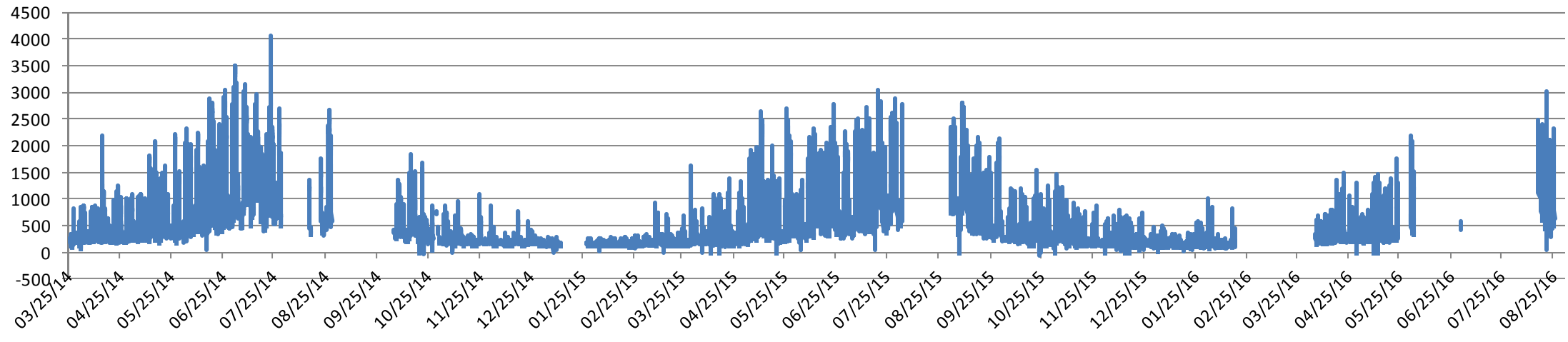
+ dP external to interconnection point

**System dT: 13 deg F** Based on supplied data

**Recommended Equipment Schedule:**

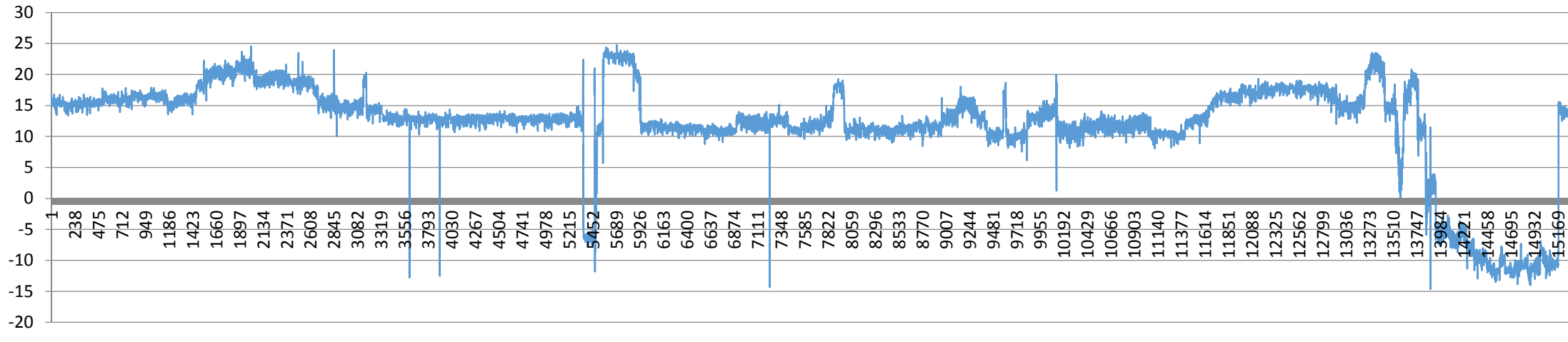
To meet the design load with N+1 redundancy, (3) 2500 ton Electric Centrifugal Chillers with turn down to 15% are recommended. To meet the minimum winter chilling load of 100tons with N+1 Redundancy, (2) 500 ton Electric Centrifugal Chillers with turn down to 15% are recommended. The intent is that the large chillers could be run in the cooling season, and the small chillers could be run in the heating season. There is some overlap with the min load of the large chillers (~375 tons) and the max load of the small chillers (500 tons) to give some operational flexibility during shoulder seasons.

Ch Wtr Tons



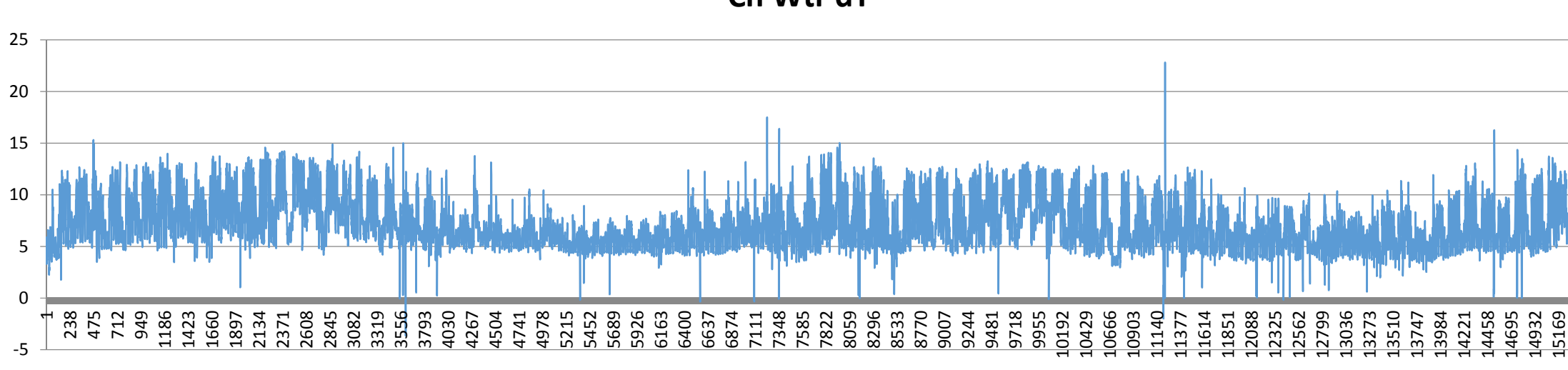
Ch Wtr dP

Missing data omitted, has same gaps as top chart



Ch Wtr dT

Missing data omitted, has same gaps as top chart



Summary of CAS System Data

Based on the data received, Waldron recommends a design basis for new hot water plant of the following:

**Max Current Load: 35 MMBtu/hr** Based on supplied data

**Total Current Load: 45.5 MMBtu/hr** Per RMF schematic

**Diversity Factor: 77%** = Max Load / Total Load

**Future Load: 75.9 MMBtu/hr** Per RMF schematic

**Removed Sigourney Building: 4.5 MMBtu/hr** Per RMF schematic

**Total Future Load: 71.4 MMBtu/hr**

**Max Future Load: 54.9 MMBtu/hr** = Total Load \* Diversity Factor

**Design Margin: 10%**

**Recommended Design Load: 60.4 MMBtu/hr**

**Min Load: 1 MMBtu/hr**

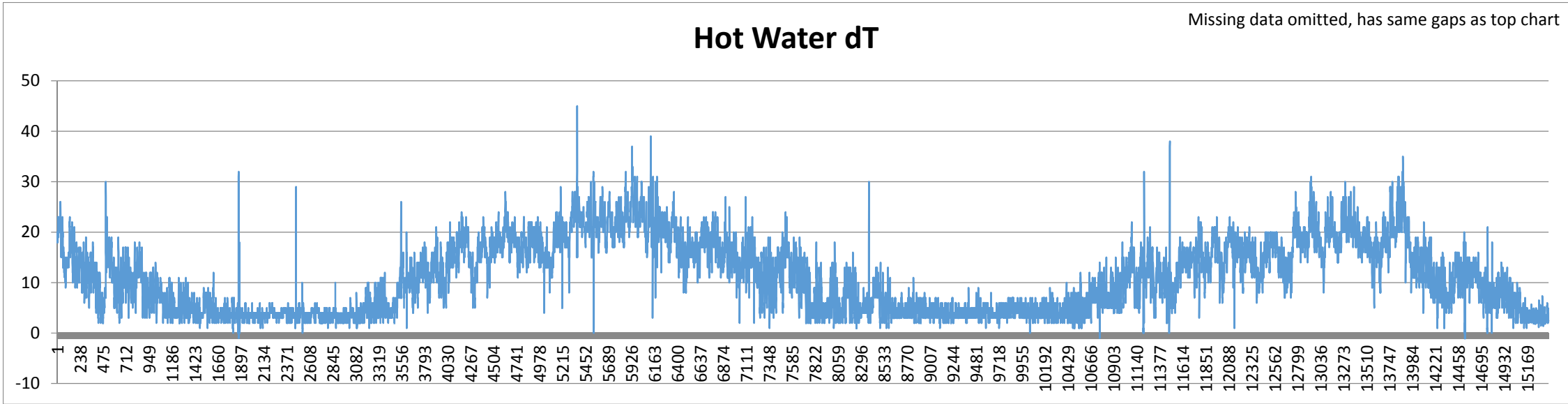
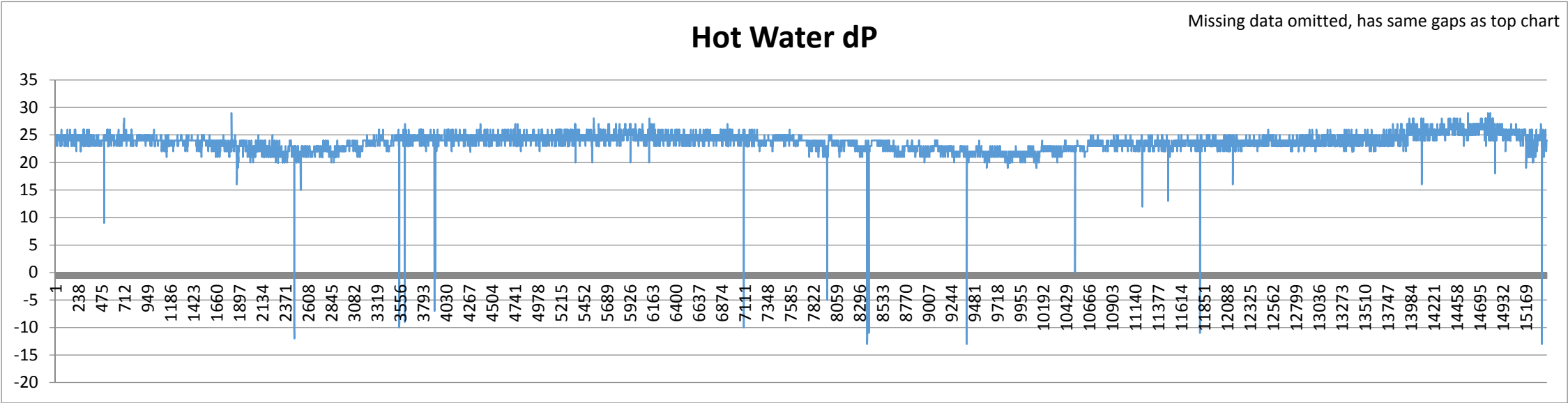
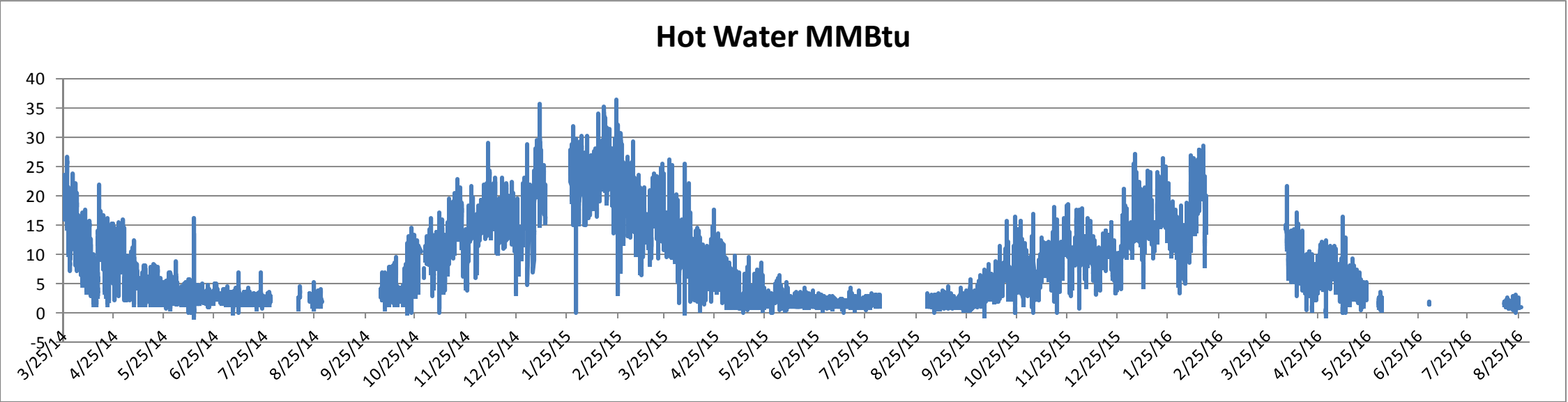
**Hydraulic dP: 30 psid** Based on Supplied Data

- + dP internal (new plant)
- + dP external to interconnection point

**System dT: 26 deg F** Based on Supplied Data

**Recommended Equipment Schedule:**

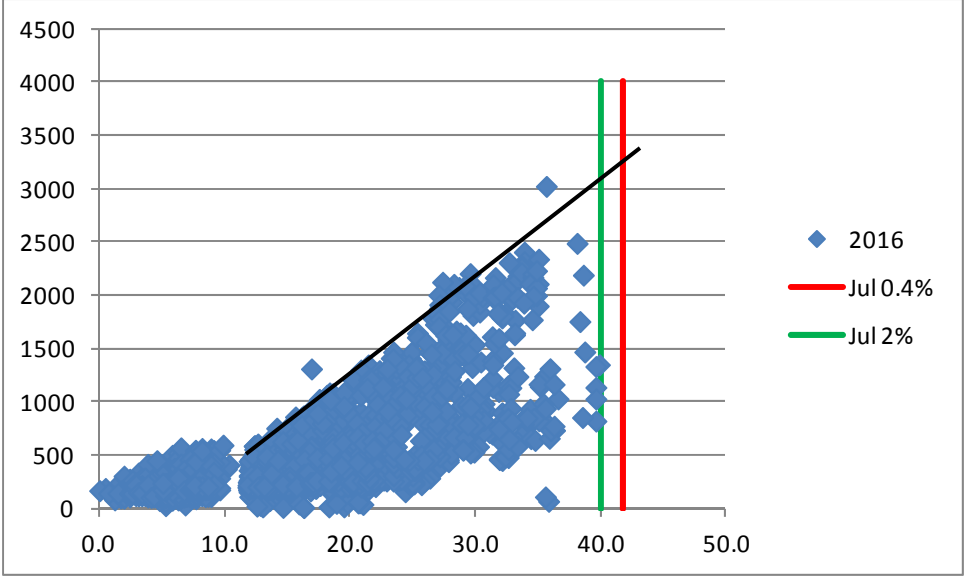
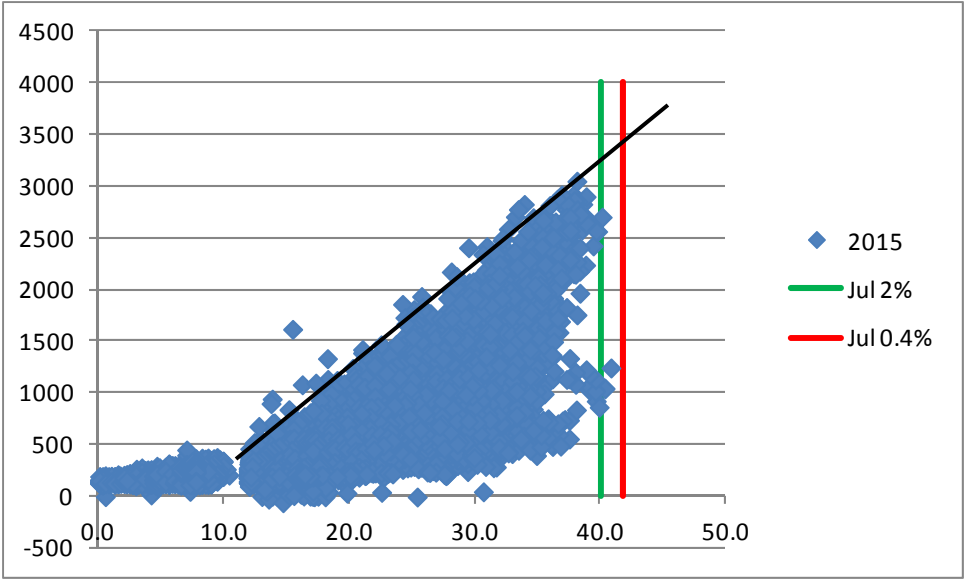
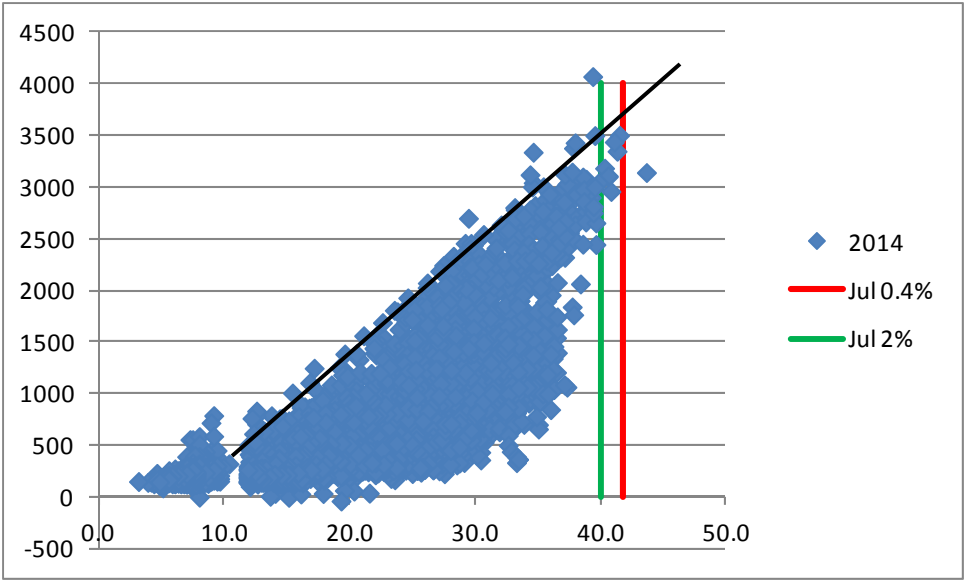
To meet the design load with N+1 redundancy, (3) 30MMBtu/hr Hot Water Boilers with turn down to 20% are recommended. To meet the minimum summer heating demand of 1 MMBtu/hr to 6MMBtu/hr with N+1 Redundancy, (3) 3 MMBtu/hr Hot Water Boilers with turn down to 25% are recommended. The intent is that the large boilers could be run in the heating season, and the small boilers could be run in the cooling season. There is some overlap with the min load of the large boilers (6 MMBtu) and the combined max load of the three small boilers (9MMBtu for all three combined) to give some operational flexibility during shoulder seasons.



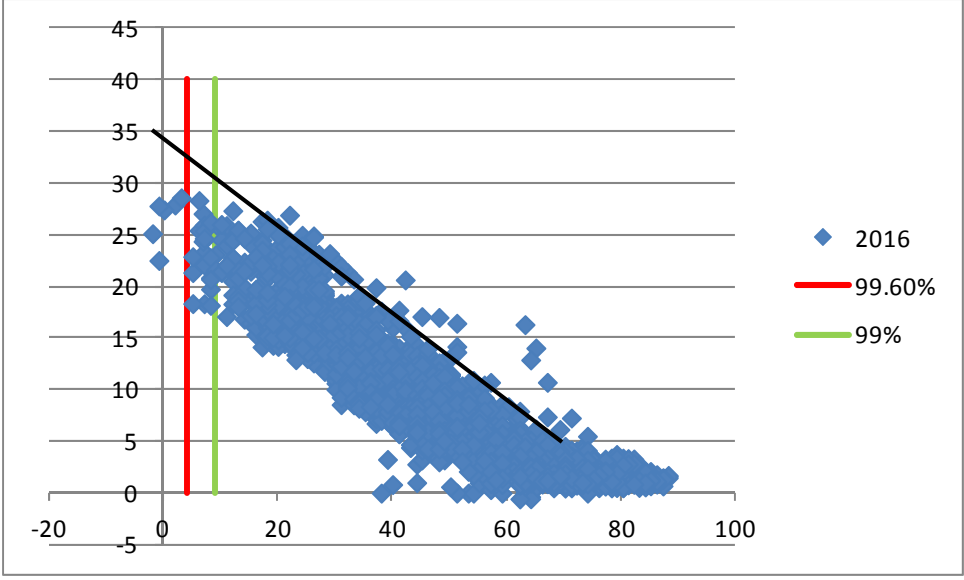
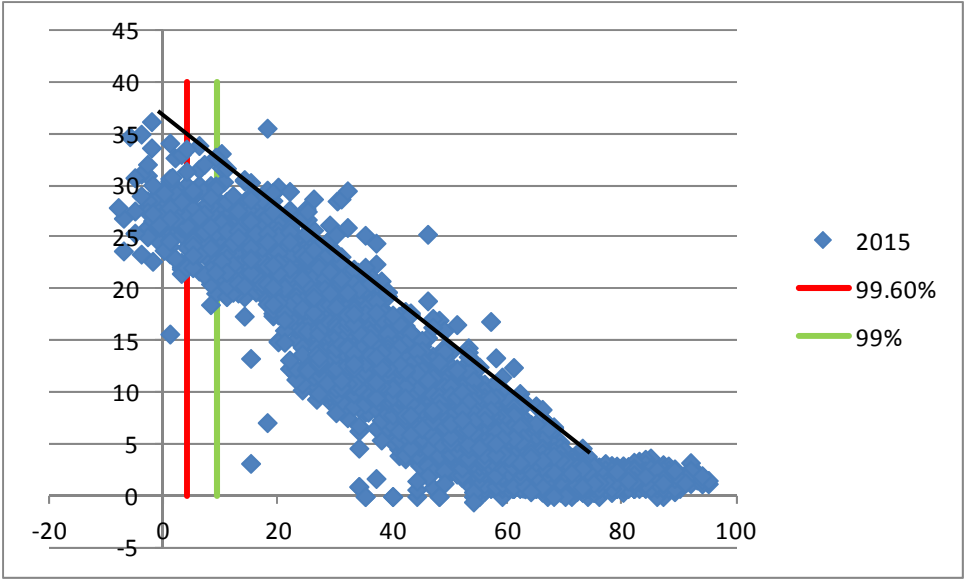
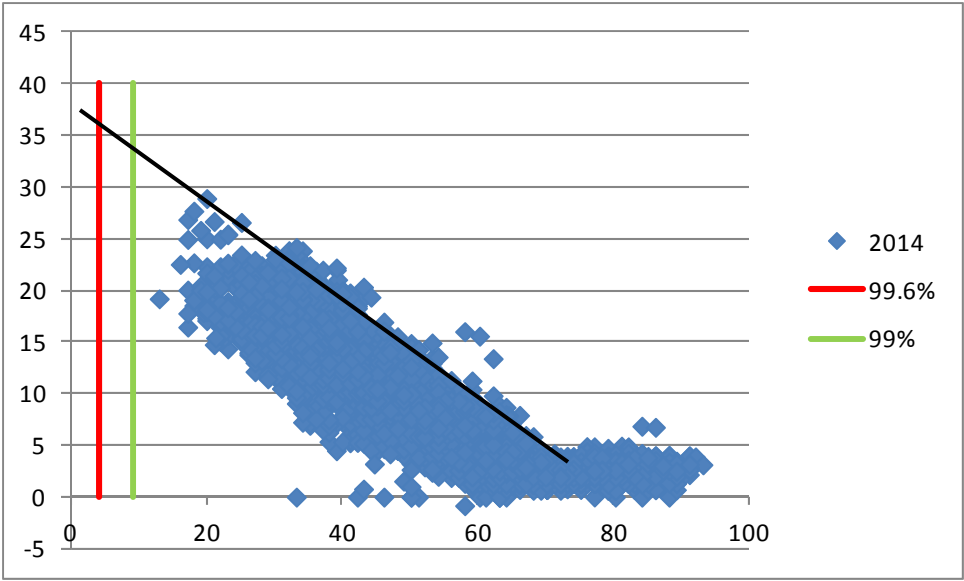
Based on the data received, Waldron made plots correlating the tons of chilling vs. ambient air enthalpy and MMBtu/hr of heating vs. ambient air dry bulb temperature. These plots are displayed to the left.

The plots were used to determine the maximum system load on the design day. The red and green lines represent two different design conditions. For the chilled water correlation, the ASHREA 0.4% condition and 2% condition are shown for the statistically hottest month, July. The hot water correlation charts show the ASHREA 96.4% and 99% dry bulb temperature for design day consideration.

Tons Chilling vs Air Enthalpy



MMBtu/hr Heating vs Air Dry Bulb Temperature



Summary of CAS System Data

Waldron built the load duration curves at right based on the pump house data received. The solid lines represent the data from 2014, 2015, and 2016. The horizontal axis of the graphs is hours per year (8760 in total). The reason the curves stop short of the far right of the axis is because there were gaps in the data.

The dashed curve represents the expected future load duration curve. It was constructed by scaling the most complete dataset, data from 2015, by the expected growth of the system. The scaling factor was calculated based on the RMF schematics and load calculations for hot and chilled water loads. The scaling factors were calculated as follows.

