EASTERN
WASHINGTON UNIVERSITY
Shawn King
Associate Vice President

MEMORANDUM

To: Jen Masterson, Senior Budget Assistant to the Governor, Office of Financial Management

From: Shawn King, Associate Vice President for Facilities and Planning

Date: August 15, 2022

Re: Major Capital Project Proposal – Infrastructure Renewal IV
Infrastructure 40000114

Eastern Washington University's major project proposal for OFM project number 40000114 Infrastructure Renewal IV in the Infrastructure Category, in accordance with requirements of the Office of Financial Management's 2023-2025 Capital Project Evaluation System.

An electronic copy of this project proposal can be found at the link below:

OFM 2023-2025 Capital Project Evaluation System

If you have any questions or issues with the link provided, please let me know.

Best Regards,

Facilities and Planning
1115 Cedar ST, 101 Rozell Cheney, WA 99004-2445 ▪ 509-359-6878 ▪ https://inside.ewu.edu/facilities

2022 PROJECT PROPOSAL CHECKLIST
2023-25 Biennium Four-year Higher Education Scoring Process

INSTITUTION	CAMPUS LOCATION
370 - Eastern Washington University	Cheney, Washington
PROJECT TITLE	**OFM/CBS Project #**
Infrastructure Renewal IV	40000114
PROJECT CATEGORY	**FPMT UNIQUE FACILITY ID # (OR NA)**
Infrastructure	A01309
PROPOSAL IS	
New or Updated Proposal (for scoring)	Resubmitted Proposal (retain prior score)
☒ New proposal ☐ Resubmittal to be scored (more than 2 biennia old or significantly changed)	☐ Resubmittal from 2018 (2019-21 biennium) ☐ Resubmittal from 2020 (2021-23 biennium)
CONTACT	**PHONE NUMBER**
Steve Schmedding	509-359-04205

Proposal content

- ☒ Project Proposal Checklist: this form; one for each proposal
- ☒ Project Proposal Form: Specific to category/subcategory (10-page limit)
- ☒ Appendices: templates, forms, exhibits and supporting/supplemental documentation for scoring.

Institutional priority

- ☒ Institutional Priority Form. Sent separately (not in this packet).

Check the corresponding boxes below if the proposed project meets the minimum threshold or if the item listed is provided in the proposal submittal.

Minimum thresholds

- ☒ Project is not an exclusive enterprise function such as a bookstore, dormitory, or contract food service.
- ☐ Project meets LEED Silver Standard requirements.
- ☒ Institution has a greenhouse gas emissions reduction policy in place in accordance with RCW 70A.45.050 and vehicle emissions reduction policy in place per RCW 47.01.440 or RCW 43.160.020 as applicable.
- ☐ A complete predesign report was submitted to OFM by July 1, 2022 and approved.
- ☐ Growth proposals: Based on solid enrollment projections and is more cost-effectively providing enrollment access than alternatives such as university centers and distance learning.
- ☐ Renovation proposals: Project should cost between 60 – 80% of current replacement value and extend the useful life of the facility by at least 25 years.
- ☐ Acquisition proposals: Land acquisition is not related to a current facility funding request.
- ☐ Infrastructure proposals: Project is not a facility repair project.

- ☒ Stand-alone, infrastructure and acquisition proposals is a single project requesting funds for one biennium.

Required appendices

- ☒ Project cost estimate: Excel C-100
- ☐ Degree Totals and Targets template to indicate the number of Bachelors, High Demand and Advanced degrees expected to be awarded in 2023. (Required for Overarching Criteria scoring criteria for Major Growth, Renovation, Replacement and Research proposals).
- ☒ Availability of Space/Campus Utilization template for the campus where the project is located. (Required for all categories/subcategories except Infrastructure and Acquisition proposals).
- ☒ Assignable Square Feet template to indicate program-related space allocation. (Required for Growth, Renovation and Replacement proposals, all categories/subcategories).

Optional appendices

Attach supplemental and supporting project documentation, *limit to materials directly related to and needed for the evaluation criteria*, such as:

- ☐ Degree and enrollment growth projections
- ☐ Selected excerpts from institutional plans
- ☐ Data on instructional and/or research space utilization
- ☐ Additional documentation for selected cost comparables (acquisition)
- ☐ Selected materials on facility conditions
- ☐ Selected materials on code compliance
- ☐ Tables supporting calculation of program space allocations, weighted average facility age, etc.
- ☐ Evidence of consistency of proposed research projects with state, regional, or local economic development plans
- ☐ Evidence of availability of non-state matching funds
- ☐ Selected documentation of prior facility failures, high-cost maintenance, and/or system unreliability for infrastructure projects
- ☐ Documentation of professional assessment of costs for land acquisition, land cleanup, and infrastructure projects
- ☐ Selected documentation of engineering studies, site survey and recommendations, or opinion letters for infrastructure and land cleanup projects
- ☒ Other: Energy Audit Report

I certify that the above checked items indicate either that the proposed project meets the minimum thresholds, or the corresponding items have been included in this submittal.