Hot Water:

**Total Current Load: 45.5 MMBtu/hr** Per RMF schematic

**Future Load: 75.9 MMBtu/hr** Per RMF schematic

**Removed Sigourney Building: 4.5 MMBtu/hr** Per RMF schematic

**Total Future Load: 71.4 MMBtu/hr**

**Scaling Factor: 1.57** = Future Load/Current Load

Chilled Water:

**Total Current Load: 5,522 tons** Per RMF schematic

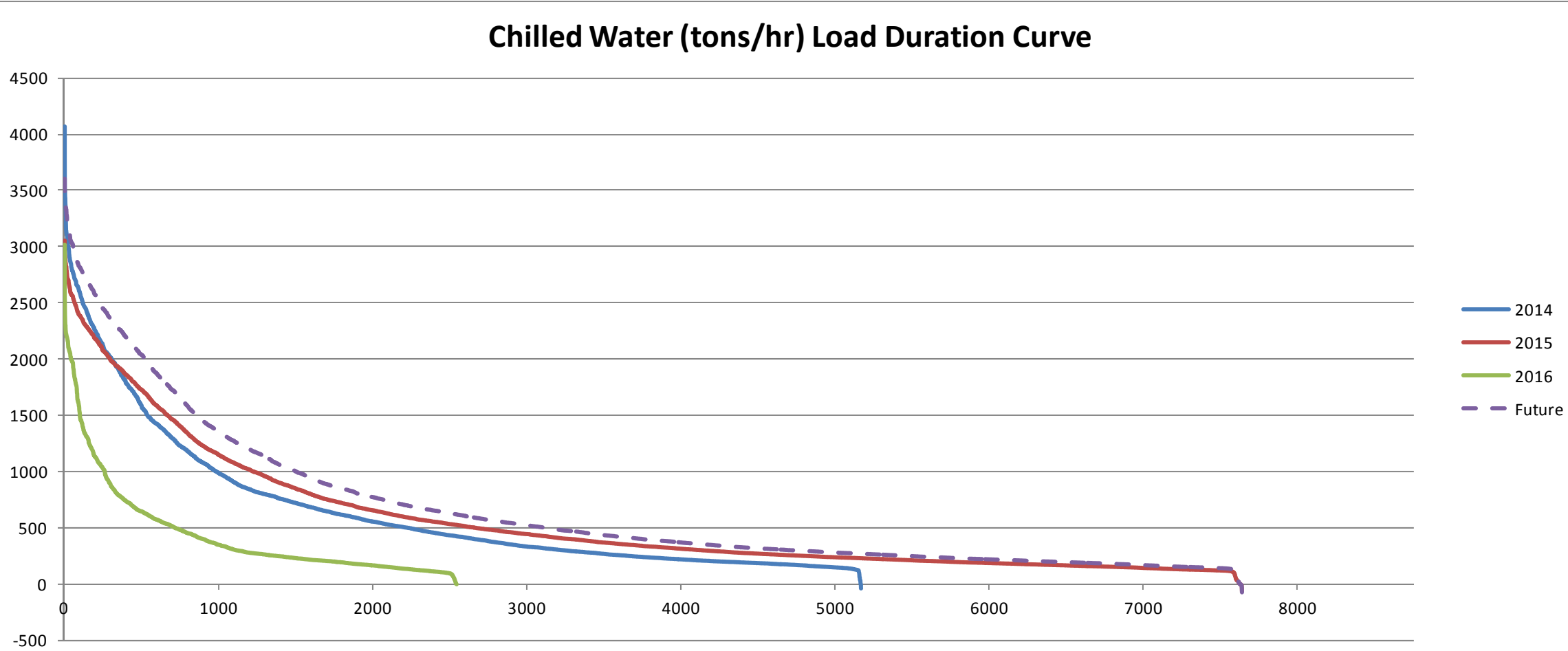
**Future Load: 7,494 tons** Per RMF schematic

**Removed Sigourney Building: 957 tons** Per RMF schematic

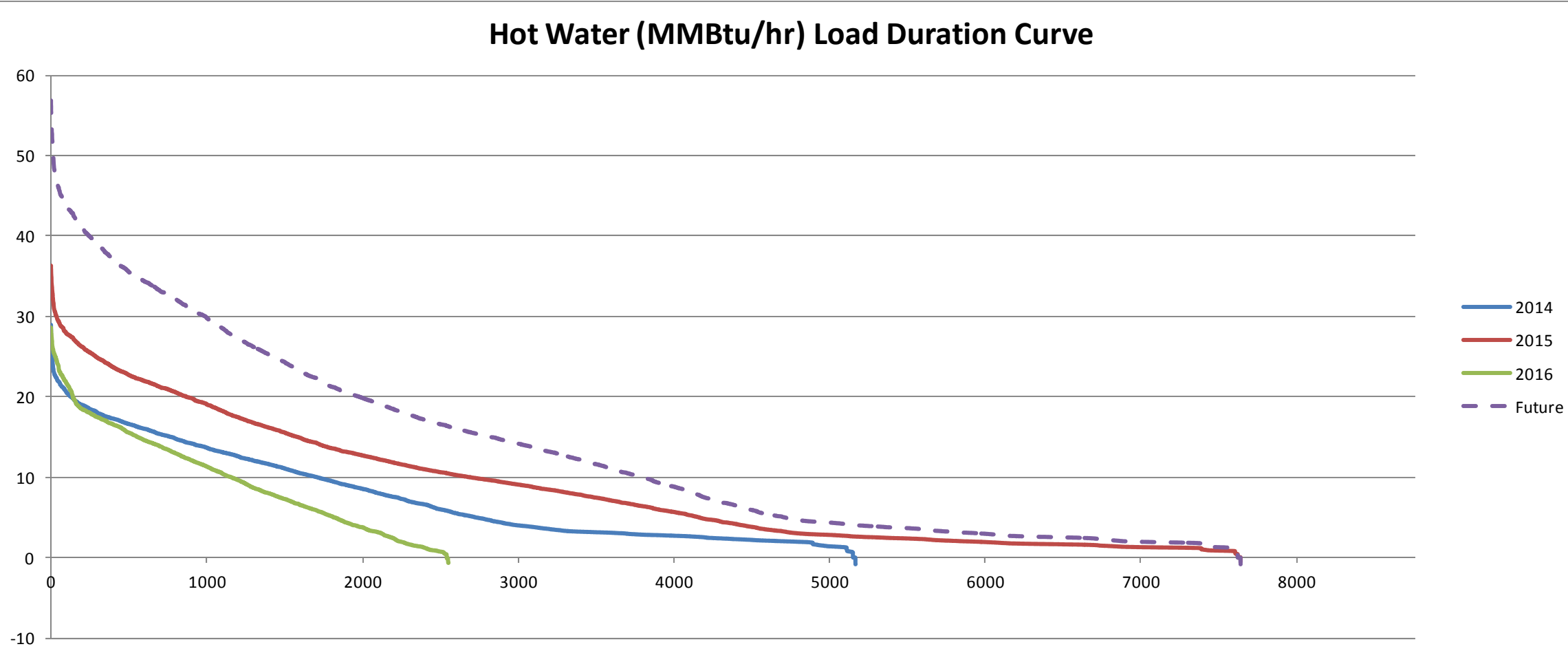
**Total Future Load: 6,537 tons**

**Scaling Factor: 1.18** = Future Load/Current Load

Chilled Water (tons/hr) Load Duration Curve

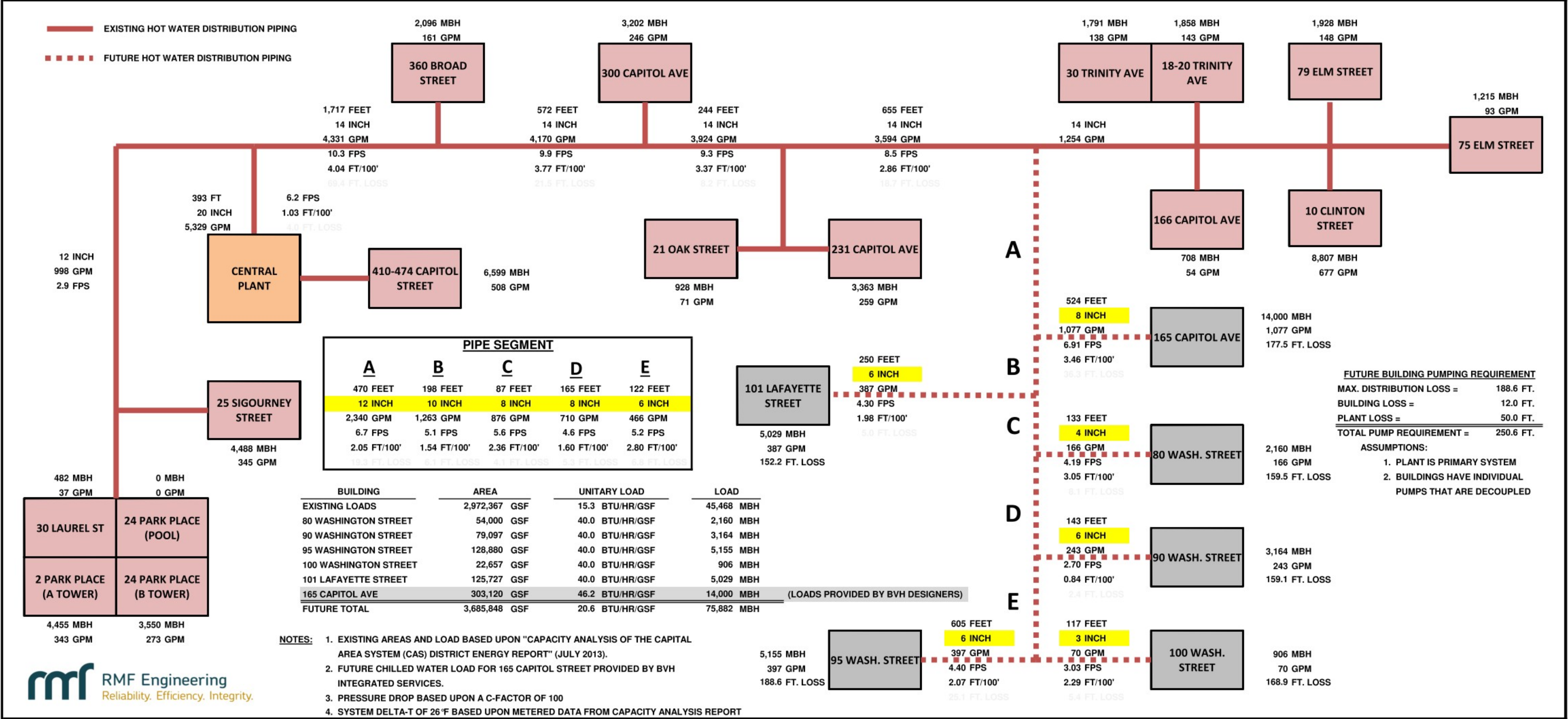


Hot Water (MMBtu/hr) Load Duration Curve

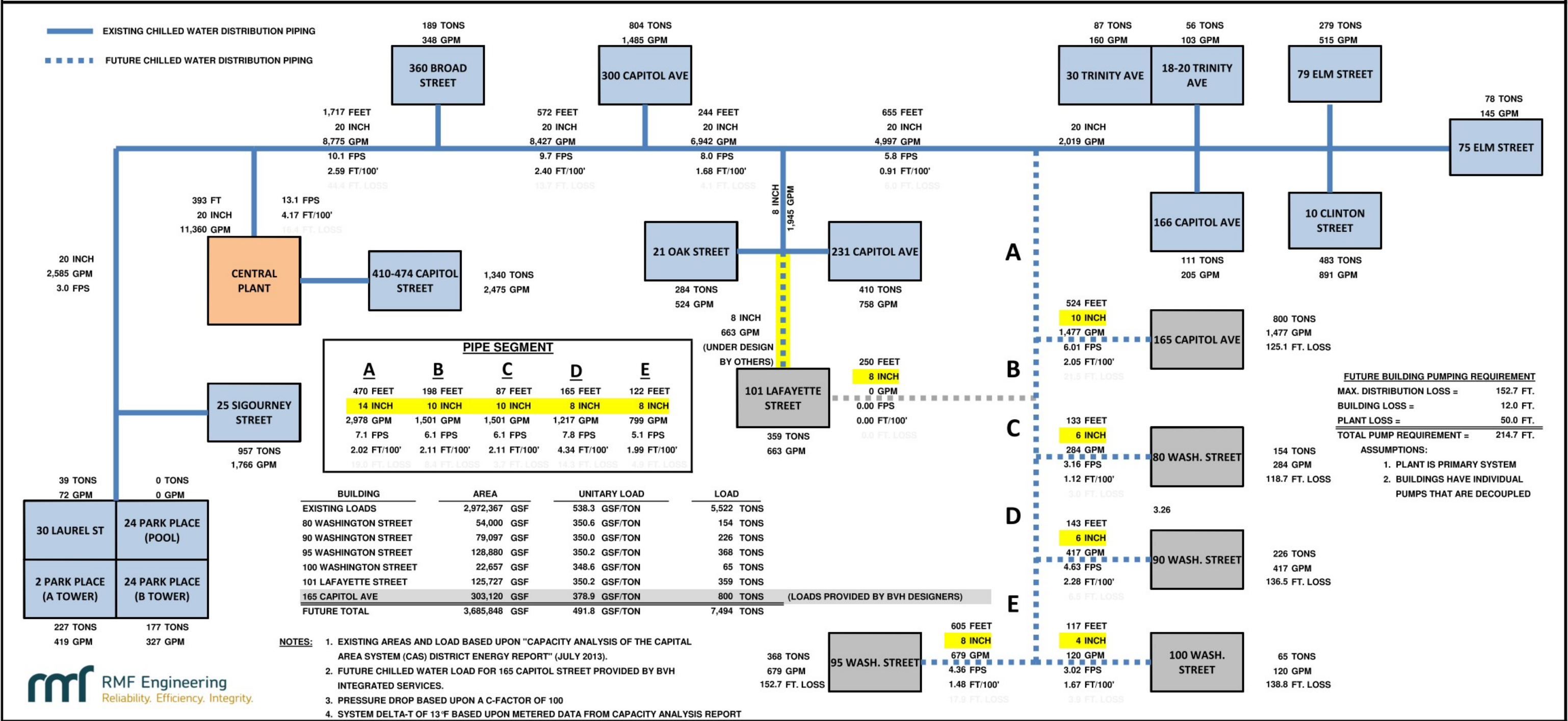




HOT WATER SCHEMATIC (26°F DELTA-T)  
CAPITOL AREA SYSTEM - HARTFORD, CT



CHILLED WATER SCHEMATIC (13°F DELTA-T)  
CAPITOL AREA SYSTEM - HARTFORD, CT



## **APPENDIX B**

# **SourceOne – State of Connecticut 470 Capitol Avenue, Hartford, CT, Schematic Design Basis of Design: MEP/FP/FA and Structural**

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Project Number: 20463.000

## **Revision History**

| <b>Revision</b> | <b>Date</b>        | <b>Description of Change</b>                                                                                                                |
|-----------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 0               | August 30, 2019    | Draft for General Arrangement                                                                                                               |
| 1               | September 23, 2019 | Revisions for 9/23/2019 Issued for Review drawings, including but not limited to changes in equipment and answers to questions from client. |
| 2               | September 27, 2019 | Corrections and clarifications from internal review.                                                                                        |
| 3               | September 27, 2019 | Corrections and clarifications from internal review.                                                                                        |
| 4               | October 24, 2019   | Revisions for 10/23/2019 Issued for Review package, including but not limited to answers to questions from client.                          |
| 5               | October 28, 2019   | Clarification of permit requirements for air emissions.                                                                                     |





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# 1 Introduction

## 1.1 Background

The State of CT is considering 470 Capitol Avenue in Hartford, CT as a potential location for a new chilled water and hot water plant for their district heating and cooling system, the Capitol Area System (CAS). The existing plant, owned and operated by a third party (CDECCA) is under contract to provide thermal utilities to the State until the end of March 2021. The State of CT is looking to explore the technical and financial feasibility of constructing and operating its own thermal plant. Another driver for this study is the potential relocation of I-84 which, if it occurs is expected to be in the way of the existing CDECCA plant.

SourceOne is conducting a feasibility study and is reviewing thermal plant alternatives for the State of CT, among which the 470 Capitol Avenue alternative is referred to as "Option C". Hallam-ICS' scope of work is only related to Option C.

SourceOne has previously developed a schematic design / RFP for a new thermal plant at the back of 410 Capitol Avenue. The 410 Capitol Avenue schematic design is the basis for the types and sizes of heating and cooling equipment for a thermal plant at 470 Capitol Avenue. The heating and cooling equipment capacities and quantities were modified from the 410 Capitol Avenue design at the request of the State of CT and as described in this Basis of Design document.

SourceOne has contracted Hallam-ICS to develop a general arrangement of equipment at 470 Capital Avenue, as well as this Basis of Design document, to present the feasibility of using the existing buildings for the new thermal plant ("Option C"). The scope of work of the feasibility study and design includes:

- Evaluate existing 470 Capitol Avenue facility size with respect to all required thermal plant components.
- Evaluate required structural demolition and/or modifications for installation and proper function of all thermal plant components.
- Evaluate utility connections and building services requirements, such as electrical, natural gas, storm & sanitary sewer, potable water, and communications.
- Evaluate connections to existing CAS loop piping requirements.
- Provide location of chimney and cooling tower.
- Review list of required permits and comment on applicability to project and significant hurdles.

Hallam-ICS has been contracted to produce drawings limited to the following scope of work:

- General arrangement of the as-defined equipment with simple solid object representations.
- Section and elevation views of the arrangement, no piping/duct/power.

This Basis of Design document presents design considerations for a technically feasible Option C.

## 1.2 Building Description

470 Capitol Avenue consists of three types/phases of building construction, all of which are a single level slab on grade (see Figure 1) and with a total floor area of approximately 30,300 SF. The easternmost portion is a structural brick and wood roof-truss structure that serves as an open dining space. The westernmost portion is steel-framed with face-brick and serves as a commercial kitchen and conference space. The westernmost portion has an equipment platform/attic containing the commercial kitchen HVAC equipment. The middle portion is a concrete waffle slab structure that serves as the cafeteria for the dining facility and a vestibule/connector for the building. Hallam-ICS performed site visits on August 14, 2019 and August 23, 2019 to review the existing condition of the building (see Figure 3, Figure 4, Figure 5).

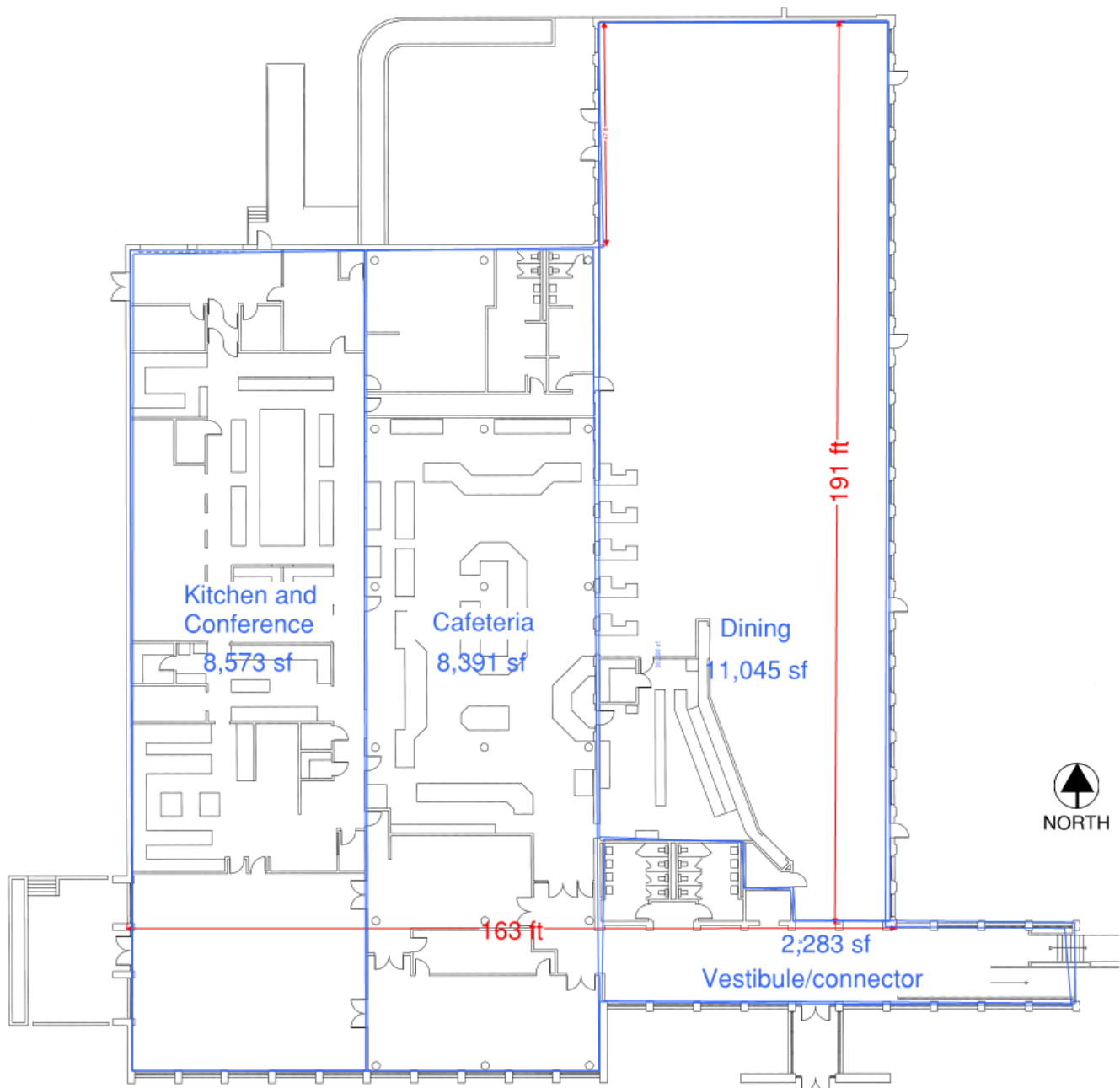


Figure 1: Floor plan of existing 470 Capitol Ave.



Figure 2: Satellite image of site (source: Google Earth).





Figure 3: Easternmost portion (dining).



Figure 4: Westernmost portion (kitchen and conference).

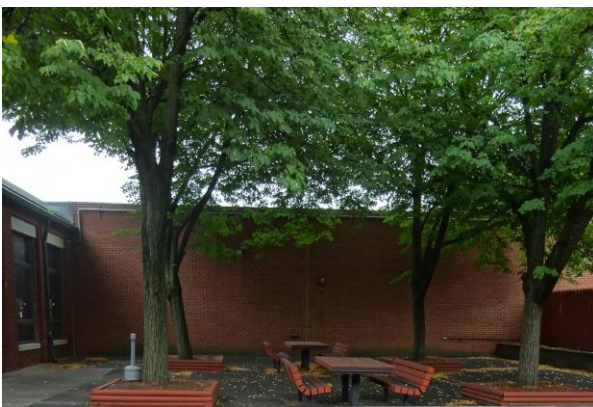
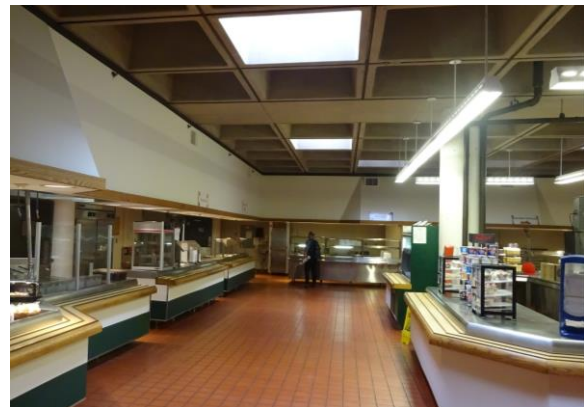


Figure 5: Middle portion (cafeteria).





### 1.3 Governing Codes and Standards

Table 1: MEP/FP/FA Codes and Standards

| Code / Standard                                                                                                | Notes                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2018 Connecticut State Building Code                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                    |
| 2018 Connecticut State Fire Safety Code                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                    |
| International Building Code (IBC), 2015 edition                                                                | State building code, with Amendments                                                                                                                                                                                                                                                                                                                                                               |
| International Existing Building Code (IEBC), 2015 edition                                                      | State building code, with Amendments. Not applicable if major renovation or change of use.                                                                                                                                                                                                                                                                                                         |
| International Fire Code (IFC), 2015 edition                                                                    | State fire code, with Amendments                                                                                                                                                                                                                                                                                                                                                                   |
| NFPA 101 Life Safety Code, 2015 edition                                                                        | State life safety code for existing buildings/occupancies.                                                                                                                                                                                                                                                                                                                                         |
| NFPA 13 Standard for the Installation of Sprinkler Systems, 2013 edition                                       | Referenced by 2018 Connecticut State Fire Safety Code                                                                                                                                                                                                                                                                                                                                              |
| NFPA 70 National Electrical Code, 2017 edition                                                                 | State electrical code, with Amendments                                                                                                                                                                                                                                                                                                                                                             |
| International Plumbing Code (IPC), 2015 edition                                                                | State plumbing code, with Amendments                                                                                                                                                                                                                                                                                                                                                               |
| International Energy Conservation Code (IECC), 2015 edition                                                    | State energy code, with Amendments                                                                                                                                                                                                                                                                                                                                                                 |
| International Mechanical Code (IMC), 2015 edition                                                              | State mechanical code, with Amendments                                                                                                                                                                                                                                                                                                                                                             |
| Hartford Noise Ordinance                                                                                       | See Section 4.1.3 Cooling Towers of this Basis of Design                                                                                                                                                                                                                                                                                                                                           |
| Hartford Historic Preservation Ordinance                                                                       | See "Municipalities – Planning and Zoning (Historic Preservation)" in Section 11. Permits of this Basis of Design.                                                                                                                                                                                                                                                                                 |
| Connecticut Department of Administrative Services (DAS) Capital Projects High Performance Buildings Guidelines | <p>"3.3 Pre-Design High Performance Building Feasibility Study:</p> <p>Where it appears that compliance with High Performance Building Standards may significantly outweigh its benefits for a renovation project, the DCS PM will request the Design Team to produce a written Pre-Design High Performance Building Feasibility Study, prior to the beginning of the Schematic Design Phase."</p> |



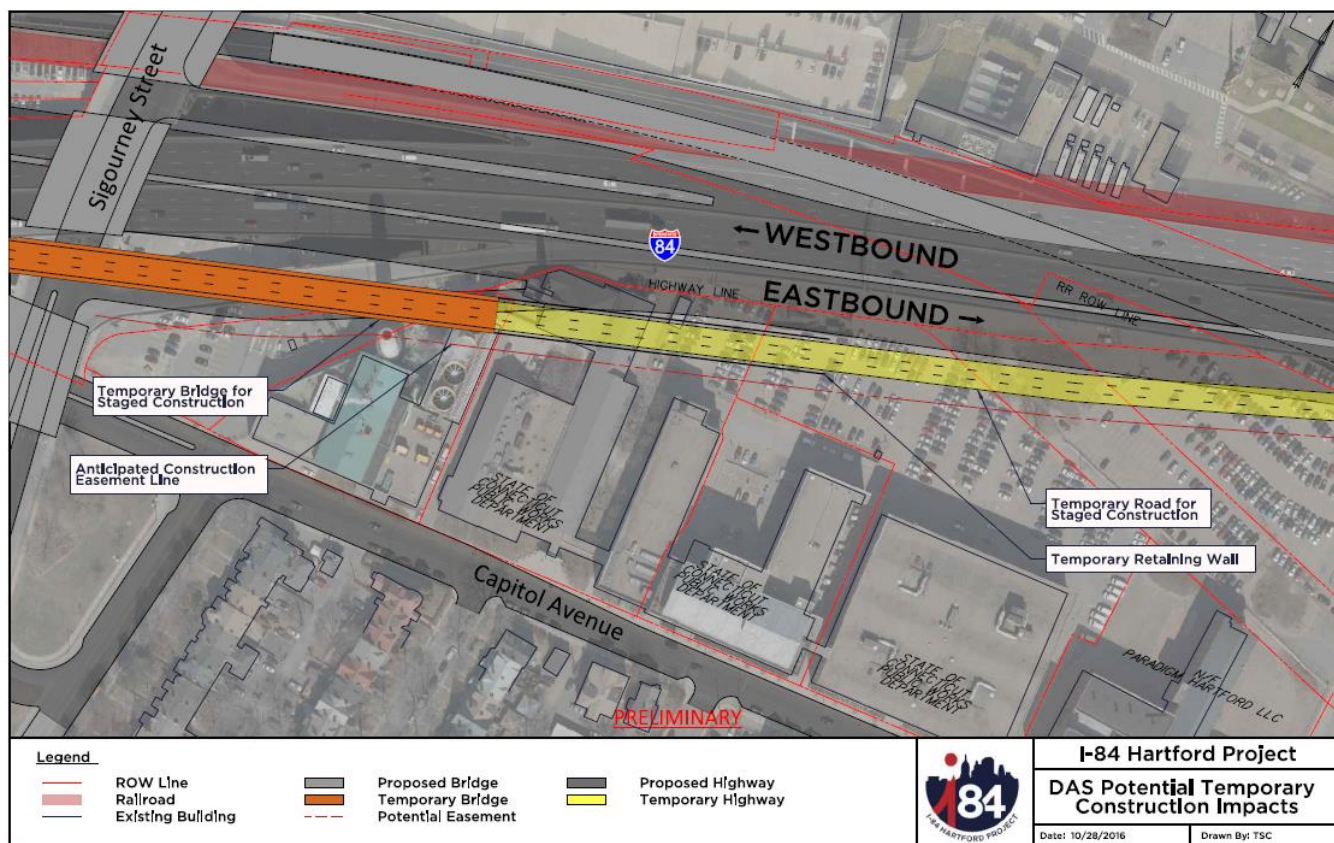
## **2 Design Decisions and Assumptions**

### ***2.1 Criteria for General Arrangement***

The following criteria were considered for the general arrangement of equipment and systems:

1. Sizes of equipment based on General Arrangement sheet G-1001 in 410 Capitol Ave. TEP Schematic Design.
2. Quantities of equipment based on modifications communicated by the State of CT.
3. Avoid easement areas of potential highway construction (see Figure 6).
4. Minimize impacts on square footage and program of existing building.
5. Avoid use of conference areas and connector/vestibule areas.
6. Connect hot water and chilled water distribution piping to either the existing CAS connection point or the CAS connection point proposed for the 410 Capitol Ave. TEP Schematic Design.
7. Locate valve chamber outside of existing building footprint, below grade.
8. Locate cooling towers away from areas sensitive to noise and moisture impacts.
9. Minimize length of breeching between boilers and stack.
10. Minimize length of electrical power distribution.
11. Minimize relocation of underground utilities.





**Figure 6: Potential highway construction (source: Capitol Area System Thermal Plan Project, SOC Project Number: BI-2B-414, Volume II of III: Program of Design, State of Connecticut).**

## 2.2 Unknowns, Risks, and Owner Decisions

1. The Risk Category in accordance with table 1604.5 of the IBC has the potential for significant impact on the cost of the project. Section 1007 of the IBC requires evaluating the structure for wind, snow and seismic loads if the Risk Category of the new use is greater than the previous use. The costs of evaluation, design, and construction could be significant to the point of impacting the feasibility of the project. Referring to table 1604.5 from the IBC, the existing dining area should be Category II. According to the Capitol Area System Thermal Plan Project, SOC Project Number: BI-2B-414, Volume II of III: Program of Design, the new use of the building is Occupancy Category II ("Occupancy Category" of ASCE 7-10 is analogous to "Risk Category" of the IBC). The Owner has confirmed that the new use is intended to be Risk Category II, based on the code requirements in the RFP (410 Capitol Ave. TEP Schematic Design).
2. The existing foundation and underlying soil conditions for the site are unknown at the time of Revision 2 of this Basis of Design document. The preliminary design has assumed that normal bearing conditions exist that would allow for traditional spread footing foundations to be used with a minimum allowable bearing pressure of 2,000 pounds per square foot.
3. No existing drawings or other documentation has been made available for the existing structures. For the concrete waffle slab roof structure, this makes an analysis essentially unfeasible as there is no way to determine the reinforcing details without either performing selective demolition or attempting to document it through Ground Penetrating Radar (which may not give a full and accurate picture of the existing reinforcing). For the existing wood roof trusses, a determination of the grade of wood would need to be done prior to performing an analysis to determine the roof snow load capacity. For this study,



these unknowns for the existing roof systems have been avoided by not adding additional load to the existing roofs and instead providing independent support structures.

4. The potential highway construction (see Figure 6) could impact the routing of utilities to the building, including the connection to the existing CAS, and relocation of portions of the existing CAS. The easement area of the highway construction impinges on a portion of the designated parking area for portable generators and the location of the new utility meter. This Basis of Design assumes that the line of the easement area is temporary based on the temporary bridge/road for staged construction, and that the easement area can be coordinated with the construction processes of the highway and Option C. In the absence of such coordination, an alternative arrangement of the portable generator parking area and utility meter are feasible, as is an alternative layout of site utilities. An alternative CAS connection is feasible via pipe supports to the connection point shown in the 410 Capitol Ave. TEP Schematic Design.



## 3 Architectural

The general arrangement of thermal plant equipment utilizes the space in the existing dining area (see Figure 1) of the building. This arrangement minimizes impacts on square footage and program of existing building. Additional space and cost optimization should be considered (e.g. extensive demolition of existing building and construction of a new building) as part of a design process beyond this feasibility study.

### 3.1 Use and Occupancy Classification

The use of 470 Capitol Ave. as a thermal plant is a change in use and occupancy with respect to the International Building Code (IBC), 2015 edition. Chapter 3 of the IBC controls the classification of the use and occupancy of buildings and structures. A thermal plant falls within the classification of "Factory Group F", as defined in Section 306 of the IBC.

The new thermal plant will not contain an "electricity generating plant" (which is specifically F-1 occupancy). One could make an aggressive argument the thermal plant can be F-2: "Factory industrial uses that involve the fabrication or manufacturing of noncombustible materials that during finishing, packing or processing do not involve a significant fire hazard shall be classified as F-2 occupancies and shall include..." However, we do not take an aggressive perspective on this portion of the code and propose the new thermal plant will be F-1. We also do not believe a Group U classification is appropriate.

#### 3.1.1 Change of Use

The building's current official occupancy classification is unknown, but the current operation of a kitchen, cafeteria, and dining is most likely an A-2 (assembly two) use classification (section 303.3 from the IBC).

The portion of the renovation that will include the thermal plant equipment will change to use classification F-1. In the interest of preserving the remaining building square footage for other use, the renovation will employ a mixed use and occupancy consistent with IBC Section 508. The allowable classifications of the space separate from the F-1 portion of the building are limited by the allowable areas of occupancy classification per IBC Section 506, Table 506.2. Assuming unrated exterior walls (Type V construction), an occupancy classification of B is allowed (building square footage of 30,300 SF is less than the allowable area of 36,000 SF. An occupancy classification of B represents Business Group B, which "includes, among others, the use of a building structure, or a portion thereof, for office, professional or service-type transactions, including storage or records and accounts." Per Table 508.4, no fire-rated separation is required between the F-1 and B occupancy, and therefore no rated separation would be required between the thermal plant equipment space and the existing cafeteria space.

If the existing conference room at the southeast corner of the building is to remain in service, and is intended for an occupant load of less than 50 persons, then this space is most likely a Group B occupancy (section 303.1.2 from the IBC). If this space is intended for an occupant load of 50 persons or more, then this space is likely an A-3 (assembly three) use classification (section 303.4 from the IBC). The vestibule/connector (see Figure 1) may also be classified as A-3 (assembly three) if the intended occupant load is 50 persons or more. In this case, a 1-hour separation would be required between the assembly space(s) and any space classified as F-1, per Table 508.4 in the IBC.

A change of use is covered in the International Existing Building Code by chapter 10. The items below evaluate sections of interest and relevance from chapter 10 that have meaning to this project.

1004 Fire Protection: The project building will need to have a fire protection system which suits the new building. The F-1 occupancy will need to be Ordinary Hazard, see other sections of this report for a discussion on the existing fire protection system.

1005 Means of Egress: The project building will have to comply with current egress requirements of the International Building Code. The requirements for egress are described in chapter 10 of the IBC.

1007 Structural: This section requires evaluating the structure for wind, snow and seismic loads if the Risk Category of the new use is greater than the previous use. The costs of evaluation,



design, and construction could be significant to the point of impacting the feasibility of the project. Referring to table 1604.5 from the IBC, the existing cafeteria should be Category II. According to the Capitol Area System Thermal Plan Project, SOC Project Number: BI-2B-414, Volume II of III: Program of Design, the new use of the building is Occupancy Category II ("Occupancy Category" of ASCE 7-10 is analogous to "Risk Category" of the IBC).

1008 Electrical: Since the building will need an electrical service upgrade to suit the new equipment, this section's verbiage is immaterial to this study.

1009 Mechanical: Since the building will undergo a significant mechanical change to meet the needs of the project, this section's verbiage is immaterial to this study.

1010 Plumbing: This section covers assuring adequate water supply and installation of waste interceptors if needed. The existing building's commercial kitchen equipment leads us to expect the existing water supply is adequate for the thermal plant use.

1012.4 Means of egress hazard category: The new occupancy group (F-1) is a lower egress hazard than the current group (A-2), which means special egress evaluation or provision is not necessary. The means of egress must comply with the current International Building Code requirements.

1012.5 Heights and areas: The existing A-2 occupancy is a higher hazard category than the future F-1 use, and in this condition, the existing height and area is "deemed acceptable."

1012.6 Exterior wall fire resistance ratings: Even though the new use has a higher exterior wall hazard category, there is an exception to 2-hour rating for F use buildings.

1012.2.2 Fire alarm: A fire alarm system is needed, complying with chapter 9 from the International Building Code. Reviewing IBC for Group F occupancy, a manual fire alarm is needed. This fire alarm will also be needed for monitoring the fire protection system.

The use of space outside of the existing dining area (outside of space for thermal plant equipment) is to be decided by the Owner.

## **3.2 Construction Classification**

The construction classification depends upon the fire resistance rating of the exterior walls (unrated vs. 2-hour rated), which is unknown at the time of Revision 2 of this Basis of Design document. However, in either case the building is within the allowable area for the occupancy classification.

### **3.2.1 For a Building with Unrated Exterior Walls**

The existing structure includes structural masonry (brick) walls and wooden roof framing, and the wood framing is not protected with fire resisting elements. Referring to section 602.3, we discern the building is Type V construction (no fire rated building elements). Table 601 indicates the subject building is Type VB (no fire rating on any elements). Table 506.2 allows an F-1 building 34,000 square feet maximum as a single story, sprinkled structure.

### **3.2.2 For a Building with 2-Hour Rated Exterior Walls**

The existing structure includes structural masonry (brick) walls and wooden roof framing, the wood framing is not protected with fire resisting elements. Referring to section 602.3, we discern the building is Type III construction (noncombustible exterior walls, combustible interior elements). Table 601 indicates the subject building is Type IIIB (no fire rating on structural frame, 2 hour exterior walls. Table 506.2 allows an F-1 building of 48,000 square feet maximum as a single story, sprinkled structure.

## **3.3 Classification for Fire Protection**

Based on our review of NFPA 13, 2013 edition (statutory under the 2015 IBC), the most appropriate classification of the thermal plant is Ordinary Hazard Group 1. The text of the code is most appropriate to





the boilers, chillers, electrical equipment and pumping systems: “5.3.1.1 Ordinary hazard (Group 1) occupancies shall be de-fined as occupancies or portions of other occupancies where combustibility is low, quantity of combustibles is moderate, stockpiles of combustibles do not exceed 8 ft (2.4 m), and fires with moderate rates of heat release are expected.”

### **3.4 Electrically Classified Hazard**

It is not appropriate to electrically classify the area around a boiler, as the boiler itself is a source of ignition. For the areas around the boilers, the industry standard is to consider those areas as not classified, following the concepts from NFPA 497, section 5.51: “Experience has shown that the release of ignitable mixtures from some operations and apparatus is so infrequent that area classification is not necessary. For example, it is not usually necessary to classify the following locations where combustible materials are processed, stored, or handled:

- (1) Locations that have adequate ventilation, where combustible materials are contained within suitable, well-maintained, closed piping systems
- (2) Locations that lack adequate ventilation, but where piping systems are without valves, fittings, flanges, and similar accessories that may be prone to leaks”

Oil filled transformers are not allowed for this building (see 2017 National Electrical Code, 450.23; they can only be installed in Type I or Type II buildings). If an oil filled transformer is needed for electrical reasons, we would have to construct a transformer vault, which has specific construction requirements, including a 3-hour fire resistance rating for the walls, floor and ceiling/roof, or locate the transformers exterior to the building with a 3-hour fire resistance rating for the exterior walls.

### **3.5 Architectural Alterations**

The following alterations to the existing building architecture are required for the new thermal plant.

1. A new roll-up door for equipment access.
2. A new valve chamber below grade, adjacent to the north of the building.
3. A new 3-hour fire resistance rated partition for the electrical switchgear room.
4. A new 2-hour fire wall between the outdoor transformers and the existing building.
5. A new fire-rated partition between the chiller/boiler/pump room and the existing-to-remain cafeteria (middle portion of building), public restrooms, and lobby area.
6. Revised doorways for egress.
7. Demolition of kitchen area in eastern portion of building, north of the existing restrooms.
8. A new control room.
9. Demolition of various partition walls in the middle portion of the building to accommodate coordinated location of cooling tower support columns.
10. A new 1-hour fire resistance rated partition between F-1 and A occupancy areas (existing-to-remain vestibule/connector and conference space) with sound transmission mitigation. The Owner's intended use of spaces adjacent to the thermal plant equipment space will define what fire rated construction is needed.



## 4 Mechanical

### 4.1 Main Equipment

#### 4.1.1 Boilers

The basis of design boilers are defined by the 410 Capitol Ave. TEP Schematic Design, supplemental information provided by SourceOne, and modifications to equipment capacities and quantities by the State of CT.

The boilers include:

1. 15 MMBTU/hr Cleaver Brooks CBEX Elite 500 HP-125HW natural gas-fired, hot water units. Quantity: Three plus one future.

The Cleaver Brooks CBEX Elite 500 HP-125HW boilers are actually 16.7 MMBTU/hr (not 15 MMBTU/hr requested by the State of CT). The Cleaver Brooks CBEX Elite 500 HP-125HW boilers represent the closest representation of this capacity for the design basis boilers from the 410 Capitol Ave. TEP Schematic Design.

The boiler breaching will be of double-wall construction (e.g. Van-Packer DW Plus) to effectively insulate and to minimize the required clearances to combustible material.

Combustion air ductwork will connect to the boilers and will include louvered penthouses or goosenecks above the roof. Combustion air ductwork provides a sealed combustion arrangement, which complies with ASHRAE Standard 15, section 8.11.6 option a. Alternatively, a partition separation between the fuel fired equipment and the refrigeration equipment could be provided. A partition would allow omission of ductwork, but would add complexity and cost for architectural, electrical and mechanical elements.

#### 4.1.2 Chillers

The basis of design chillers are defined by the 410 Capitol Ave. TEP Schematic Design, supplemental information provided by SourceOne, and modifications to equipment capacities and quantities by the State of CT.

The chillers include:

1. 1875 RT York YKTRRSK4-DEG. Quantity: Three plus one future.

The State of CT had requested 1800 RT capacity chillers. The 1875 RT York YKTRRSK4-DEG chillers are the design basis chillers from the 410 Capitol Ave. TEP Schematic Design and are a close representation of the size and cost of the requested chiller capacity.

The general arrangement drawing and section drawing show the basis of design chiller Revit families selected by York, and a 6" equipment pad.

#### 4.1.3 Cooling Towers

The basis of design cooling towers are defined by the 410 Capitol Ave. TEP Schematic Design, and by supplemental information provided by SourceOne.

The cooling towers include:

1. SPX NC8407SCN6 units. Quantity: Six cells plus three futures.

Screens for roof-mounted cooling towers are not prescriptively required by Planning and Zoning. However Hartford Zoning Regulations requires wood or brick screening of mechanical equipment facing adjoining properties and right of way. Conservatively, the project should anticipate review by Planning and Zoning and negotiation of screening design for cooling towers (e.g. metal, louvered screening on the south, east, and west sides of the cooling towers).



The project is located in a “Commercial Industrial Mix District” per the City of Hartford Adopted Zoning Map, August 22, 2017. Properties across Capital Avenue are located in a “Neighborhood District.” According to the Hartford Noise Ordinance, Receptor Zone (Residential) Maximum Levels are 61 dBA during the day and 51 dBA during the night for noise emitted from an Industrial Zone. The Receptor Zone (Residential) Maximum Levels are 55 dBA during the day and 45 dBA during the night for noise emitted from a Commercial Zone. The cooling towers should include sound attenuation packages to reduce the transmission of noise across the project boundary down to an acceptable level, arguably 51 dBA.

#### **4.1.4 Pumps**

The basis of design pumps are defined by the 410 Capitol Ave. TEP Schematic Design.

The pumps include:

1. Primary hot water. Quantity: Three plus one future.
2. Secondary hot water. Quantity: Three plus one future.
3. Primary chilled water. Quantity: Three plus one future.
4. Secondary chilled water. Quantity: Three plus one future.
5. Condenser water. Quantity: Three plus one future.

### **4.2 Distribution**

The secondary pumps and piping shall connect to the existing CAS network. The general arrangement for 470 Capital Avenue is intended to connect to the CAS via a valve chamber at the north end of the building. From the valve chamber the piping will connect to either the existing tie-in north of the existing pump house, or the tie-in shown for the design of the 410 Capital Ave. thermal plant.

#### **4.2.1 Chilled Water**

The chilled water mains (secondary loop piping) are 20” as defined by the 410 Capitol Ave. TEP Schematic Design. The piping in the thermal plant will be supported above the equipment by new pipe racks with support columns, independent of the existing roof structure.

#### **4.2.2 Hot Water**

The hot water mains (secondary loop piping) are 14” as defined by the 410 Capitol Ave. TEP Schematic Design. The piping in the thermal plant will be supported above the equipment by new pipe racks with support columns, independent of the existing roof structure.

#### **4.2.3 Condenser Water**

The condenser water mains are 24” as defined by the 410 Capitol Ave. TEP Schematic Design. The piping in the thermal plant will be supported above the equipment by new pipe racks with support columns, independent of the existing roof structure. The condenser water piping will be routed from the condenser water pumps either up through the roof.

#### **4.2.4 Existing**

The eastern portion of the building (dining) contains existing mechanical piping (see Figure 7) from the pump house building to the north. The steam piping can be demolished for systems no longer served by steam heat. Any piping that must remain in service, including piping that passes through the space to adjacent buildings in the complex, can be re-routed around the eastern exterior of 470 Capitol Ave.





Figure 7: Existing mechanical piping in eastern portion of building (dining).

### 4.3 Building HVAC

The spaces will require heating, cooling and ventilation. The basis of design systems are air handlers with chilled water and hot water coils, and exhaust fans.

#### 4.3.1 ASHRAE Standard 15 – Refrigerating Machinery Room

The chiller plant comprises of 5,625 tons of cooling/refrigeration, neglecting the future equipment capacity. The quantity of refrigerant in the basis of design chillers is unknown at the time of Revision 2 of this Basis of Design document. Assuming 4 lbs of refrigerant per ton, the total charge of refrigerant is 22,500 lbs. The volume of space, including the space occupied by the equipment, piping, and structure is 246,800 CF. The corresponding estimate of refrigerant concentration in the event of a catastrophic leak is 0.0911 lbs/CF or 91.1 lbs/MCF. If only one refrigerant circuit is considered (1875 tons), then the refrigerant concentration would be 30.4 lbs/MCF.

Per ASHRAE Standard 15, the refrigerant concentration limit (RCL) is 26 lbs/MCF for R410A and 13 lbs/MCF for R134A. In either case, the requirement for a “refrigerating machinery room” must be met, including but not limited to refrigerant detection, alarms, and mechanical exhaust ventilation.

ASHRAE Standard 15, Section 8.12.c requires that “Walls, floor, and ceiling shall be tight and of noncombustible construction. Walls, floor, and ceiling separating the refrigerating machinery room from other occupied spaces shall be of at least one-hour fire-resistive construction.” The requirement for noncombustible construction in the space with wooden roof trusses may be addressed in one of two ways: 1) apply intumescent paint fireproofing to the exposed wood beams and roofing; 2) obtain a variance from the AHJ. A variance is justified on the basis that ASHREA Standard 15 imposes a requirement on the building construction that is otherwise not required by the IBC, and for systems that do not pose a risk of ignition of combustible materials (e.g. chillers). Hallam-ICS recommends pursuing a variance from the AHJ (option 2) for the safe use of the existing facility and to minimize alterations and costs.

#### 4.3.2 Existing

The existing HVAC system in the eastern portion of the building will be demolished.



## 5 Electrical

### 5.1 Power

#### 5.1.1 Utility Site Work

It is anticipated Eversource will proceed with the installation of two new underground switchgear manholes to complete a 22.9kV loop service for the facility, similar to the 410 Capitol Ave. TEP Schematic Design. Thus, the electric utility site work for 470 Capitol Ave. includes a loop running from the west and the east of the project area. The new routing of the underground loop can be run in closer proximity to building #410, and terminate at the existing 4.16kV manhole serving building #410 to the north. The two new 22.9kV feeder cables can then follow the 4.16kV underground raceway to the exterior of building #470. The new switchgear and utility primary metering cabinet can be relocated in closer proximity to the client owned outdoor utility isolation transformer UIT-1 location. This location will need to be coordinated with Eversource.

The possibility of tying into the 22.9kV service along Capitol Avenue by means of the alley between building #410 and #450, or through the courtyard between building #460 and #470, should also be explored with Eversource.

#### 5.1.2 Service Entrance

The existing electrical service to building #470 is fed through a meter and distribution in the adjacent pump house building to the north. The distribution does not have enough capacity for the thermal plant and the pump house building is located in the right of way of the potential highway construction (see Figure 6). The existing transformers in building #470 located on the equipment platform in the western portion of the building do not have enough capacity for the thermal plant.

The new outdoor utility isolation transformer (UIT-1) and new outdoor plant distribution transformer (T1) will be located in an enclosed area of the existing courtyard at the north side of the building. The existing courtyard will be excavated to accommodate transformer pads, less flammable liquid oil containment, and new ground grid (to meet 5 ohm system impedance to ground, and safe limits of step and touch).

A new 2 hour, fire resistance rated, protective concrete wall will be erected on the two exterior building walls enclosing the transformer switch yard. This wall will need to extend 30" above the roof line and extend 5 ft (minimum) horizontally from the edge of each transformer.

UIT-1 will be fed via an overhead feeder from the Eversource primary metering cabinet. The 4160V feeders from the transformer secondary will feed the MV switchgear located in the main electrical room, directly adjacent to the transformer yard. Transformer T1 primary will be fed from a breaker in the medium voltage switchgear (MVSG-1), and the secondary 480V feed will re-enter the main electrical room and feed the low voltage switchgear (LVSG-1). An outdoor overhead cabletray structure will be erected from each transformer to the exterior wall of the electrical room, and along the exterior wall of the electrical room to facilitate cabling.

#### 5.1.3 Main Distribution

The main electrical room configuration has been carried over from the 410 Capitol Ave. TEP Schematic Design with the following exceptions:

- LVSG-1 (480V): 500 ton chiller (400hp) has been removed
- MVSG-1 (4160V): 1875 ton chiller (1509 hp) has been added (capacity for future 1875 ton chiller to remain)
- MCC-1 / MCC-2 (480V): replace two 3MMBTU boilers with one 15MMBTU boiler, replace two 20MMBTU boilers with two 15MMBTU boilers, replace one future 20MMBTU boiler with one 15MMBTU boiler



The above modifications are not expected to modify upstream electrical service sizing, or layout of MVSG-1 or LVSG-1 switchgear. The 7.5 MVA service has approximately 21.5% reserve capacity under the following conditions: 90% loading of MCC-1 and MCC-2, and two chillers operating at 100% load.

MVSG-1 will feed the chiller 4.16kV VFD's. LVSG-1, MCC-1, and MCC-2 will feed the remaining 480V equipment. As much as practical the main equipment VFD's have been placed along the western wall, and will be fed via wall mount cabletray directly exiting the main electrical room. Other loads will be fed from conduit and cable supported on suspended strut.

#### **5.1.4 Generator**

Upon complete loss of the Eversource electrical supply, 4.16kV standby generators will be tied into the MV switchgear via outdoor termination cabinets. These have been located west of the transformer yard and should allow for the parking of two 2MW portable generators (further evaluation is required to confirm). The transfer will be accomplished manually in an open transition scheme, and a lockout relay will prevent the possibility of the generators feeding back into the utility system.



## 6 Plumbing

### 6.1 Domestic Water

The existing domestic water service is a 4" line in the middle portion of the building (see Figure 8). The domestic water service will need to be upgraded to a 6" line to meet the sizing defined by the 410 Capitol Ave. TEP Schematic Design. A new water service line can connect to the existing 12" water main under Capitol Avenue, similar to the design for the 410 Capitol Ave. TEP Schematic Design. Alternatively, a new water service line can connect to an existing 6" water line east of 470 Capitol Avenue; however, the load on this existing line and the available capacity is unknown.



**Figure 8: Water service entrance located in northeast corner of middle portion of building.**

Assuming 0.03 gpm/ton of evaporation and cooling tower make-up water, and based on a peak cooling load of 3,750 tons, the peak demand for water will be approximately 115 gpm.

### 6.2 Sanitary Waste

The existing connection to the municipal wastewater is unknown at the time of Revision 2 of this Basis of Design document. A new connection for sanitary waste will be required from a new floor drain system and oil-water separator. The IPC does not require an oil-water separator for this application.

According to existing drawings provided by the State of CT, there is an existing 60" sewer line located in the alleyway between 470 Capitol Avenue and 460 Capitol Avenue.

### 6.3 Natural Gas

The natural gas demand for the main equipment is 340 CFM per each 15 MMBtu/h boiler. The total natural gas demand for three boilers operating simultaneously is 1,020 CFM.

A new connection to the natural gas utility will be required. An existing pathway from Capitol Avenue exists to the west of the building, serving 490 Capitol Avenue; however, this is on the opposite side of the portion of the building with the gas-fired boilers. The new gas service line will tie into the existing 12" main under Capitol Avenue. According to the 410 Capitol Ave. TEP Schematic Design, the gas utility has the capability to provide up to 15 psig natural gas service.





## 7 Fire Protection

### 7.1 Building Classification and Hazard Classification

Per NFPA 2013, 2013 Edition, the most appropriate classification of the thermal plant is Ordinary Hazard Group 1. The text of the code is most appropriate to the boilers, chillers, electrical equipment and pumping systems.

“5.3.1.1 Ordinary hazard (Group 1) occupancies shall be de-fined as occupancies or portions of other occupancies where combustibility is low, quantity of combustibles is moderate, stockpiles of combustibles do not exceed 8 ft (2.4 m), and fires with moderate rates of heat release are expected.”

The entire building is to be fully sprinklered.

### 7.2 Water Supply

The existing supply of water for the sprinklers is 4" (see Figure 9), which is likely inadequate for the change in use and occupancy. Pending a sprinkler design and flow test data of the available water supply, we assume a new 6" fire protection main for the building.

Based on the design of the 410 Capitol Ave. TEP Schematic Design, fire pumps are not included/required.

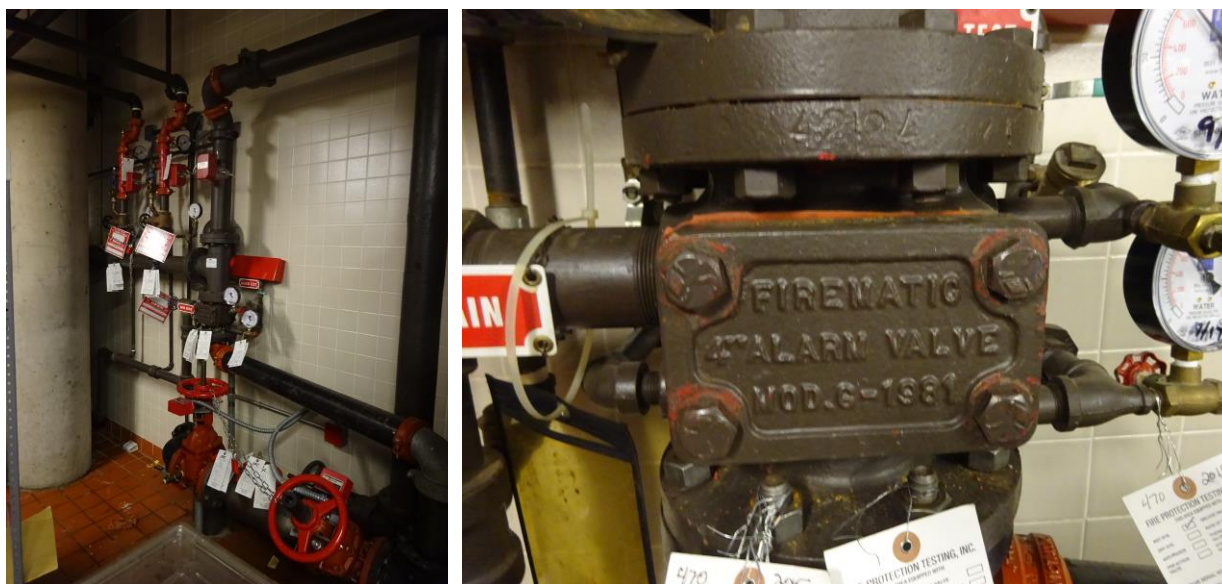


Figure 9: Fire protection riser located in northeast corner of middle portion of building.



## 8 Fire Alarm

The existing Simplex addressable fire alarm system in building #470 is tied into the central fire alarm system for the Capitol Avenue Complex. The existing fire alarm sub panel will be relocated to the entrance of the office space (existing to remain), and a new fire alarm sub panel will be installed at the south entrance to the Thermal Plant. This new addressable fire alarm sub panel will be dedicated to the thermal plant, and will also be tied into the main fire alarm panel for Capitol Avenue Complex.

This fire alarm system will interface with the plant control system, and shall be composed of the following:

- Manual pull stations at each exit (existing devices to be relocated)
- Strobes and emergency voice evacuation capable audible devices (new)
- Smoke and Heat detectors (existing to be relocated, and new devices required)

## 9 Structural

The existing building is slab on grade with no basement. The boilers, chillers, and pumps will be installed on equipment pads on the floor slab.

The cooling towers and associated piping will be supported from a new structural moment frame with bracing above the roof. The bracing will be arranged above the level of the existing roof. The frame columns will extend through the concrete waffle slab roof. This will require some selective demolition of the roof at the columns. A pitch pocket or other flexible roof flashing boot which will allow the new steel frame to move independently from the existing roof. As part of the final design, a thermal break detail may be incorporated into the columns. The new columns will typically be sixteen inch square structural steel tubes supported on five foot square isolated footings. The new footings will require some selective demolition of the existing slab and subsequent reconstruction. Wide flange steel beams will span between columns to support the cooling towers. Angle bracing in both directions with an associated level of steel just above the roof will provide lateral stability.

The cooling tower structure will impact the open volume of space below. Alternative arrangements of cooling towers were considered and a linear arrangement of the cells was found to be the most efficient in terms of space, structure and piping. The space below the cooling towers can be utilized for functions other than a thermal plant and can have an occupancy classification of B (see Section 3.1.1 Change of Use).

A similar frame system with five inch square structural steel tubes on three foot square isolated footings will be used to support piping near the elevation of the bottom chord of the existing timber roof trusses. W10 structural steel beams will span between columns to provide support for the piping. Four inch square structural steel tube X-bracing will be used for seismic resistance.



## 10 Utility Connection List

**Table 2: Utility Connection List**

| Utility                  | Requirements                                                                             | Existing                         | Alteration                                                                   |
|--------------------------|------------------------------------------------------------------------------------------|----------------------------------|------------------------------------------------------------------------------|
| Electric                 | 22.9 kV feed,<br>7.5MVA utility isolation<br>transformer                                 | Less than required               | See Section 5.1.1 Utility Site<br>Work and Section 5.1.2 Service<br>Entrance |
| Gas                      | 1,020 CFM,<br>See Section 6.3 Natural Gas                                                | Less than required               | See Section 6.3 Natural Gas                                                  |
| Domestic<br>Water        | 6",<br>115 gpm<br>See Section 6.1 Domestic<br>Water                                      | 4"                               | See Section 6.1 Domestic<br>Water                                            |
| Sanitary<br>Waste Water  | 2"                                                                                       | 60" main adjacent<br>to building | See Section 6.2 Sanitary Waste                                               |
| Fire Protection<br>Water | TBD                                                                                      | 4"                               | See Section 7.2 Water Supply                                                 |
| Hot Water                | 14" supply and return,<br>40 MMBtu/h<br>3,336 gpm<br>(two secondary pumps)               | N/A                              | See Section 4.2.2 Hot Water                                                  |
| Chilled Water            | 20" supply and return,<br>3,750 tons (summer load)<br>7,264 gpm<br>(two secondary pumps) | N/A                              | See Section 4.2.1 Chilled Water                                              |





## 11 Permits

**Table 3: Permit Requirements**

| Permit                                                                                                                                               | Rqd. for 410 Capitol Ave. | Rqd. for 470 Capitol Ave.                                              | Significant Activities for 470 Capitol Ave.                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Army Corps of Engineers – Individual Permit                                                                                                          | Yes                       | Yes, for site utility work                                             |                                                                                                                                                                                            |
| EPA – Form 1170 DCS PCBs in Caulk Policy                                                                                                             | TBD                       | TBD                                                                    |                                                                                                                                                                                            |
| Federal Aviation Administration – Notice of Proposed Construction or Alteration                                                                      | Yes                       | Yes, for exhaust stack                                                 |                                                                                                                                                                                            |
| DAS Office of Design and Construction – Above and/or Underground Storage Tank Installation                                                           | Yes                       | No, oil water separators are not required by IPC for this application. | The EPA has published a technical compendium for underground storage tanks that describes exclusions of regulation for oil water separators discharging to publicly owned treatment works. |
| DAS Office of Design and Construction – Above and/or Underground Storage Tank Removal                                                                | Yes                       | No                                                                     |                                                                                                                                                                                            |
| DAS Office of Design and Construction – Connecticut Environmental Policy Act (CEPA) and Initial Environmental Review                                 | Yes                       | Yes                                                                    |                                                                                                                                                                                            |
| DAS Office of Design and Construction – Environmental Site Assessments: Initial Site Assessment, Phase I, Phase II, Phase III, Remedial Action (RAP) | Yes                       | Yes                                                                    |                                                                                                                                                                                            |
| DAS Office of Design and Construction – Hazardous Material Inspection/Abatement Request (asbestos, PCBs, lead, or indoor air quality).               | Yes                       | Yes                                                                    |                                                                                                                                                                                            |
| DAS Office of Design and Construction – High Performance Buildings                                                                                   | Yes                       | Yes                                                                    | Perform “Pre-Design High Performance Building Feasibility Study.”                                                                                                                          |
| DAS Office of Design and Construction – National Environmental Policy Act (NEPA)                                                                     | TBD                       | TBD                                                                    | To be determined by civil engineer.                                                                                                                                                        |
| DAS Office of Design and Construction – Transfer Act Site Assessment (TASA)                                                                          | TBD                       | TBD                                                                    |                                                                                                                                                                                            |



| Permit                                                                                                           | Rqd. for 410 Capitol Ave. | Rqd. for 470 Capitol Ave. | Significant Activities for 470 Capitol Ave.              |
|------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------|----------------------------------------------------------|
| DAS Office of Design and Construction – Building and Fire Safety Codes Review, Schematic Design Submittal        | TBD                       | TBD                       |                                                          |
| DAS Office of Design and Construction – Building and Fire Safety Codes Review, Design Development Submittal      | TBD                       | TBD                       |                                                          |
| DAS Office of Design and Construction – Building and Fire Safety Codes Review, Contract Documents Submittal      | TBD                       | TBD                       |                                                          |
| DAS Office of Design and Construction – Building and Fire Safety Codes Review, ICC Plan Review Record Forms      | Yes                       | Yes                       |                                                          |
| DAS Office of Design and Construction – Building and Fire Safety Codes Review, Connecticut State Demolition Code | Yes                       | Yes                       |                                                          |
| DAS Office of Design and Construction – Building and Fire Safety Codes Review, Certificate of Compliance         | Yes                       | Yes                       |                                                          |
| DAS Office of Design and Construction – Building and Fire Safety Codes Review, Statement of Special Inspections  | Yes                       | Yes                       |                                                          |
| DAS Office of Design and Construction – Building Code Modification Request                                       | TBD                       | Yes                       | Variance request for ASHRAE Standard 15, Section 8.12.c. |
| DAS Office of Design and Construction – Accessibility Exemption Waiver Request                                   | TBD                       | No                        |                                                          |
| DAS Office of Design and Construction – Chair Lifts, Wheelchair, and Limited Elevators Application               | TBD                       | No                        |                                                          |
| DAS Office of Design and Construction – Fire Code Modification Request                                           | TBD                       | TBD                       |                                                          |
| DAS Office of Design and Construction – Construction Project Close-Out: Certificate of Substantial Completion    | Yes                       | Yes                       |                                                          |



| Permit                                                                                                                                                                                                             | Rqd. for 410 Capitol Ave. | Rqd. for 470 Capitol Ave. | Significant Activities for 470 Capitol Ave.                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DAS Office of Design and Construction – Construction Project Close-Out: Certificate of Compliance                                                                                                                  | Yes                       | Yes                       |                                                                                                                                                                                                                                                                              |
| DAS Office of Design and Construction – Construction Project Close-Out: Certificate of Acceptance                                                                                                                  | Yes                       | Yes                       |                                                                                                                                                                                                                                                                              |
| DAS Office of Design and Construction – Construction Project Close-Out: Certificate of Completion                                                                                                                  | Yes                       | Yes                       |                                                                                                                                                                                                                                                                              |
| DAS Office of Design and Construction – Construction Project Close-Out: Certificate of Compliance Requirements for:<br>Fire Alarm System Inspection Testing;<br>Certification for all Protective Signaling Systems | Yes                       | Yes                       |                                                                                                                                                                                                                                                                              |
| Department of Economic and Community Development (DECD) – State Historic Preservation Office: Impact to Cultural Resources                                                                                         | TBD                       | Yes                       | Approval to renovation of eastern portion of building, including exhaust stack and exterior breaching, as well as approval of cooling tower screening. According to the State of CT the cafeteria building is a contributing structure in the Frog Hollow historic district. |

| Permit                                                                                                                                                                                                                         | Rqd. for 410 Capitol Ave. | Rqd. for 470 Capitol Ave.                   | Significant Activities for 470 Capitol Ave.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Air Management<br>(Individual Permits): Title V Operating Permit                                                                                         | TBD                       | No                                          | To determine the requirement for this permit, an “application package must be submitted. “Upon receipt of the application package, a preliminary review of the application is conducted for sufficiency and general consistency with applicable standards and criteria. An initial technical review is performed to assess the maximum potential emissions of the facility. . . If a permit is required, a detailed technical review is conducted to ensure that all applicable requirements have been identified and that the source is in compliance with such requirements.” [Air Emissions - Title V Operating Permit – An Environmental Permitting Fact Sheet]<br><br>Based on 97,000 MMBTU/yr of natural gas consumption and 30 ppm NOx emissions, the heating plant will produce approximately 5,690 tons of CO2e and approximately 0.5 tons of NO2, both of which are below the Title V thresholds. |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Air Management<br>(Individual Permits): New Source Review Permit                                                                                         | Yes                       | Yes                                         | An engineering study is required to determine required stack height.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Materials Management and Compliance Assurance (Individual Permits): Pre-Treatment Permit (Sewer Permit) for Discharges to Publicly Owned Treatment Works | Yes                       | Yes                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Materials Management and Compliance Assurance (Individual Permits): Underground Storage Tank Registration                                                | TBD                       | No, storage tanks are not in scope of work. | The EPA has published a technical compendium for underground storage tanks that describes exclusions of regulation for oil water separators discharging to publicly owned treatment works.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Permit                                                                                                                                                                                                                                         | Rqd. for 410 Capitol Ave. | Rqd. for 470 Capitol Ave.                                | Significant Activities for 470 Capitol Ave. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------------------------|---------------------------------------------|
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Materials Management and Compliance Assurance (General Permits):<br>Contaminated Soil and/or Sediment Management                                                         | Yes                       | Yes                                                      |                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Aquifer Protection Area:<br>Registration Form for Regulated Activities in Aquifer Protection Area                  | TBD                       | No, project is not located in an Aquifer Protection Area |                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Aquifer Protection Area: Permit Form to Add a Regulated Activity to a Registered Facility in an Aquifer Protection | TBD                       | No, project is not located in an Aquifer Protection Area |                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Domestic Sewage                                                                                                    | Yes                       | Yes                                                      |                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Hydrostatic Pressure Testing Wastewater                                                                            | Yes                       | Yes                                                      |                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Minor Boiler Blowdown Wastewater                                                                                   | Yes                       | Yes                                                      |                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Minor Non-Contact Cooling and Heat Pump Water                                                                      | Yes                       | Yes                                                      |                                             |



| Permit                                                                                                                                                                                                   | Rqd. for 410 Capitol Ave. | Rqd. for 470 Capitol Ave.                                                                                                         | Significant Activities for 470 Capitol Ave. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Miscellaneous (MISC) Discharges of Sewer Compatible Wastewater               | Yes                       | Yes                                                                                                                               |                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Stormwater and Dewatering Wastewater Associated with Construction Activities | Yes                       | Yes                                                                                                                               |                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Stormwater Assoc. w/ Commercial Activity                                     | TBD                       | TBD                                                                                                                               |                                             |
| Department of Energy & Environmental Protection (DEEP)<br>– Bureau of Water Protection and Land Reuse (General Permits):<br>Stormwater Assoc. w/ Industrial Activity                                     | TBD                       | TBD                                                                                                                               |                                             |
| Department of Transportation (DOT) – Encroachment Permit                                                                                                                                                 | No                        | Yes, or utilities in right of way of construction easement                                                                        |                                             |
| City of Hartford – Greater Hartford Flood Certificate Approval                                                                                                                                           | Yes                       | No, project is not in a flood plain, will not affect flood control infrastructure, and will not increase impervious surface area. |                                             |



| Permit                                                                         | Rqd. for 410 Capitol Ave. | Rqd. for 470 Capitol Ave.        | Significant Activities for 470 Capitol Ave.                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------|---------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Municipalities – Planning and Zoning (Historic Preservation)                   | TBD                       | Yes                              | Approval of exterior alterations to existing building and screening of cooling towers, per the Hartford Preservation Ordinance. Applications must be submitted at least 7 days before the monthly Commission meeting, and shall include 2 sets of architectural plans. Approval is required before applying for a demolition permit. Thus, delivery and approval of a set of review drawings is advisable before Issued for Bid / Permit drawings. |
| Municipalities – Building Demolition Permit                                    | TBD                       | Yes, for alteration of building. |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utility Service Companies – Energy Conservation Programs                       | Yes                       | Yes                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utility Service Companies – Energy Conscious Blueprint (CL&P new construction) | TBD                       | TBD                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utility Service Companies – Energy Opportunities (CL&P)                        | TBD                       | TBD                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utility Service Companies – Energy Blueprint United Illuminating Company       | TBD                       | TBD                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Cable TV                                                           | TBD                       | TBD                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Closed Circuit TV                                                  | TBD                       | TBD                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Electric                                                           | TBD                       | TBD                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Fire Alarm                                                         | TBD                       | Yes                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Gas                                                                | TBD                       | TBD                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Security Systems                                                   | TBD                       | TBD                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Septic                                                             | TBD                       | No                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Sewer                                                              | TBD                       | Yes                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Telephone                                                          | TBD                       | TBD                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Utilities – Water Supply                                                       | TBD                       | Yes                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Installer-Boiler Registration & Inspection Request                             | Yes                       | Yes                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Boiler Installation Report                                                     | Yes                       | Yes                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |





End

## **APPENDIX C**



SourceOne - State of CT  
470 Capitol Ave.  
Hartford, CT 06106  
Schematic Design - Option C

## DRAWING LIST

| GENERAL        |                                 |          |
|----------------|---------------------------------|----------|
| DRAWING NUMBER | DRAWING NAME                    | REVISION |
| G0.00          | SITE - GENERAL ARRANGEMENT PLAN | A        |
| G0.01          | LEVEL 1 - GENERAL ARRANGEMENT   | D        |
| G0.02          | ROOF - GENERAL ARRANGEMENT PLAN | D        |

| STRUCTURAL     |                                    |          |
|----------------|------------------------------------|----------|
| DRAWING NUMBER | DRAWING NAME                       | REVISION |
| S100           | FOUNDATION PLAN                    | A        |
| S101           | ROOF FRAMING PLAN                  | A        |
| S102           | COOLING TOWER SUPPORT FRAMING PLAN | A        |
| S300           | SECTION                            | A        |
| S301           | SECTION                            | A        |
| S302           | SECTION                            | A        |
| S303           | SECTION                            | A        |

|                |                     |          |
|----------------|---------------------|----------|
| MECHANICAL     |                     |          |
| DRAWING NUMBER | DRAWING NAME        | REVISION |
| M3.01          | MECHANICAL SECTIONS | C        |

CONSULTANTS:

**HallamICS**  
AN EMPLOYEE OWNED COMPANY  
8 Eastwood Drive, Suite 200  
South Burlington, VT 05403  
Tel: 802.658.4891 [www.Hallam-ICS.com](http://www.Hallam-ICS.com)

NOT FOR CONSTRUCTION

|    |            |                   |
|----|------------|-------------------|
|    |            |                   |
|    |            |                   |
|    |            |                   |
|    |            |                   |
|    |            |                   |
| c  | 10/23/2019 | ISSUED FOR REVIEW |
|    | 09/27/2019 | ISSUED FOR REVIEW |
|    | 09/23/2019 | ISSUED FOR REVIEW |
| d. | Date       | Description       |

JED

SourceOne - State of CT  
Schematic Design - Option C  
470 Capitol Ave.  
Hartford, CT 06106

DRAWING TITLE:  
TITLE SHEET

|           |            |
|-----------|------------|
| DESIGNED: | DATE:      |
| IL        | 08/30/2019 |
| CHECKED:  | PROJ. No.  |
| BW        | 20463.000  |
| SHEET NO. |            |

Г0.00

SHEET SIZE: 30x42





|             |                        |
|-------------|------------------------|
| — CDS —     | CONDENSER WATER SUPPLY |
| --- CDR --- | CONDENSER WATER RETURN |
| — E —       | UNDERGROUND ELECTRICAL |
| — F —       | FIRE PROTECTION        |
| — G —       | NATURAL GAS            |
| — CHWS —    | CHILLED WATER SUPPLY   |
| — CHWR —    | CHILLED WATER RETURN   |
| — HWS —     | HOT WATER SUPPLY       |
| — HWR —     | HOT WATER RETURN       |
| — S —       | SANITARY WASTE         |
| — W —       | MUNICIPAL WATER        |

|      |                              |
|------|------------------------------|
| CHWS | CHILLED WATER SUPPLY         |
| CHWR | CHILLED WATER RETURN         |
| CDS  | CONDENSER WATER SUPPLY       |
| CDR  | CONDENSER WATER RETURN       |
| GEN  | GENERATOR                    |
| HWS  | HOT WATER SUPPLY             |
| HWR  | HOT WATER RETURN             |
| HX   | HEAT EXCHANGER               |
| LV   | LOW VOLTAGE                  |
| MCC  | MOTOR CONTROL CENTER         |
| MV   | MEDIUM VOLTAGE               |
| PNL  | PANEL                        |
|      | TYPICAL                      |
| UPS  | UNINTERRUPTIBLE POWER SUPPLY |
| VFD  | VARIABLE FREQUENCY DRIVE     |
| XFO  | TRANSFORMER                  |

NOT FOR CONSTRUCTION

|        |            |                   |
|--------|------------|-------------------|
| B      | 09/27/2019 | ISSUED FOR REVIEW |
| A      | 09/23/2019 | ISSUED FOR REVIEW |
| No.    | DATE       | ISSUED            |
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SourceOne - State of CT  
Schematic Design - Option C  
470 Capitol Ave.  
Hartford, CT 06106

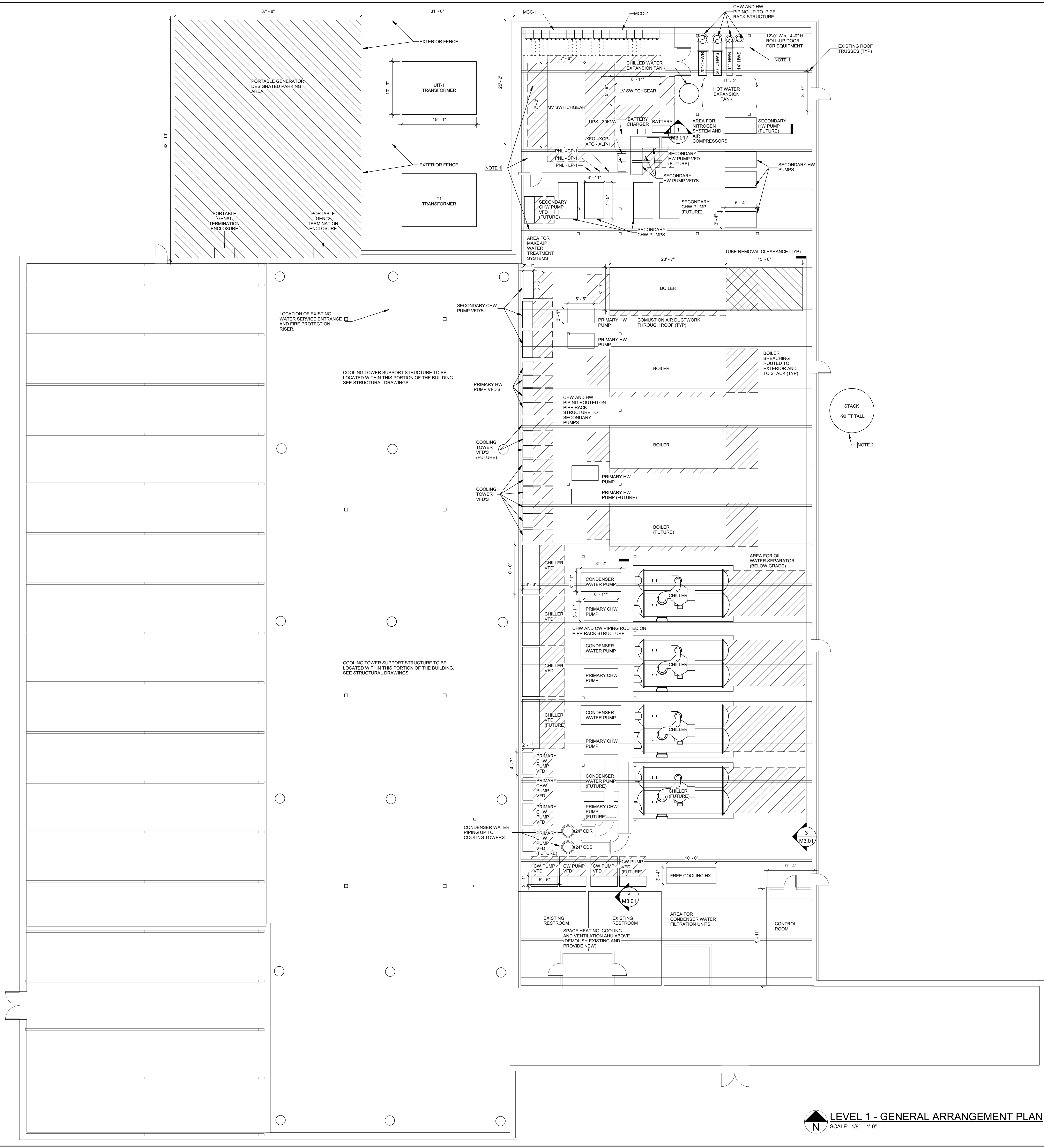
DRAWING TITLE:

SITE  
GENERAL ARRANGEMENT  
PLAN

|           |            |
|-----------|------------|
| DESIGNED: | DATE:      |
| TS/BW     | 09/23/2019 |
| CHECKED:  | PROJ. No.  |
| BW        | 20463.000  |
| SHEET NO. |            |

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GENERAL NOTES:  
A. EQUIPMENT SHOWN AS BLOCKS REPRESENTING EXTREMES OF DIMENSIONS.  
B. CHILLERS SHOWN AS BASIS OF DESIGN SELECTION BY YORK.  
C. SQUARE FOOTAGE OF EASTERN PORTION OF BUILDING TO BE CLASSIFIED AS F-1. 11,050 SF. AREA DOES NOT INCLUDE EXISTING RESTROOMS AND CLOSET.

KEYED NOTES:  
1. EXISTING MECHANICAL PIPING THRU ROOF TRUSSES TO BE DEMOLISHED OR RELOCATED AS REQUIRED. PIPING SERVING ADJACENT BUILDINGS IN THE COMPLEX TO BE RE-ROUTED TO THE EASTERN EXTERIOR OF 470 CAPITOL AVE AND SUPPORTED BY PIPE RACKS.  
2. AN ENGINEERING STUDY IS REQUIRED TO DETERMINE REQUIRED STACK HEIGHT.

CONSULTANTS:  
**Hallam ICS**  
AN EMPLOYEE OWNED COMPANY  
38 Eastwood Drive, Suite 200  
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Tel: 802.658.4891 www.Hallam-ICS.com

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| C      | 09/27/2019 | ISSUED FOR REVIEW   |
| B      | 08/23/2019 | ISSUED FOR REVIEW   |
| A      | 08/30/2019 | GENERAL ARRANGEMENT |
| No.    | Date       | Description         |
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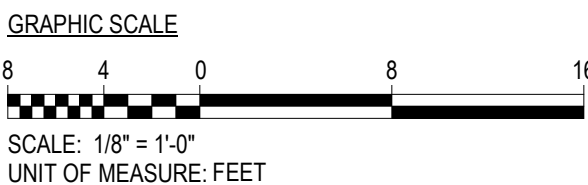
DRAWING TITLE:  
**LEVEL 1 -  
GENERAL  
ARRANGEMENT**

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| DESIGNED: | DATE:      |
| BITW/STK  | 08/30/2019 |
| CHECKED:  | PROJ. NO.  |
| BW        | 20463.000  |
| SHEET NO. |            |

**G0.01**

SHEET SIZE: 30x42

**LEVEL 1 - GENERAL ARRANGEMENT PLAN**  
SCALE: 1/8" = 1'-0"





A. THE PROJECT SHOULD ANTICIPATE REVIEW BY PLANNING AND ZONING AND NEGOTIATION OF SCREENING DESIGN FOR COOLING TOWERS (E.G. METAL, LOUVERED SCREENING ON THE SOUTH, EAST, AND WEST SIDES OF THE COOLING TOWERS).

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South Burlington, VT 05403  
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|  | 09/27/2019 | ISSUED FOR REVIEW   |
|  | 09/23/2019 | ISSUED FOR REVIEW   |
|  | 08/30/2019 | GENERAL ARRANGEMENT |
|  | Date       | Description         |
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Schematic Design - Option C  
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DRAWING TITLE:  
**ROOF - GENERAL  
ARRANGEMENT  
PLAN**

|           |            |
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| DESIGNED: | DATE:      |
| BW        | 08/30/2019 |
| CHECKED:  | PROJ. No.  |
| OWN       | 20463.000  |
| SHEET NO. |            |

G0.02

SHEET SIZE: 30x42

 **ROOF - GENERAL ARRANGEMENT PLAN**  
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE

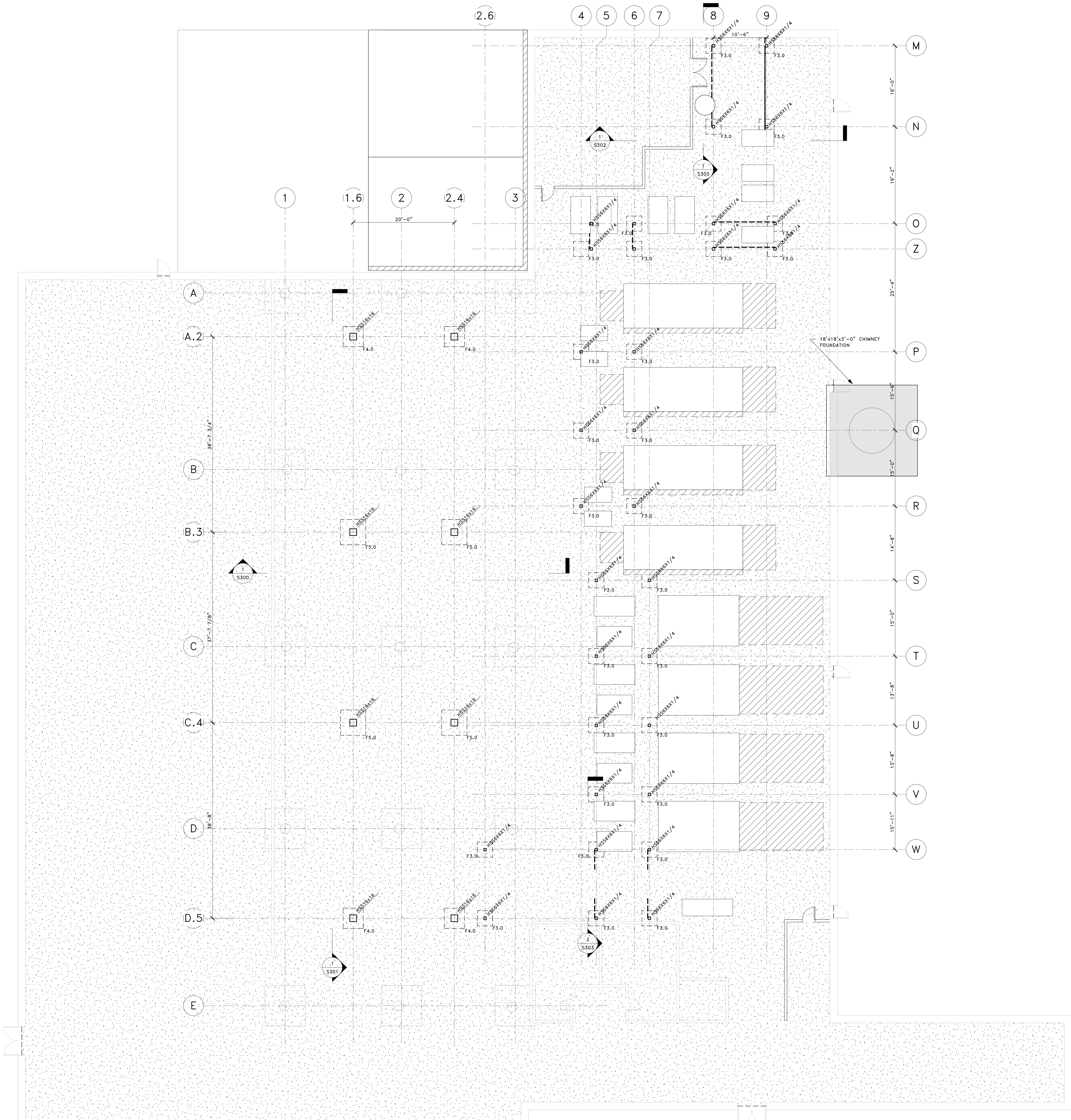
SCALE:  $1/8" = 1'-0"$   
UNIT OF MEASURE: FEET

10/23/2019 4:55:25 PM

20463.000\ Schematic Design - Option C



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FOUNDATION PLAN

SCALE: 1/8" = 1'-0"

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|     |         | ISSUED            |

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Hartford, CT 06106

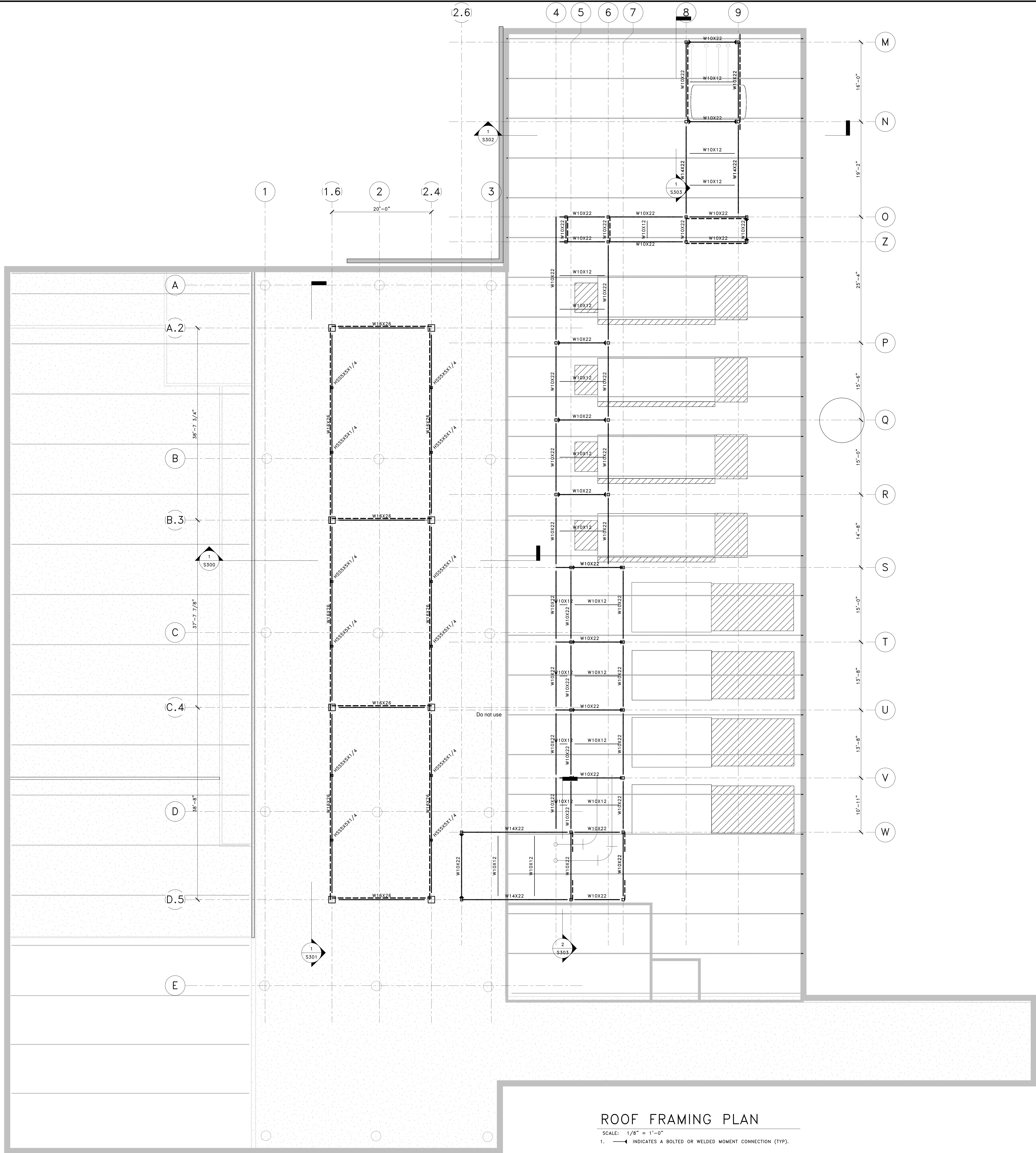
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**FOUNDATION PLAN**

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| DESIGNED: | DATE:      |
| CEP       | 09/19/2019 |
| CHECKED:  | PROJ. NO.  |
| CEP       | 20463.000  |
| SHEET NO. |            |

**S100**

SHEET SIZE: 30x42





ROOF FRAMING PLAN

SCALE: 1/8" = 1'-0"  
1. INDICATES A BOLTED OR WELDED MOMENT CONNECTION (TYP).

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DRAWING TITLE:  
**EQUIPMENT  
FRAMING PLAN**

|           |            |
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| DESIGNED: | DATE:      |
| CEP       | 09/19/2019 |
| CHECKED:  | PROJ. NO.: |
| CEP       | 20463.000  |
| SHEET NO. |            |

**S101**

SHEET SIZE: 30x42



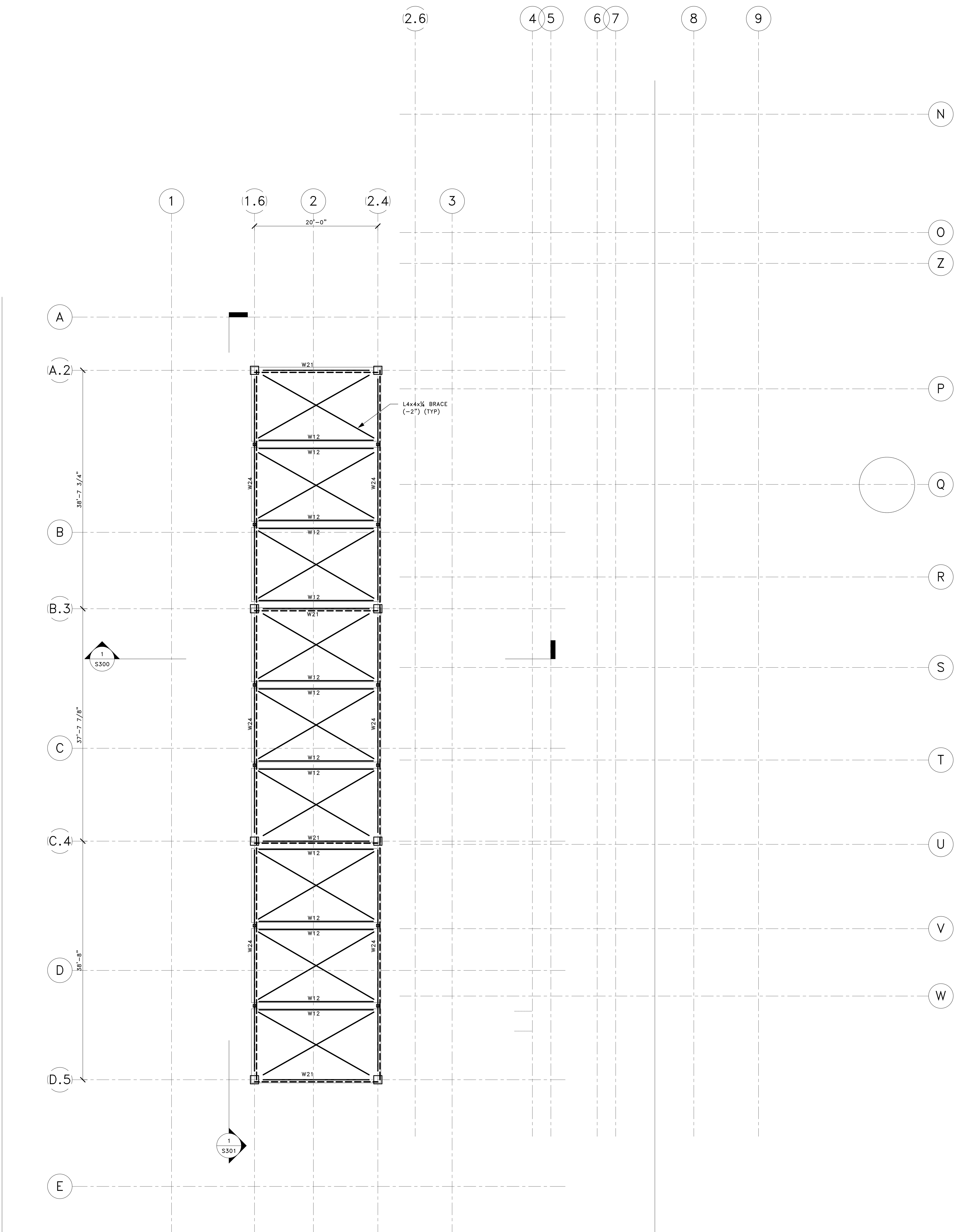
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DRAWING TITLE:  
COOLING TOWER  
SUPPORT  
FRAMING PLAN

|           |            |
|-----------|------------|
| DESIGNED: | DATE:      |
| Designer  | 09/19/2019 |
| CHECKED:  | PROJ. No.  |
| Checker   | 20463.000  |
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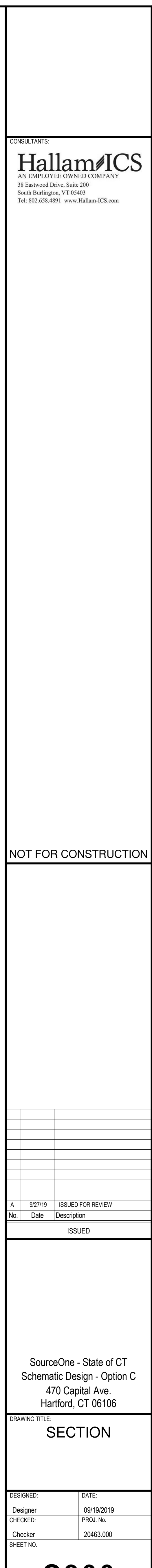
S102



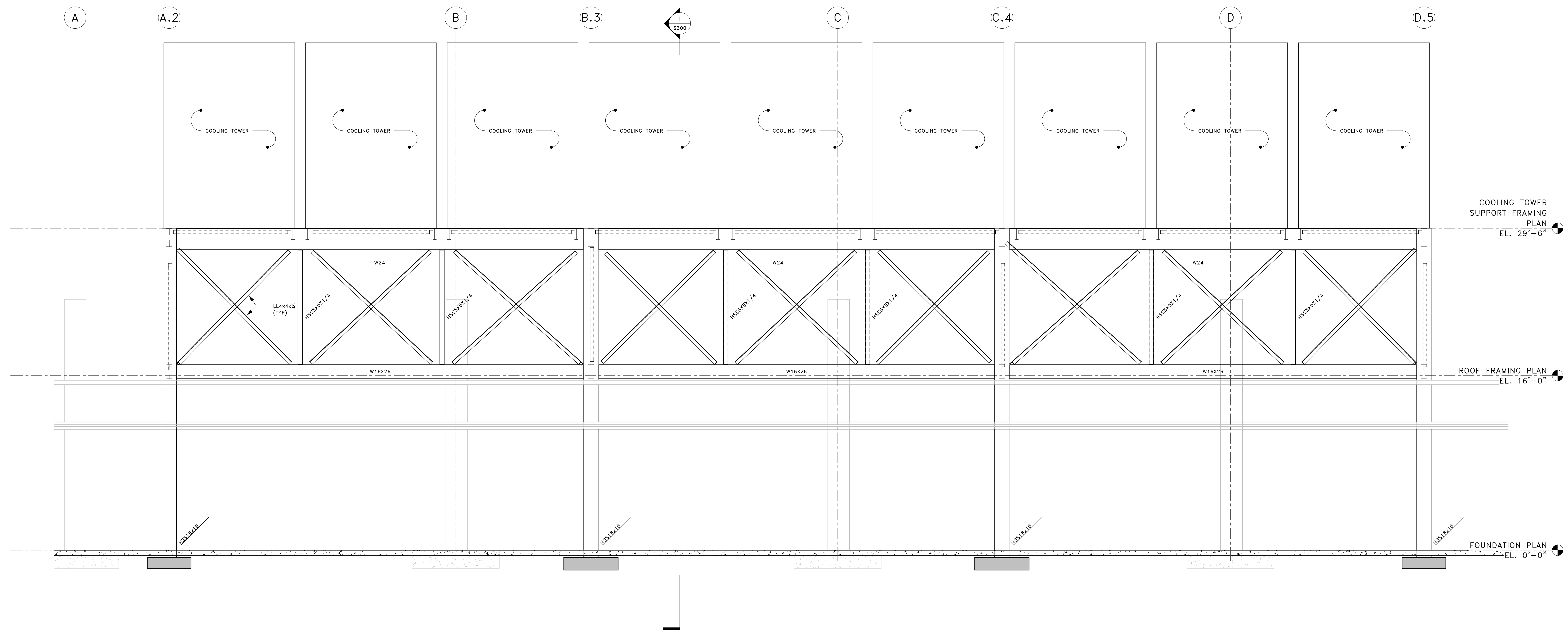
# COOLING TOWER SUPPORT FRAMING PLAN

SCALE: 1/8" = 1'-0"









1 SECTION  
S100 S301 SCALE: 1/4" = 1'-0"

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DRAWING TITLE:  
SECTION

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| DESIGNED: | DATE:      |
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| CHECKED:  | PROJ. No.  |
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S301





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| No.    | Date    | Description       |
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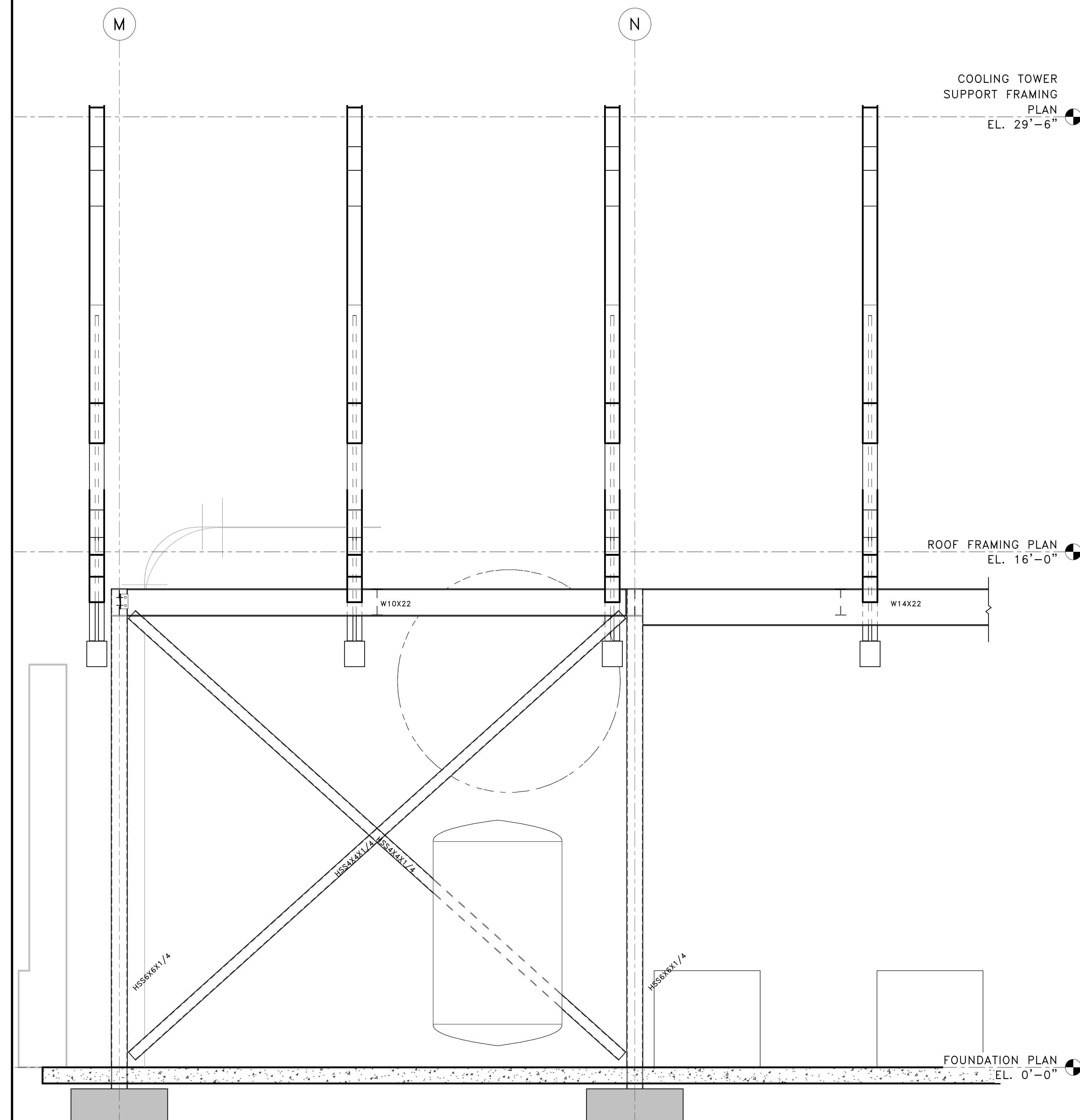
SECTION

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| Designer  | 09/19/2019 |
| CHECKED:  | PROJ. No.  |
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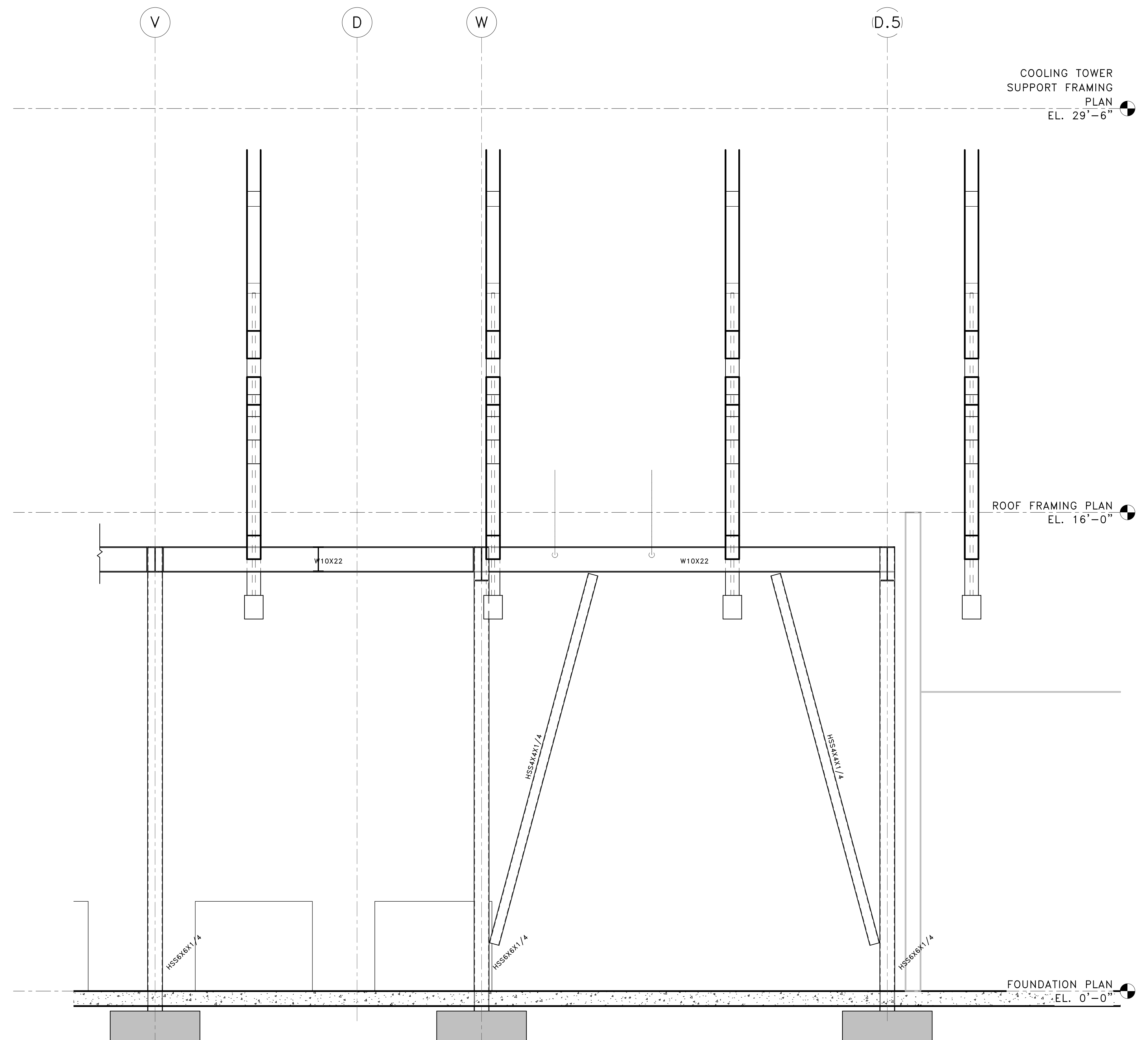
S302

SHEET SIZE: 30x42





1 SECTION  
S100 S303 SCALE: 1/2" = 1'-0"



2 SECTION  
\$100 \$303 SCALE: 1/2" = 1'-0"

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DRAWING TITLE:

SECTION

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| DESIGNED: | DATE:      |
| Designer  | 09/19/2019 |
| CHECKED:  | PROJ. No.  |
| Checker   | 20463.000  |
| SHEET NO. |            |

S303

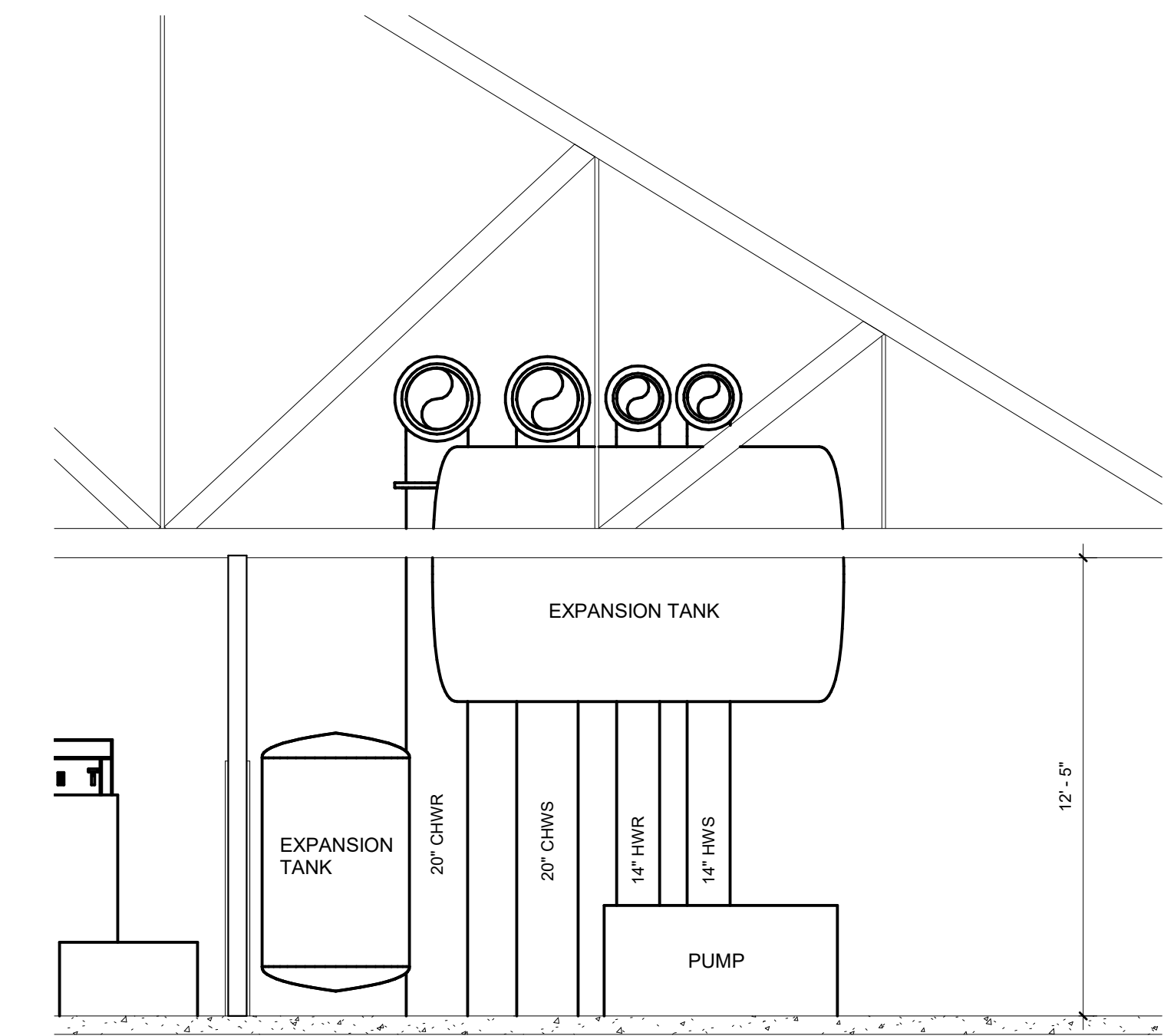




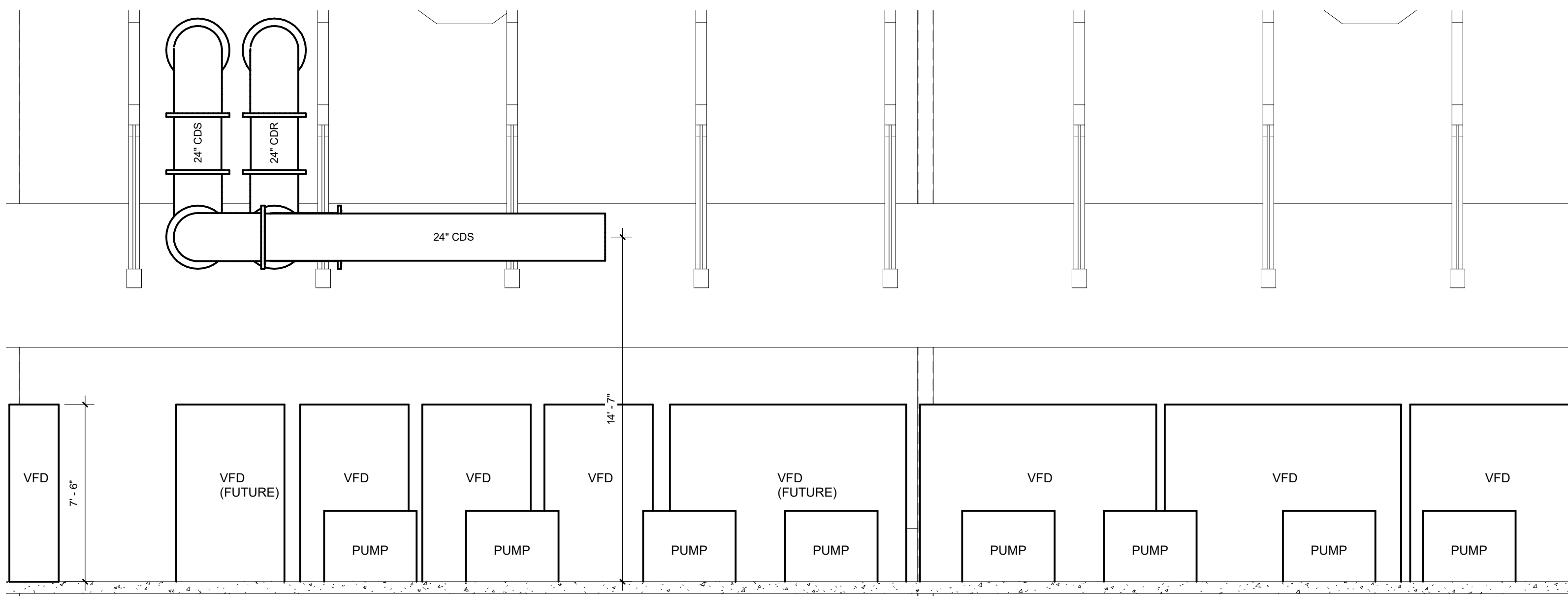


GENERAL NOTES:  
A. EQUIPMENT SHOWN AS BLOCKS REPRESENTING EXTREMES OF DIMENSIONS.  
B. CHILLERS SHOWN AS BASIS OF DESIGN SELECTION BY YORK WITH 6" CONCRETE PAD.

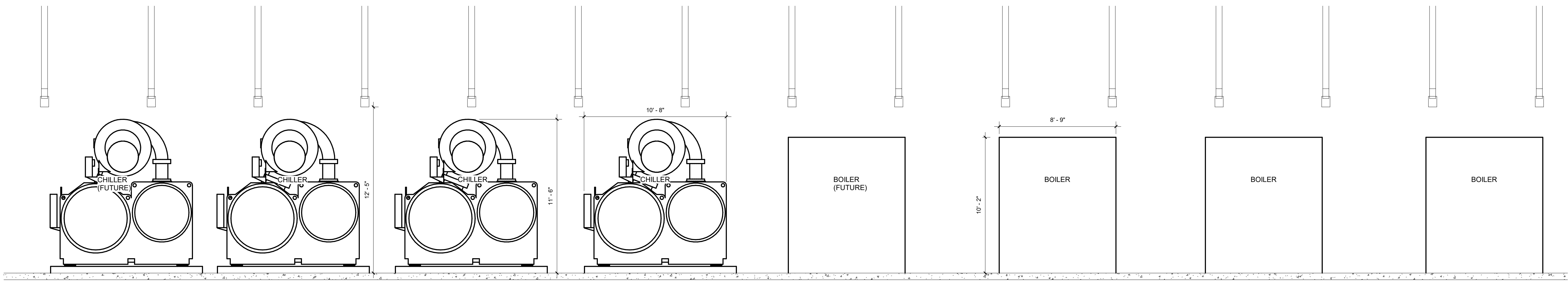
CONSULTANTS:  
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**1** SECTION OF CHILLED WATER AND HOT WATER PIPING  
SCALE: 1/4" = 1'-0"



**2** SECTION OF PUMPS, VFD'S AND CONDENSER WATER PIPING  
SCALE: 1/4" = 1'-0"



**3** SECTION OF CHILLERS AND BOILERS  
SCALE: 1/4" = 1'-0"

NOT FOR CONSTRUCTION

| No. | Date       | Description       |
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| A   | 09/23/2019 | ISSUED FOR REVIEW |

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DRAWING TITLE:  
**MECHANICAL SECTIONS**

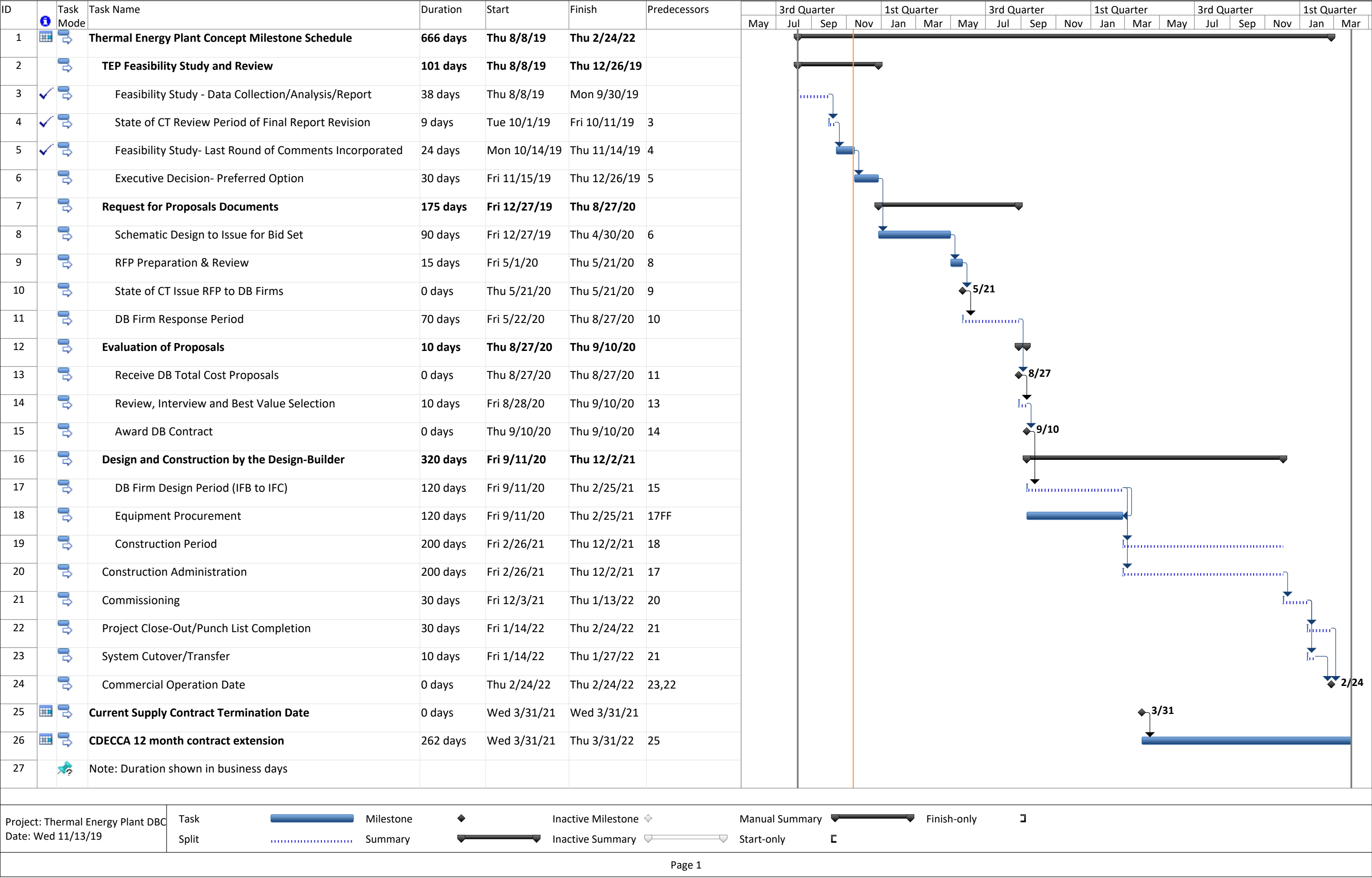
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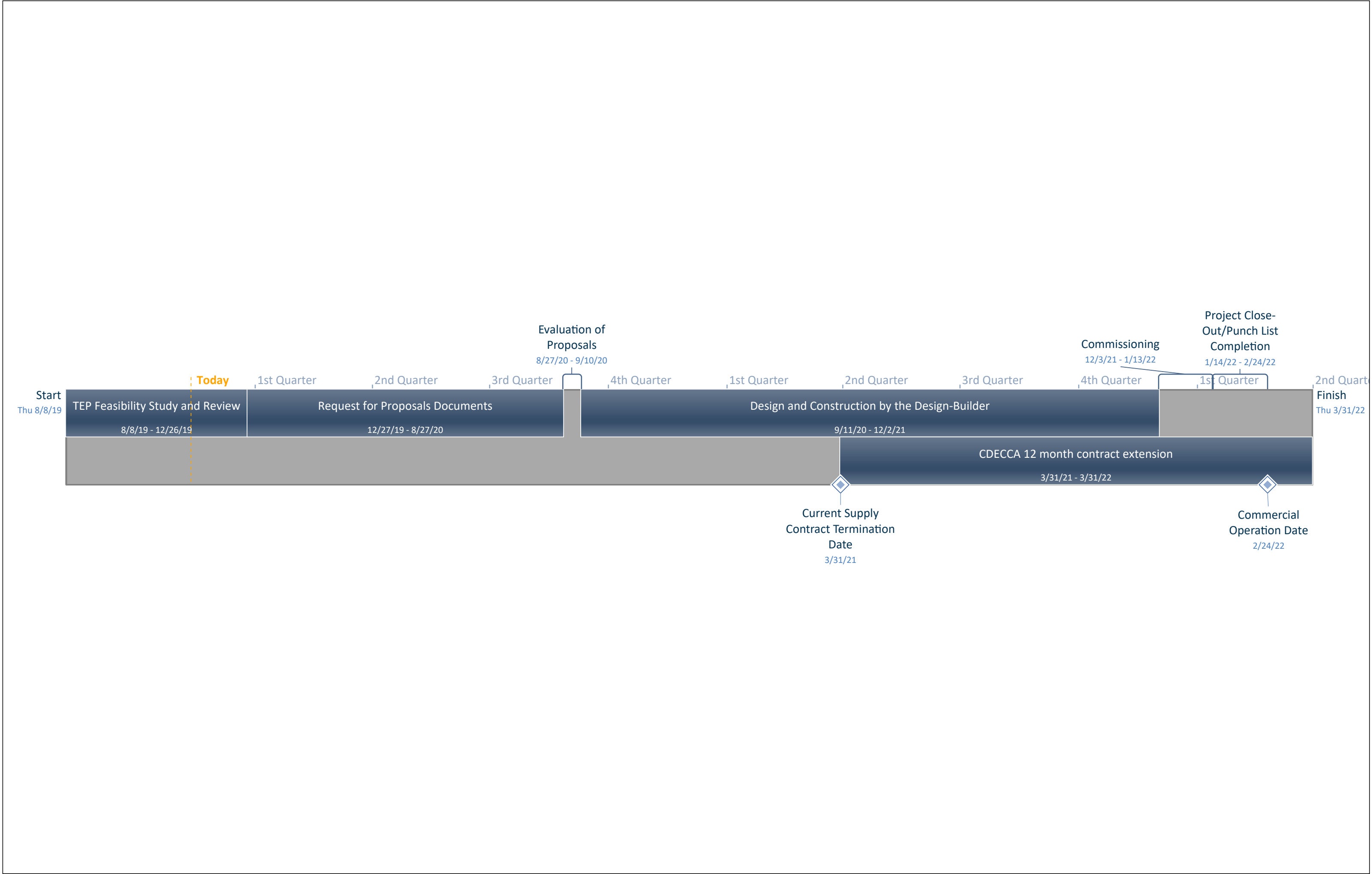
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SHEET SIZE: 30x42



## **APPENDIX D**





## **APPENDIX E**



## Opinion of Probable Capital Cost- Option C

|                 |                                                                                                             | <u><b>470 Capitol Avenue</b></u> |
|-----------------|-------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>ITEM NO.</b> | <b>DESCRIPTION</b>                                                                                          | <b>COST</b>                      |
| 1               | Engineering [Schematic-to-IFB plus IFB-to-IFC by DB]                                                        | \$ 900,000                       |
| 2               | Procurement                                                                                                 | \$ 7,245,000                     |
| 3               | Construction Directs                                                                                        | \$ 10,270,000                    |
| 4               | Construction Management                                                                                     | \$ 1,125,000                     |
| 5               | Commissioning, Training, Testing<br>[2.5% of Engineering, Procurement, Construction Directs and Management] | \$ 489,000                       |
| 6               | Building, Trade, and Air Permit Allowance                                                                   | \$ 190,000                       |
| 7               | Utility Incentives (Boilers & Chillers)                                                                     | -\$ 360,000                      |
| 8               | <b>TOTAL</b>                                                                                                | <b>\$ 19,859,000</b>             |

### CLARIFICATIONS:

- 1 Pricing based on using union contractors (prevailing wages).
- 2 Costs assume free and clear access to the site.
- 3 All work to be accomplished on a "straight " time basis, any shift, weekend, or holiday work is excluded.
- 4 All special insurances and bonds are excluded.
- 5 The identification, removal, and disposal of any hazardous material is excluded.
- 6 Existing systems are of adequate pressure, volume, and size to accommodate the new work.
- 7 A building & trades permitting allowance of \$150,000 is included in the cost estimate.
- 8 State provided Air Permitting estimate of \$40,000.
- 9 No piling or deep foundations are included.
- 10 Total area of concrete pads and equipment footings is ~4300 sq ft.
- 11 Cost assumes existing soil is reusable as backfill.
- 12 Utility incentives per Eversource and CNG incentive letters from early 2017
- 13 Excavation of major obstructions, blasting, or boulder removal not included.
- 14 Relocation or removal of any utilities not shown on drawings excluded.
- 15 Supply and installation of standby gensets, and all associated work not included.
- 16 Cost includes an allowance of \$206,700 to comply with high-performance building code requirements.
- 17 All other owner's costs, special inspections, insurances, etc. are not included.
- 18 Allowance of \$25,000 for temporary heating support included.
- 19 Price assumes end user has contract for nitrogen bottles for use with HW / CHW exp. tanks.
- 20 Cost of new electrical service from utility to new plant is included.
- 21 Cost of new water, fire main, and gas service from street to plant is included.
- 22 Interconnect fees from all utilities are excluded.
- 23 10% design, procurement and construction contingency as well as 10% contraction overhead & profit included.
- 24 Any additional environmental permitting is not included other than indicated above.
- 25 All values shown in summary table rounded to the nearest \$1,000.

## Procurement Opinion of Probable Capital Cost

Note: Costs herein only for furnishing equipment (design & construction costs shown elsewhere)

| ID   | DESCRIPTION                                   | Type/Size                | <u>470 Capitol Avenue</u> |           |
|------|-----------------------------------------------|--------------------------|---------------------------|-----------|
|      |                                               |                          | QTY                       | TOTAL \$  |
|      |                                               |                          |                           |           |
| 1.1  | 1875T Electric Chiller                        |                          | 2.0                       | 1,303,000 |
| 1.2  | Back-up Electric Chiller Rental [12 months]   |                          | 1.0                       | 120,000   |
|      |                                               |                          |                           |           |
| 2    | Cooling Towers                                | 6 cell tower arrangement | 1.0                       | 505,000   |
|      |                                               |                          |                           |           |
| 3    | 16.7 MMBtu HW Boiler                          |                          | 3.0                       | 809,168   |
|      |                                               |                          |                           |           |
| 4    | Side stream filter                            |                          | 1.0                       | 57,000    |
|      |                                               |                          |                           |           |
| 5.1  | Free cooling HEX                              |                          | 1.0                       | 28,540    |
| 5.2  | 410 Bldg. HW/HW HEX (Not included)            |                          |                           |           |
|      |                                               |                          |                           |           |
| 6.1  | HW Primary Pumps                              |                          | 3.0                       | 60,183    |
| 6.2  | HW Secondary Pumps                            |                          | 3.0                       | 153,812   |
| 6.3  | Primary Chilled Water Pumps                   |                          | 3.0                       | 72,356    |
| 6.4  | Secondary Chilled Water Pumps                 |                          | 3.0                       | 161,273   |
| 6.5  | Condenser Water Pumps                         |                          | 3.0                       | 146,944   |
| 6.6  | Chilled Water Make-up Pump                    |                          | 2.0                       | 10,175    |
| 6.7  | Waste Water Pumps                             |                          | 2.0                       | 8,140     |
| 6.8  | Valve Chamber Sump Pump                       |                          | 1.0                       | 4,070     |
| 6.9  | Cap Ave Circ Pumps                            |                          | 2.0                       | 10,175    |
|      |                                               |                          |                           |           |
| 7    | Air Compressor/Dryer/Receiver/Safety          |                          | 1.0                       | 17,500    |
|      |                                               |                          |                           |           |
| 8.1  | HW Expansion Tank                             |                          | 1.0                       | 25,700    |
| 8.2  | CHW Expansion Tank                            |                          | 1.0                       | 25,700    |
| 8.3  | Cap Ave HW exp. Tank                          |                          | 1.0                       | 1,550     |
| 8.4  | Chilled Water & HW Air Separator              |                          | 2.0                       | 7,123     |
|      |                                               |                          |                           |           |
| 9    | Oily Water Separator                          |                          | 1.0                       | 6,614     |
|      |                                               |                          |                           |           |
| 10   | City Water Metering Station (meter & instru.) |                          | 1.0                       | 5,088     |
|      |                                               |                          |                           |           |
| 11   | Water Treatment Equipment                     |                          | 1.0                       | 50,000    |
|      |                                               |                          |                           |           |
| 12   | Gas Metering Station (meter & instru.)        |                          | 1.0                       | 12,210    |
|      |                                               |                          |                           |           |
| 13   | CW System coupon rack (for sampling)          |                          | 1.0                       | 1,526     |
|      |                                               |                          |                           |           |
| 14   | Louvers/dampers (Louvers to be used)          |                          | 1.0                       | 5,000     |
|      |                                               |                          |                           |           |
| 15   | Field Instruments (inc. refrigerant detect.)  |                          | 1.0                       | 329,136   |
|      |                                               |                          |                           |           |
| 16.1 | Control Hardware/software                     |                          | 1.0                       | 400,000   |
| 16.2 | Changes to Bldg. BMS syst.                    |                          | 1.0                       | 25,000    |
|      |                                               |                          |                           |           |
| 17.1 | 22kV/4.16kV Utility Isol XFMR                 | 7.5MVA                   | 1.0                       | 116,500   |
| 17.2 | 4.16kV/480V Station XFMR                      | 3.75MVA                  | 1.0                       | 75,800    |
|      |                                               |                          |                           |           |

## Procurement Opinion of Probable Capital Cost

Note: Costs herein only for furnishing equipment (design & construction costs shown elsewhere)

| ID   | DESCRIPTION                          | Type/Size                 | <u>470 Capitol Avenue</u> |                  |
|------|--------------------------------------|---------------------------|---------------------------|------------------|
|      |                                      |                           | QTY                       | TOTAL \$         |
|      |                                      |                           |                           |                  |
| 18.1 | MV Switchgear                        | w/battery system          | 1.0                       | 400,500          |
| 18.2 | LV SWGR                              |                           | 1.0                       | 225,500          |
| 18.3 | Utility SWGR outdoor                 | late addition to estimate | 1.0                       | 120,500          |
|      |                                      |                           |                           |                  |
| 19   | MCCs                                 |                           | 2.0                       | 289,000          |
|      |                                      |                           |                           |                  |
| 20.1 | HW Primary Pump VFDs                 | 40 HP                     | 3.0                       | 14,301           |
| 20.2 | HW Secondary Pump VFDs               | 150 HP                    | 3.0                       | 80,433           |
| 20.3 | Primary Chilled Water Pumps VFDs     | 60 HP                     | 3.0                       | 24,643           |
| 20.4 | Secondary Chilled Water Pumps VFDs   | 250 HP                    | 3.0                       | 113,947          |
| 20.5 | Condenser Water Pumps VFDs           | 150 HP                    | 3.0                       | 80,433           |
| 20.6 | 1500HP Chiller VFDs (INCLUDED ABOVE) |                           |                           |                  |
| 20.8 | Cooling Tower Fan VFDs               | 60 HP                     | 6.0                       | 49,286           |
|      |                                      |                           |                           |                  |
| 21   | DC System (included in MVSWGR)       |                           |                           |                  |
|      |                                      |                           |                           |                  |
| 22   | UPS System - 30kVA                   |                           | 1.0                       | 25,000           |
|      |                                      |                           |                           |                  |
|      | <b>PROCUREMENT SUBTOTALS</b>         |                           |                           | <b>5,977,826</b> |
|      |                                      |                           |                           |                  |
|      | Sales Tax (Included at line item)    |                           |                           |                  |
|      | Contingency                          |                           | 10.0%                     | 597,783          |
|      | Freight Contingency                  |                           | 0.10%                     | 4,483            |
|      |                                      |                           |                           |                  |
|      | <b>PROCUREMENT SUBTOTAL</b>          |                           |                           | <b>6,580,092</b> |
|      |                                      |                           |                           |                  |
|      | Overhead & Profit                    |                           | 10.0%                     | 658,009          |
|      | Overhead & Profit on Freight         |                           | 0.10%                     | 6,580            |
|      |                                      |                           |                           |                  |
|      | <b>PROCUREMENT TOTAL</b>             |                           |                           | <b>7,244,681</b> |

## Construction Opinion of Probable Capital Cost

| CODE | DESCRIPTION                                                                      | 470 Capitol Avenue |
|------|----------------------------------------------------------------------------------|--------------------|
|      |                                                                                  | TOTAL \$           |
|      | <b>DEMOLITION (Incl. CDECCA Chiller)</b>                                         |                    |
|      | DEMOLITION SUBTOTAL                                                              | 250,000            |
|      |                                                                                  |                    |
|      | <b>SITE WORK</b>                                                                 |                    |
|      | SITE WORK SUBTOTAL                                                               | 0                  |
|      |                                                                                  |                    |
|      | <b>CONCRETE</b>                                                                  |                    |
|      | CONCRETE SUBTOTAL                                                                | 750,000            |
|      |                                                                                  |                    |
|      | <b>STRUCTURAL</b>                                                                |                    |
|      | STRUCTURAL SUBTOTAL (COOLING TOWER SUPPORT / PIPE RACKS / BREECHING]             | 508,460            |
|      |                                                                                  |                    |
|      | <b>ARCHITECTURAL</b>                                                             |                    |
|      | ARCHITECTURAL SUBTOTAL                                                           | 188,307            |
|      |                                                                                  |                    |
|      | <b>RIGGING &amp; SETTING MAJOR EQUIP.</b>                                        |                    |
|      | RIGGING SUBTOTAL                                                                 | 415,761            |
|      |                                                                                  |                    |
|      | <b>MECHANICAL</b>                                                                |                    |
|      | MECHANICAL SUBTOTAL                                                              | 240,772            |
|      |                                                                                  |                    |
|      | <b>PIPING</b>                                                                    |                    |
|      | PIPING SUBTOTAL                                                                  | 2,011,035          |
|      |                                                                                  |                    |
|      | <b>INSULATION</b>                                                                |                    |
|      | INSULATION SUBTOTAL                                                              | 301,655            |
|      |                                                                                  |                    |
|      | <b>ELECTRICAL &amp; I/C</b>                                                      |                    |
|      | ELECTRICAL & I/C SUBTOTAL                                                        | 2,090,989          |
|      |                                                                                  |                    |
|      | <b>FIRE PROTECTION</b>                                                           |                    |
|      | FIRE PROTECTION SUBTOTAL                                                         | 180,000            |
|      |                                                                                  |                    |
|      | <b>DIRECTS SUBTOTALS</b>                                                         | <b>6,936,979</b>   |
|      |                                                                                  |                    |
|      | HP Building Code adder                                                           | 208,109            |
|      | Construction Indirects, General Conditions & General Requirements not on Sub \$s | 937,688            |
|      | Construction Indirects, General Conditions & General Requirements on Sub \$s     | 404,425            |
|      |                                                                                  |                    |
|      | <b>CONSTRUCTION SUBTOTAL</b>                                                     | <b>8,487,201</b>   |
|      |                                                                                  |                    |
|      | Contingency                                                                      | 848,720            |
|      |                                                                                  |                    |
|      | <b>CONSTRUCTION SUBTOTAL</b>                                                     | <b>9,335,921</b>   |
|      |                                                                                  |                    |
|      | Overhead & Profit                                                                | 933,592            |
|      |                                                                                  |                    |
|      | <b>CONSTRUCTION TOTALS</b>                                                       | <b>10,269,513</b>  |

3.0%

10.0%

10.0%

## **APPENDIX F**



**Checklist for Permits, Certifications, and Approvals**  
**Department of Administrative Services, Construction Services**

|                                                                                                                                                                                                                                                                                                                                                                                               |                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>DAS Project Manager:</b> _____                                                                                                                                                                                                                                                                                                                                                             | <b>Date:</b> 10/29/2019                            |
| <b>DAS Project Number:</b> _____                                                                                                                                                                                                                                                                                                                                                              |                                                    |
| <b>DAS Project Title:</b> Capitol Area System (CAS) Thermal Plant - Option C                                                                                                                                                                                                                                                                                                                  |                                                    |
| <b>Facility Address:</b> 470 Capitol Avenue, Hartford CT, 06106                                                                                                                                                                                                                                                                                                                               |                                                    |
| <b>Anticipated Bid Date</b> _____                                                                                                                                                                                                                                                                                                                                                             |                                                    |
| <b>Project Delivery Method:</b> <input type="checkbox"/> Design-Bid-Build <input checked="" type="checkbox"/> Design-Build <input type="checkbox"/> CMR (Construction Manager At Risk)                                                                                                                                                                                                        |                                                    |
| <b>Submitted With:</b> <input checked="" type="checkbox"/> Proposal Phase <i>(Preliminary Applicable Review)</i><br><input type="checkbox"/> SD Phase<br><input type="checkbox"/> DD Phase <i>(Include Completed Drafts Of All Applicable Permit Applications)</i><br><input type="checkbox"/> CD Phase<br><input type="checkbox"/> Bid Phase<br><input type="checkbox"/> Environmental Phase |                                                    |
| <b>Project Type:</b> <input type="checkbox"/> New <input type="checkbox"/> Addition<br><i>(Check All Applicable to this Project)</i> <input checked="" type="checkbox"/> Major Renovation <input type="checkbox"/> Minor Renovation                                                                                                                                                           |                                                    |
| <b>Other Information:</b>                                                                                                                                                                                                                                                                                                                                                                     |                                                    |
| Existing Gross Square Footage (GSF): 30,300                                                                                                                                                                                                                                                                                                                                                   | No. of Existing Parking Spaces: TBD                |
| Proposed New GSF: 0                                                                                                                                                                                                                                                                                                                                                                           | No. of Proposed New Parking Spaces: 0              |
| Proposed GSF To Be Demolished: 15,000                                                                                                                                                                                                                                                                                                                                                         | No. of Existing Parking Spaces To Be Demolished: 0 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>INSTRUCTIONS TO ARCHITECT/ENGINEER CONSULTANT:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                              |
| <ul style="list-style-type: none"><li><b>For all Department of Administrative Services (DAS) Construction Services Projects:</b> This Checklist shall be submitted with the Architect/Engineer Consultant's ("Consultant") proposal and revised and resubmitted with <b>each</b> Preconstruction Phase Submittal.</li><li>The Checklist must be submitted to the <b>DAS Project Manager</b>, with copies to the <b>DAS Environmental Planning Unit</b> and the <b>DAS Office of the State Building Inspector</b>. See the addresses below.</li><li>Comments may be included at the end of the Checklist.</li><li>Drafts of all permits, certifications, and approvals shall be submitted as part of the Design Development (DD) Phase Submission.</li><li>Select the appropriate answers from the dropdown menus for each permit, certification, and approval.</li><li>See "<b>Additional Checklist Instructions</b>" (3030.1) at the end of the Checklist for additional information.</li></ul> |                                                                                                                                              |
| <b>In addition to submitting this Checklist to the DAS Project Manager, submit a copy of the Checklist to:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                              |
| DAS Construction Services<br>Environmental Planning Unit<br>450 Columbus Blvd, Suite 1305<br>Hartford, CT 06103                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>AND</b><br><br>DAS Construction Services<br>Office of the State Building Inspector<br>450 Columbus Blvd, Suite 1303<br>Hartford, CT 06103 |





# Checklist for Permits, Certifications, and Approvals

| FEDERAL AGENCIES                                                                                                                                                                                                                                                                                                                     | Telephone Number | Click On Drop Down Box In Each Category |                                      |               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------------------------|--------------------------------------|---------------|
|                                                                                                                                                                                                                                                                                                                                      |                  | Is the Permit Required?                 | Who is responsible to obtain Permit? | Permit Status |
| <b>ARMY CORPS OF ENGINEERS (USACOE)</b>                                                                                                                                                                                                                                                                                              |                  |                                         |                                      |               |
| <a href="#">Connecticut Programmatic General Permits</a> Applicability: Projects with structures or work in navigable waters of the United States and projects that discharge dredged or fill material into waters/wetlands of the United States; the projects shall result in minimal adverse effects to aquatic resources.         | 202-761-5903     | No                                      |                                      |               |
| <b>Individual Permit Procedures</b> Applicability: Projects that have more than minimal individual or cumulative impacts to aquatic resources, are evaluated using additional environmental criteria, and involve a more comprehensive public interest review. See <a href="#">Connecticut General Permits</a> for more information. | 202-761-5903     | Yes                                     | DAS                                  |               |
| <b>ENVIRONMENTAL PROTECTION AGENCY (EPA)</b>                                                                                                                                                                                                                                                                                         |                  |                                         |                                      |               |
| <a href="#">PCBs in Caulk</a> (See Form 1170 DAS PCBs in Caulk Policy) Applicability: In general, projects that disturb existing caulk in buildings constructed/renovated/repared between 1950 and 1979.                                                                                                                             | 860 713-5631     | Not Sure                                |                                      |               |
| <a href="#">Sole Source Aquifer (SSA) Review</a> Applicability: Projects that have federal funding and are located within a SSA. CT has two SSAs: the Pootatuck Aquifer (Newtown, Monroe, and Easton) and the Pawcatuck River Aquifer (Stonington and North Stonington).                                                             | 617-918-1683     | No                                      | DAS                                  |               |
| <b>FEDERAL AVIATION ADMINISTRATION (FAA)</b>                                                                                                                                                                                                                                                                                         |                  |                                         |                                      |               |
| <a href="#">Notice of Proposed Construction or Alteration</a> Applicability: Projects that may affect navigable airspace.                                                                                                                                                                                                            | 781 238-7522     | Yes                                     | DAS                                  |               |

| STATE AGENCIES                                                                                                                                                                                                                                                             | Telephone Number | Click On Drop Down Box In Each Category |                                      |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------------------------|--------------------------------------|---------------|
|                                                                                                                                                                                                                                                                            |                  | Is the Permit Required?                 | Who is responsible to obtain Permit? | Permit Status |
| <b>CONNECTICUT SITING COUNCIL (CSC)</b>                                                                                                                                                                                                                                    |                  |                                         |                                      |               |
| <a href="#">Certificate of Environmental Compatibility &amp; Public Need</a> Applicability: Projects that include telecommunication towers, electric generating facilities, and transmission lines which may have a substantial adverse environmental effect in the state. | 860 827-2935     | No                                      |                                      |               |
| <b>DEPARTMENT OF ADMINISTRATIVE SERVICES (DAS)</b>                                                                                                                                                                                                                         |                  |                                         |                                      |               |
| <b>Environmental Planning &amp; Energy Unit</b> (responsible for managing the following activities during DAS construction projects)                                                                                                                                       |                  |                                         |                                      |               |
| Above and/or Underground Storage Tank Installation                                                                                                                                                                                                                         | 860 713-5631     | No                                      |                                      |               |
| Above and/or Underground Storage Tank Removal                                                                                                                                                                                                                              | 860 713-5631     | No                                      |                                      |               |
| Connecticut Environmental Policy Act (CEPA) and Initial Environmental Review                                                                                                                                                                                               | 860 713-5631     | Yes                                     | DAS                                  |               |
| Environmental Site Assessments:                                                                                                                                                                                                                                            | 860 713-5631     | —                                       | —                                    | —             |
| • Phase I                                                                                                                                                                                                                                                                  | 860 713-5631     | Yes                                     | DAS                                  |               |
| • Phase II                                                                                                                                                                                                                                                                 | 860 713-5631     | Yes                                     | DAS                                  |               |
| • Phase III                                                                                                                                                                                                                                                                | 860 713-5631     | Yes                                     | DAS                                  |               |
| • Remedial Action Plan (RAP)                                                                                                                                                                                                                                               | 860 713-5631     | Yes                                     | DAS                                  |               |
| Hazardous Material Inspection/Abatement Request (asbestos, PCBs, lead, or indoor air quality)                                                                                                                                                                              | 860 713-5631     | Yes                                     | Not Sure                             |               |
| High Performance Buildings                                                                                                                                                                                                                                                 | 860 713-5631     | Yes                                     | A/E Consultant                       |               |
| LEED                                                                                                                                                                                                                                                                       | 860 713-5631     | No                                      |                                      |               |
| National Environmental Policy Act (NEPA)                                                                                                                                                                                                                                   | 860 713-5631     | Not Sure                                |                                      |               |
| Property Transfer Program                                                                                                                                                                                                                                                  | 860 713-5631     | Not Sure                                |                                      |               |



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**Checklist for Permits,**  
**Certifications, and Approvals**

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| STATE AGENCIES<br>(continued)                                                                                                                                                                                                                                                                                                                               | Telephone<br>Number | Click On Drop Down Box In Each Category |                                            |               |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------|--------------------------------------------|---------------|--|
|                                                                                                                                                                                                                                                                                                                                                             |                     | Is the Permit<br>Required?              | Who is<br>responsible to<br>obtain Permit? | Permit Status |  |
| <b>DEPARTMENT OF ADMINISTRATIVE SERVICES (DAS) (continued)</b>                                                                                                                                                                                                                                                                                              |                     |                                         |                                            |               |  |
| <b>Office of the State Building Inspector (OSBI)</b>                                                                                                                                                                                                                                                                                                        |                     |                                         |                                            |               |  |
| <b>Construction Project Initiation</b>                                                                                                                                                                                                                                                                                                                      |                     |                                         |                                            |               |  |
| Building Permit Application ( <a href="#">Form 3040</a> )                                                                                                                                                                                                                                                                                                   | 860-713-5900        | Yes                                     | DAS                                        |               |  |
| Connecticut State Demolition Code                                                                                                                                                                                                                                                                                                                           | 860-713-5900        | Yes                                     | DAS                                        |               |  |
| Certificate of Compliance-Preconstruction ( <a href="#">Form 3150</a> )                                                                                                                                                                                                                                                                                     | 860-713-5900        | Not Sure                                |                                            |               |  |
| Statement of Special Inspections ( <a href="#">CASE Form 101</a> )                                                                                                                                                                                                                                                                                          | 860-713-5900        | No                                      |                                            |               |  |
| Third Party Structural Review ( <a href="#">Threshold Only</a> )                                                                                                                                                                                                                                                                                            | 860-713-5900        | No                                      |                                            |               |  |
| Building Code Modification Request                                                                                                                                                                                                                                                                                                                          | 860-713-5900        | Yes                                     |                                            |               |  |
| Accessibility Exemption Waiver Request                                                                                                                                                                                                                                                                                                                      | 860-713-5900        | No                                      |                                            |               |  |
| Chair Lifts, Wheelchair, and Limited Elevators Application Request                                                                                                                                                                                                                                                                                          | 860-713-5900        | No                                      |                                            |               |  |
| <b>Construction Project Close-out</b>                                                                                                                                                                                                                                                                                                                       |                     |                                         |                                            |               |  |
| Certificate Of Occupancy Checklist ( <a href="#">Form 7160</a> )                                                                                                                                                                                                                                                                                            | 860-713-5900        | Yes                                     | DAS                                        |               |  |
| Certificate of Occupancy ( <a href="#">from OSBI</a> )                                                                                                                                                                                                                                                                                                      | 860-713-5900        | Yes                                     | DAS                                        |               |  |
| Certificate of Substantial Completion ( <a href="#">Form 7810</a> )                                                                                                                                                                                                                                                                                         | 860-713-5900        | Yes                                     | DAS                                        |               |  |
| Certificate of Compliance-Construction Phase ( <a href="#">Form 7150</a> )                                                                                                                                                                                                                                                                                  | 860-713-5900        | Yes                                     | DAS                                        |               |  |
| Certificate of Acceptance ( <a href="#">Form 7820</a> )                                                                                                                                                                                                                                                                                                     | 860-713-5900        | Yes                                     | DAS                                        |               |  |
| <b>Office of the State Fire Marshal (OSFM)</b>                                                                                                                                                                                                                                                                                                              |                     |                                         |                                            |               |  |
| Fire Code Modification Request                                                                                                                                                                                                                                                                                                                              | 860-713-5750        | No                                      |                                            |               |  |
| <b>Bureau of Properties and Facilities Maintenance</b>                                                                                                                                                                                                                                                                                                      |                     |                                         |                                            |               |  |
| Leasing/Transfers/Acquisitions/Easements                                                                                                                                                                                                                                                                                                                    | 860 713-5682        | No                                      |                                            |               |  |
| Proximity to Railroads/Bus Routes<br>( <i>Only for leasing or purchasing properties</i> )                                                                                                                                                                                                                                                                   | 860 713-5631        | No                                      |                                            |               |  |
| <b>DEPARTMENT OF AGRICULTURE (DOA) (<a href="#">Contact DAS Environmental Planning -- 860-713-5631</a>)</b>                                                                                                                                                                                                                                                 |                     |                                         |                                            |               |  |
| <a href="#">Farmland Preservation Program</a><br>( <i>25 plus acres of prime or statewide farmland soils</i> )                                                                                                                                                                                                                                              | 860 713-5631        | No                                      |                                            |               |  |
| <b>OFFICE OF EARLY CHILDHOOD</b>                                                                                                                                                                                                                                                                                                                            |                     |                                         |                                            |               |  |
| <a href="#">Child Day Care Licensing Program</a> Applicability: Projects that include the construction of a Child Day Care Facility.                                                                                                                                                                                                                        | 860 500-4450        | No                                      |                                            |               |  |
| <b>DEPARTMENT OF ECONOMIC AND COMMUNITY DEVELOPMENT (DECD)</b>                                                                                                                                                                                                                                                                                              |                     |                                         |                                            |               |  |
| <b>Office of the Arts</b>                                                                                                                                                                                                                                                                                                                                   |                     |                                         |                                            |               |  |
| <a href="#">Art in Public Spaces Program</a> Applicability: Projects that involve the construction, reconstruction or remodeling of any state building that will be open to the public or intended for such use, exclusive of any shed, warehouse, garage, building of a temporary nature or building located on the grounds of a correctional institution. | 860 256-2800        | No                                      |                                            |               |  |
| <b>State Historic Preservation Office</b>                                                                                                                                                                                                                                                                                                                   |                     |                                         |                                            |               |  |
| <a href="#">Environmental Review</a> Applicability: Projects that might affect historic resources.                                                                                                                                                                                                                                                          | 860-256-2759        | Yes                                     | A/E Consultant                             |               |  |



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**Checklist for Permits,**  
**Certifications, and Approvals**

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| STATE AGENCIES<br>(continued)                                                                                                                                                                                                                                                                                                                                 | Telephone<br>Number | Click On Drop Down Box In Each Category |                                            |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------|--------------------------------------------|---------------|
|                                                                                                                                                                                                                                                                                                                                                               |                     | Is the Permit<br>Required?              | Who is<br>responsible to<br>obtain Permit? | Permit Status |
| <b>DEPARTMENT OF ENERGY &amp; ENVIRONMENTAL PROTECTION (DEEP)</b>                                                                                                                                                                                                                                                                                             |                     |                                         |                                            |               |
| <a href="#">Where to Begin</a> (Permit Assistance Office)                                                                                                                                                                                                                                                                                                     | 860 424-3003        | —                                       | —                                          | —             |
| <b>Common Forms</b>                                                                                                                                                                                                                                                                                                                                           |                     |                                         |                                            |               |
| <a href="#">Coastal Consistency Review</a> Applicability: Projects within the coastal boundary and within a town in the coastal area.                                                                                                                                                                                                                         | 860 424-3034        | No                                      |                                            |               |
| <a href="#">NDDB Review Request</a> ( <i>Endangered, threatened, and special concern species and habitats</i> ) Applicability: Projects that intersect with or overlap an NDDB Area of Concern for state listed species.                                                                                                                                      | 860 424-3011        | No                                      |                                            |               |
| <b>Air Emissions Permits</b>                                                                                                                                                                                                                                                                                                                                  |                     |                                         |                                            |               |
| <a href="#">New Source Review (NSR) Permit</a> Applicability: In general, projects that install a new stationary source of air pollution with potential individual air pollutant emissions greater than 15 tons per year, unless an exemption is met or the source operates under one of the "permit by rule" regulations.                                    | 860 424-4152        | Yes                                     | A/E Consultant                             |               |
| <a href="#">General Permit to Limit Potential to Emit from Major Stationary Sources of Air Pollution (GPLPE)</a> Applicability: In general, projects that install a major stationary source of air pollution with potential emissions equal to or greater than Title V source thresholds and actual emissions are less than 80% of such thresholds.           | 860 424-4152        | No                                      |                                            |               |
| <a href="#">Permit-by-Rule Notification</a> Applicability: In general, projects that install a new source with potential emissions greater than 15 tons per year and operate the source under one of the "permit by rule" regulations.                                                                                                                        | 860 424-4152        | Yes                                     |                                            |               |
| <a href="#">Title V Operating Permit</a> Applicability: In general, projects that install a major source of air pollution. The Title V Operating Permit is a facility-wide permit.                                                                                                                                                                            | 860 424-4152        | No                                      |                                            |               |
| <b>Coastal Program Permits</b>                                                                                                                                                                                                                                                                                                                                |                     |                                         |                                            |               |
| <a href="#">Minor Coastal Structures</a> Applicability: Projects that include the construction, installation, maintenance, removal and seasonal replacement of various minor structures within the tidal, coastal, and navigable waters of the state below the elevation of the coastal jurisdiction line and, where specifically allowed, in tidal wetlands. | 860 424-3034        | No                                      |                                            |               |
| <a href="#">Coastal Maintenance</a> Applicability: Projects that include the maintenance of various coastal structures and activities within the tidal, coastal, and navigable waters of the state.                                                                                                                                                           | 860 424-3034        | No                                      |                                            |               |
| <a href="#">Programmatic General Permit, Department of the Army</a> Applicability: Projects with structures or work in navigable waters of the United States and projects that discharge dredged or fill material into waters of the United States; see <b>Army Corps of Engineers</b> on page 2 of this Checklist.                                           | 202-761-5903        | No                                      |                                            |               |
| <a href="#">Structures, Dredging &amp; Fill Permit</a> Applicability: Projects that are waterward of the Coastal Jurisdiction Line in tidal, coastal or navigable waters of the state.                                                                                                                                                                        | 860 424-3034        | No                                      |                                            |               |
| <a href="#">Tidal Wetlands Permit</a> Applicability: Projects within tidal wetlands.                                                                                                                                                                                                                                                                          | 860 424-3034        | No                                      |                                            |               |
| <a href="#">Coastal 401 Water Quality Certification</a> Applicability: Projects which may result in a discharge to navigable waters (including all wetlands, watercourses, and natural & man-made ponds) and require a federal license or permit.                                                                                                             | 860 424-3034        | No                                      |                                            |               |
| <a href="#">Certificate of Permission Application</a> Applicability: Certain minor activities involving dredging, erection of structures, or fill in any tidal, coastal or navigable waters of the state.                                                                                                                                                     | 860 424-3003        | No                                      |                                            |               |



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**Checklist for Permits,**  
**Certifications, and Approvals**

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| STATE AGENCIES<br>(continued)                                                                                                                                                                                                                                                                                                            | Telephone<br>Number | Click On Drop Down Box In Each Category |                                            |               |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------|--------------------------------------------|---------------|--|
|                                                                                                                                                                                                                                                                                                                                          |                     | Is the Permit<br>Required?              | Who is<br>responsible to<br>obtain Permit? | Permit Status |  |
| <b>DEPARTMENT OF ENERGY &amp; ENVIRONMENTAL PROTECTION (DEEP) (continued)</b>                                                                                                                                                                                                                                                            |                     |                                         |                                            |               |  |
| <b>Inland Water Resources Permits (Contact the DAS Environmental Planning Unit for DEEP Coordination: 860-713-5631)</b>                                                                                                                                                                                                                  |                     |                                         |                                            |               |  |
| <a href="#">Aquifer Protection Area</a> Applicability: Projects located within an Aquifer Protection Area and involve Regulated Activities.                                                                                                                                                                                              | 860 424-3019        | No                                      |                                            |               |  |
| <a href="#">Inland 401 Water Quality Certification</a> Applicability: Projects which may result in a discharge to navigable waters (including all wetlands, watercourses, and natural & man-made ponds) and require a federal license or permit.                                                                                         | 860 424-3034        | No                                      |                                            |               |  |
| <a href="#">Dam Construction Permit</a> Applicability: Projects that include the construction, alteration, repair or removal of dams, dikes, reservoirs and similar structures.                                                                                                                                                          | 860 424-3706        | No                                      |                                            |               |  |
| <a href="#">Flood Management Certification</a> Applicability: Projects located in or affecting floodplains, floodways, or storm drainage facilities.                                                                                                                                                                                     | 860 424-3706        | No                                      |                                            |               |  |
| <a href="#">Inland Wetlands &amp; Watercourses Permits</a> Applicability: Projects that shall conduct any operation within or use of a wetland or watercourse involving the removal or deposition of material, or any obstruction, construction, alteration or pollution of such wetlands or watercourses.                               | 860 424-3019        | No                                      |                                            |               |  |
| <a href="#">Water Diversion Permit (Detention/Retention Ponds)</a> Applicability: In general, any project that will result in the alteration of surface water flows and withdrawals of surface and ground water exceeding 50,000 gallons in any 24-hour period.                                                                          | 860 424-3019        | No                                      |                                            |               |  |
| <a href="#">Diversion of Remediation Groundwater</a> Applicability: Projects that include any diversion of remediation groundwater greater than 50,000 gallons during any twenty-four hour period.                                                                                                                                       | 860 424-3019        | No                                      |                                            |               |  |
| <a href="#">Diversion of Water for Consumptive Use</a> Applicability: Projects that include diverting the waters of the state in excess of 50,000 gallons per day.                                                                                                                                                                       | 860 424-3704        | No                                      |                                            |               |  |
| <a href="#">Water Resource Construction Activities</a> Applicability: In general, projects that include trail construction, public works projects, infrastructure repairs, conservation activities, and US Army Corps of Engineers General Permit and 401 Water Quality Certification within wetlands, watercourses and/or flood plains. | 860 424-3019        | No                                      |                                            |               |  |
| <b>Wastewater Discharge Permits</b>                                                                                                                                                                                                                                                                                                      |                     |                                         |                                            |               |  |
| <a href="#">Domestic Sewage</a> Applicability: Projects that will generate a discharge of domestic sewage from a community sewerage system to a Publicly Owned Treatment Works (POTW or sewage treatment plant).                                                                                                                         | 860 424-3025        | Yes                                     | A/E Consultant                             |               |  |
| <a href="#">Food Service Establishment Wastewater</a> Applicability: Projects that include the installation of a "Fats, Oil, and Grease" (FOG) separator.                                                                                                                                                                                | 860 424-3758        | No                                      |                                            |               |  |
| <a href="#">Miscellaneous (MISC) Discharges of Sewer Compatible Wastewater</a> Applicability: Projects that will generate miscellaneous discharges of wastewater to a POTW either directly via a sanitary sewer, or to an approved holding tank. <b>See the general permit for applicable discharges.</b>                                | 860 424-3025        | Yes                                     |                                            |               |  |
| <a href="#">Stormwater and Dewatering Wastewater Associated with Construction Activities</a> Applicability: Construction activities that disturb one or more total acres on a site regardless of project phasing resulting in discharges of stormwater and dewatering wastewater.                                                        | 860 424-3025        | Not Sure                                |                                            |               |  |
| <a href="#">Vehicle Maintenance Wastewater</a> Applicability: Projects that will generate a discharge of wastewater from 1) floor washdown and incidental drippage from vehicles as a result of routine servicing operations and 2) washing of vehicle exteriors or steam cleaning of engines.                                           | 860 424-3025        | No                                      |                                            |               |  |



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**Checklist for Permits,**  
**Certifications, and Approvals**

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| STATE AGENCIES<br>(continued)                                                                                                                                                                                                                                                                                                                                                                     | Telephone<br>Number | Click On Drop Down Box In Each Category |                                            |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------|--------------------------------------------|---------------|
|                                                                                                                                                                                                                                                                                                                                                                                                   |                     | Is the Permit<br>Required?              | Who is<br>responsible to<br>obtain Permit? | Permit Status |
| <b>DEPARTMENT OF ENERGY &amp; ENVIRONMENTAL PROTECTION (DEEP) (continued)</b>                                                                                                                                                                                                                                                                                                                     |                     |                                         |                                            |               |
| <b>Waste &amp; Materials Management Permits and Remediation &amp; Site Clean-Up</b>                                                                                                                                                                                                                                                                                                               |                     |                                         |                                            |               |
| <a href="#">Aerial Pesticide Application</a> Applicability: Projects that apply pesticides and fertilizers by aircraft.                                                                                                                                                                                                                                                                           | 860 424-3369        | No                                      |                                            |               |
| <a href="#">Aquatic Pesticide Application</a> Applicability: Projects that introduce pesticides into the waters of the state for control of aquatic organisms.                                                                                                                                                                                                                                    | 860 424-3369        | No                                      |                                            |               |
| <a href="#">Beneficial Use Determination (BUD) Approval</a> Applicability: Projects that will generate a solid waste material and want to provide such material to others for beneficial use.                                                                                                                                                                                                     | 860-424-3366        | No                                      |                                            |               |
| <a href="#">Contaminated Soil and/or Sediment Management (Staging and Transfer)</a> Applicability: Projects that include the staging, transfer, and temporary storage of contaminated soil and/or sediment.                                                                                                                                                                                       | 860 424-3366        | Yes                                     | A/E Consultant                             |               |
| <a href="#">Disposal of Special Wastes (Including Asbestos)</a> Applicability: Projects that include the disposal of a "special waste" or asbestos into Solid Waste Disposal Areas (Connecticut landfills) or Resources Recovery Facilities.                                                                                                                                                      | 860 424-3366        | No                                      |                                            |               |
| <a href="#">Emergency or Temporary Authorization to Discharge to Groundwater to Remediate Pollution</a> Applicability: Projects that include the discharge of a substance into groundwater to remediate pollution.                                                                                                                                                                                | 860 424-3705        | No                                      |                                            |               |
| <a href="#">Groundwater Remediation Wastewater Directly to Surface Water</a> Applicability: Projects that will generate a discharge of groundwater remediation wastewater directly to a surface water during the process of investigating and remediating groundwater and soil.                                                                                                                   | 860 424-3025        | No                                      |                                            |               |
| <a href="#">Groundwater Remediation Wastewater to a Sanitary Sewer</a> Applicability: Projects that will generate a discharge of groundwater remediation wastewater directly to a sanitary sewer during the process of investigating and remediating groundwater and soil.                                                                                                                        | 860 424-3025        | No                                      |                                            |               |
| <a href="#">Property Transfer Program</a> Applicability: Projects that include the transfer of certain real properties and/or businesses ("establishments").                                                                                                                                                                                                                                      | 860-424-3705        | No                                      |                                            |               |
| <a href="#">Radiation - Registration of Devices</a> Applicability: Projects that install Diagnostic and Therapeutic X-Ray (DTX) Devices and Radioactive Materials and Industrial (RMI) Devices.                                                                                                                                                                                                   | 860 424-3029        | No                                      |                                            |               |
| <a href="#">Site Characterization and/or Remediation</a> Applicability: Projects that include the investigation and remediation of environmental contamination.                                                                                                                                                                                                                                   | 860-424-3705        | Yes                                     | DAS                                        |               |
| <a href="#">Underground Storage Tanks</a> Applicability: Projects that include the installation and/or removal of an Underground Storage Tank(s).                                                                                                                                                                                                                                                 | 860 424-3374        | No                                      |                                            |               |
| <b>Public Utilities Regulatory Authority</b>                                                                                                                                                                                                                                                                                                                                                      |                     |                                         |                                            |               |
| <a href="#">Utility Service:</a>                                                                                                                                                                                                                                                                                                                                                                  | 860 827-1553        | No                                      |                                            |               |
| <b>NOTE:</b> The Consultant <u>shall not contact</u> the Public Utilities Regulatory Authority unless requested to do so by the DAS Project Manager. In the event that the utility company and DAS Construction Services are unable to reach an agreement with regard to utility services for the project, the Consultant may be instructed to contact the Public Utilities Regulatory Authority. |                     |                                         |                                            |               |



# Checklist for Permits, Certifications, and Approvals

| STATE AGENCIES<br>(continued)                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Telephone<br>Number                | Click On Drop Down Box In Each Category |                                            |               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------------|--------------------------------------------|---------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                    | Is the Permit<br>Required?              | Who is<br>responsible to<br>obtain Permit? | Permit Status |
| <b>DEPARTMENT OF PUBLIC HEALTH (DPH)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                         |                                            |               |
| <a href="#">Asbestos Abatement Notification Form</a> Applicability: Projects that include Asbestos Abatement. Must be submitted to DPH at least ten days prior to the start of asbestos abatement.                                                                                                                                                                                                                                                                                      | 860 509-7367                       | No                                      |                                            |               |
| <a href="#">Asbestos Alternative Work Practice Form</a> Applicability: Projects that include Asbestos Abatement and alternative work practices.                                                                                                                                                                                                                                                                                                                                         | 860 509-7367                       | No                                      |                                            |               |
| <a href="#">Asbestos Demolition Notification Form</a> Applicability: Projects that include demolition of buildings that contain no known asbestos-containing material. Must be submitted to DPH at least ten days prior to the start of demolition.                                                                                                                                                                                                                                     | 860 509-7367                       | Yes                                     |                                            |               |
| <a href="#">Asbestos Management Plan</a> Applicability: An Asbestos Management Plan must be submitted to DPH if the purpose of a project is to inspect and document asbestos-containing building material in schools for grades kindergarten to 12.                                                                                                                                                                                                                                     | 860 509-7367                       | No                                      |                                            |               |
| <a href="#">Environmental Laboratory Certification</a> Applicability: Projects that include the construction of an environmental laboratory which tests drinking water, sewage, solid waste, soil, air, food, and other environmental samples for bacteria, inorganics, organics, and radiochemicals.                                                                                                                                                                                   | 860 509-7389                       | No                                      |                                            |               |
| <a href="#">General Application - Public Water System</a> Applicability: Projects that include the construction of a regulated public water system.                                                                                                                                                                                                                                                                                                                                     | 860 509-7333                       | No                                      |                                            |               |
| <a href="#">Health Care Facilities - Certificate of Need (CON)</a> Applicability: In general, projects that include the construction, renovation, or termination of health care facilities that provide services for the prevention, diagnosis or treatment of human health conditions.                                                                                                                                                                                                 | 860 418-7001                       | No                                      |                                            |               |
| <a href="#">Lead-Based Paint</a> Applicability: In general, projects that include painted surfaces in structures built before 1978.                                                                                                                                                                                                                                                                                                                                                     | 860 509-7299                       | Not Sure                                |                                            |               |
| <a href="#">Public Pools</a> Applicability: Projects that include the construction, alteration or reconstruction of public pools.                                                                                                                                                                                                                                                                                                                                                       | 860 509-7296                       | No                                      |                                            |               |
| <b>Subsurface Sewage Treatment and Disposal System (Septic System)</b> Applicability: Projects that include a septic system, as described below:                                                                                                                                                                                                                                                                                                                                        | (see below)                        | —                                       | —                                          | —             |
| • <a href="#">Local Health Department</a> : Conventional system with design flow less than 2000 gpd.                                                                                                                                                                                                                                                                                                                                                                                    | <a href="#">Local Health Dept.</a> | No                                      |                                            |               |
| • <a href="#">DPH Sewage Program</a> : Conventional system with design flow between 2000 and 5000 gpd.                                                                                                                                                                                                                                                                                                                                                                                  | 860-509-7296                       | No                                      |                                            |               |
| • <a href="#">DEEP Subsurface Sewage Disposal Program</a> : Conventional system with design flow greater than 5000 gpd; community system; and alternative treatment system.                                                                                                                                                                                                                                                                                                             | 860-424-3025                       | No                                      |                                            |               |
| <b>DEPARTMENT OF TRANSPORTATION (DOT)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                    |                                         |                                            |               |
| <a href="#">Encroachment Permit</a> Applicability: Projects that require the use of a State highway for purposes other than travel. Normally, excavations, utility work, driveway curb cuts, etc. within the right of way.                                                                                                                                                                                                                                                              | 860 594-2610                       | Yes                                     |                                            |               |
| <b>Office of the State Traffic Administration (OSTA) (Contact the DAS Environmental Planning Unit for OSTA Coordination: 860-713-5631)</b>                                                                                                                                                                                                                                                                                                                                              |                                    |                                         |                                            |               |
| <a href="#">Administrative Decisions</a> Applicability: <b>New facilities:</b> 200 or more parking spaces and/or a gross floor area of 100,000 square feet or more <b>OR existing facilities with a MTG Certificate:</b> 50 or more parking spaces and/or any increase in square footage; <b>BUT</b> have demonstrated through a traffic impact analysis that the added traffic <b>DOES NOT</b> trigger the need for mitigation or traffic safety measures on the State highway system. | 860 594-3020                       | No                                      |                                            |               |
| <a href="#">Major Traffic Generator Certificate</a> Applicability: Projects that include 200 or more parking spaces, or a gross floor area of 100,000 square feet or more, <b>AND</b> trigger the need for mitigation or traffic safety measures on the State highway system.                                                                                                                                                                                                           | 860 594-3020                       | No                                      |                                            |               |





# Checklist for Permits, Certifications, and Approvals

| MUNICIPAL                                                                                                                                                                                          | Telephone Number                        | Click On Drop Down Box In Each Category |                                      |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------|--------------------------------------|---------------|
|                                                                                                                                                                                                    |                                         | Is the Permit Required?                 | Who is responsible to obtain Permit? | Permit Status |
| <b>CITY OF HARTFORD</b>                                                                                                                                                                            |                                         |                                         |                                      |               |
| <a href="#">Greater Hartford Flood Certificate of Approval</a><br>Applicability: In general, projects located within the floodplain management authority of the Greater Hartford Flood Commission. | 860 757-9971                            | No                                      |                                      |               |
| <b>ALL MUNICIPALITIES</b>                                                                                                                                                                          |                                         |                                         |                                      |               |
| <b>Planning and Zoning</b><br><i>(Note: State agencies are exempt from local planning and zoning regulations. However, where possible the goal is to be consistent with local regulations.)</i>    | <a href="#">List of CT Towns</a>        | —                                       | —                                    | —             |
| <b>Building Demolition Permit</b> (issued by Town Building Department)                                                                                                                             | <a href="#">List of CT Towns</a>        | Yes                                     |                                      |               |
| <b>Subsurface Sewage Treatment and Disposal System</b><br><i>(Conventional system with design flow less than 2000 gpd)</i>                                                                         | <a href="#">Local Health Department</a> | No                                      |                                      |               |

| ENERGY CONSERVATION PROGRAMS                            | Telephone Number | Click On Drop Down Box In Each Category |                                      |               |
|---------------------------------------------------------|------------------|-----------------------------------------|--------------------------------------|---------------|
|                                                         |                  | Is the Permit Required?                 | Who is responsible to obtain Permit? | Permit Status |
| <a href="#">Energize CT: Energy Conscious Blueprint</a> | 877 947 3873     | Not Sure                                |                                      |               |
| <a href="#">Energize CT: Energy Opportunities</a>       | 877 947 3873     | Not Sure                                |                                      |               |

| PERMANENT UTILITY SERVICES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                             |                    |                           |                       |                                      |               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|--------------------|---------------------------|-----------------------|--------------------------------------|---------------|
| <p><b>The Consultant is required to research, as applicable, potential connection fees and permits associated with each permanent utility service provider.</b></p> <p>A copy of the specific project data from the permanent utility company including the date of the agreement must be sent to the design engineer.</p> <p><b>NOTE:</b> If permanent utility connections are required then the Consultant must note in the applicable utility CSI Construction Specification Section that the Contractor or CMR shall be responsible for <b>obtaining all approvals and paying all fees and costs</b> associated with the each permanent utility connection to each permanent utility provider.</p> |                                                             |                    |                           |                       |                                      |               |
| Date Of Agreement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Permanent Utility                                           | Connection Needed? | Potential Connection Fees | Is a Permit Required? | Who is responsible to obtain Permit? | Permit Status |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Cable TV</b>                                             | Yes                | TBD                       | Not Sure              | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Closed Circuit TV</b> <i>(Agency System)</i>             | Yes                | TBD                       | Not Sure              | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Electric</b> <i>(Eversource, UI etc.)</i>                | Yes                | TBD                       | Not Sure              | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Fire Alarm</b> <i>(Connected to Fire Dept.)</i>          | Yes                | TBD                       | Yes                   | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Gas</b> <i>(Eversource, CNG, SCG etc.)</i>               | Yes                | TBD                       | Not Sure              | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Security Systems</b>                                     | Yes                | TBD                       | Not Sure              | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Septic</b> <i>(DPH/DEEP)</i>                             | Yes                | TBD                       | No                    | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Sewer</b> <i>(Town, MDC, agency-owned systems, etc.)</i> | Yes                | TBD                       | Yes                   | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Telephone</b>                                            | Yes                | TBD                       | Not Sure              | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Water Supply</b> <i>(Utility)</i>                        | Yes                | TBD                       | Yes                   | A/E Consultant                       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Other:</b>                                               |                    |                           |                       |                                      |               |





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**Checklist for Permits,  
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| OTHER PERMITS,<br>CERTIFICATIONS, OR<br>APPROVALS     | Telephone<br>Number | Click On Drop Down Box In Each Category |                                            |               |
|-------------------------------------------------------|---------------------|-----------------------------------------|--------------------------------------------|---------------|
|                                                       |                     | Is the Permit<br>Required?              | Who is<br>responsible to<br>obtain Permit? | Permit Status |
| Installer-Boiler Registration & Inspection<br>Request | 860-713-5880        | Yes                                     | A/E Consultant                             |               |
| Boiler Installation Report                            | 860-713-5880        | Yes                                     | A/E Consultant                             |               |
|                                                       |                     |                                         |                                            |               |

**COMMENTS**

This checklist has been prepared as part of a feasibility study for the project, which is an alternative to a CAS thermal plant at 410 Capitol Avenue. The requirement for permits is based in part on the checklist prepared for DCS Project No. BI-2B-414-DBCA.

**A/E CONSULTANT SIGNATURE**

At this submission phase, I/we have reviewed each permit, certification, and approval to determine if it is applicable to the project and will prepare all necessary permit, certification, or approval applications, as well as all required documentation for each application for the project.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
*(Architect/Engineer Signature)*

Architect/ Engineer Firm Name: \_\_\_\_\_  
*(Typed or Printed)*

Phone Number: \_\_\_\_\_  
*(Typed or Printed)*

Email: \_\_\_\_\_  
*(Typed or Printed)*

**In addition to submitting this Checklist to the DAS Project Manager, submit a copy of just the Checklist to:**

DAS Construction Services  
Environmental Planning Unit  
450 Columbus Blvd, Suite 1305  
Hartford, CT 06103

**AND**

DAS Construction Services  
Office of the State Building Inspector  
450 Columbus Blvd, Suite 1303  
Hartford, CT 06103

End  
Checklist for Permits,  
Certifications, and Approvals



## ADDITIONAL CHECKLIST INSTRUCTIONS

### Consultant's Responsibility:

- For all DAS Construction Services projects, the Consultant (or in the case of a Design-Build Project, the Design-Build Firm) shall ensure that all required permits, certificates, and/or approvals are obtained for the project.

### Evaluation and Review:

- The list of permits, certificates, and approvals is meant to assist the Consultant with their evaluation; the list and the brief "Applicability" descriptions are not intended to be all-inclusive. Ultimate responsibility for evaluating all permits, certificates, and approvals resides with the Consultant.
- The Consultant shall review each permit, certification, and approval to determine if it is applicable to the project.
- The Consultant shall also review all prior **environmental documents** for the project to assist in determining required permits and/or mitigation measures.
- For supplemental information about an individual permit, certification, or approval, contact the appropriate permitting agency or agency website for specific information.

### Additional Study:

- If additional study is required by the permitting agency, then an additional scope of work can be negotiated with the DAS Project Manager for such services.

### Submission:

- As specified in the DAS Consultant's Procedure Manual, the Consultant shall submit to the appropriate agencies all required permits, certifications, and approvals for the project. This shall include coordinating with the appropriate agencies, preparing and providing needed material, and completing all necessary documents, applications, and forms.
- NOTE:** For **DEEP Inland Water Resources** and **DOT OSTA approvals**, the Consultant **shall coordinate** with the **DAS Environmental Planning Unit** (860-713-5631).

### Fees:

- DAS is responsible for all application fees.

### General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities:

- For the "*General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities*", the Consultant is responsible for assisting with and providing permit information in the construction contract documents for use by the General Contractor or CMR. In addition, the Consultant shall assist with the online registration.
- The General Contractor, CMR, or Design-Build Firm** is responsible for electronically registering and submitting the "General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities" on **DEEP's ezFile website** (for projects involving one [1] acre or more of soil disturbance).

### General Permit for the Discharge of Domestic Sewage:

- The Consultant shall contact the DEEP and, if applicable, obtain a copy of the facility's existing "*General Permit for the Discharge of Domestic Sewage*" to determine applicability and correct submittal information.
- If the project will change any information previously submitted on an existing Domestic Sewage Permit, then the Consultant must submit, on behalf of the facility, the correct information in writing to the DEEP.

### Air Emissions Evaluation:

- If new air emission equipment (**including, but not limited to, boilers, hot water heaters, laboratory fume hoods, spray paint booths, and/or emergency generators**) are to be installed as part of the project, then the Consultant shall include appropriate **air emission calculations** in their evaluations of permit applicability. Actual and potential air emissions calculations shall be performed in accordance with DEEP Bureau of Air Management Regulations. Air emission equipment (to be installed as part of the project) must be evaluated individually (New Source Review Permit) and facility-wide (Title V Permit) with all existing air emission equipment.
- Air emission calculations shall be summarized in a letter addressed to the DAS Environmental Planning Unit.** The letter must also state that should anything change (e.g., additions or modifications to the equipment), then the owner/agency is responsible for reviewing and updating the permits as necessary.
- If there are any **exemptions** to the permits which are based on operational requirements (for example, an emergency generator), then the letter must include applicable **operational requirements** so as to remain in compliance with the permit.
- Please consult the [DEEP Air Permitting website](#) for additional details and information.

End - Additional Checklist Instructions