Name: *Shawn King* Title: *AVP Facilities and Planning*

Signature: Click or tap here to enter text. Shawn King Date: Click or tap here to enter text. 8/15/2022

Infrastructure Renewal – IV

Infrastructure - Renewal

EASTERN
WASHINGTON UNIVERSITY

2023 – 2025 Capital Budget

INSTITUTION	CAMPUS
Eastern Washington University	**Cheney, Washington**
PROJECT TITLE	
Infrastructure Renewal IV - 40000114	

SUMMARY NARRATIVE

Eastern Washington University is requesting funds in the amount of $15,800,000 for Infrastructure Renewal IV in the Infrastructure category.

- Problem Statement

This request includes **sub-sections** entitled **Central Steam Production, Chilled Water Production,** and **Medium Voltage Electrical Distribution**. A heading for each sub-section will be included in each specific criteria category for clarity.

Authors note: Many appendices have been developed as support documentation for this funding request. They are referenced throughout the narrative and contain engineering studies, project plans, Work Order repair history, etc. The author has modified some of the larger appendices to; reduce the size of the final submission packet, to aid in review, and to direct the reviewers to specifics of a particular discussion where referenced. If provided in full, Appendices A – I2 would be comprised of almost 1,000 pages. While this documentation provides justification for this request, it is also very cumbersome to any reviewer. Links are provided at the appendix heading, where appropriate, to direct the reviewer to each full appendix should they desire to review a specific appendix to a greater extent.

OFM Guidelines for Capital Projects state that for the Infrastructure Category "projects generally would be completed (predesign through construction) in one biennium." However, this infrastructure renewal request focuses attention to our campus energy plant and its aged equipment. It is neither physically, nor financially feasible from a design or construction standpoint that the entire plant renewal could be completed in one biennium. Therefore, this request is incremental, and biennium based. It is important to understand why this direction was taken, as this request builds on work completed in past biennium funding allocations. EWU and our consultants have laid out our requests in a logical manner to replace major plant equipment over several biennia. Major pieces of equipment that sometimes must operate simultaneously in parallel need to be approximately the same age/vintage so to allow plant operations to run as efficiently and seamlessly as possible. This is the most important aspect of our request.

In 2014 Eastern partnered with mechanical, electrical, and civil professional engineering consultants to examine each major utility system for current condition assessment, lifecycle renewal/replacement, potential energy savings, and sustainable upgrades. The systems that were examined include campus electrical power distribution as well as steam and chilled water production and distribution systems, and domestic water distribution system. Included in this overall study were recommendations for short and long-term actions to reduce potential failures, lower maintenance costs, increase worker safety and improve efficiencies, and to identify potential alternate energy sources for future production of utilities.

The engineering study contained in **Appendix A** is the original source document which laid the groundwork at a schematic level for the renewal of most all campus infrastructure systems. Additional appendices provide more in-depth engineering study based on the **sub-sections** described at the top of this page.

Appendix B contains pertinent information of our major Boiler and Chiller Plant equipment. As can be seen in the boiler portion of the appendix, most of the major equipment was built and put into service in the 1960's within a few years of each other. With the replacement for original boiler #3 underway, this area of plant equipment replacement is approximately 20% complete. Likewise, with two new chillers and towers installed in 2017/2018 we are approximately 40% complete with the cooling equipment replacement.

N+1 Design - Modern steam and chilled water plants are generally designed, built, and operated on the principle of "N+1 redundancy where N = the Number of (boilers or chillers) needed to produce to the required peak heating or cooling load, and +1 represents an additional boiler or chiller to support the load when one of the other, "N" units are offline. This is how the Rozell Central Energy Plant was originally planned. N+1 redundancy is an industry standard and an important design/operational aspect as it allows for continuous steam, or chilled water production meeting campus needs while taking a portion of the plant off-line for scheduled maintenance or other reason. However, due to the age of the remaining boilers and chillers currently in use, the complete loss of Boiler #3, Chiller #4, and Towers #4 & #5 as shown in appendix B, the plant does not have the needed redundancy and has very limited flexibility in maintaining the heating or cooling load when switching between remaining operable units.

Plant Operations – Being an operator in an energy plant is a lot like being a weather-forecaster. Operators are continuously looking at hourly forecasts, gauging to see what direction they may need to adjust either boiler or chiller operations. For example, if the forecast shows the temperature is dropping an additional boiler may need to be warmed up and brought online to assist in providing continuous heat production to the campus.

As can be seen in Appendix B our plant has five boilers and chillers. It is important to understand that it would never be the case that all five boilers would be firing and supplying steam at the same time. The same is true regarding the chillers. There are several reasons why this is the case, one being addressed in the N+1 discussion above. Based on the forecast the operators will bring online two and in severe heat or cold situations three boiler or chiller units to provide climate control in the campus buildings based on the outside temperature, and the forecast. At EWU it is not uncommon that both a boiler and a chiller would be brought online in the same day and utilized as the need for both exists within the campus.

Having a robust selection of boilers and chillers of varying capacities to choose from is important as this allows the most efficient use of the energy to produce heating and cooling for the campus. Additionally, each boiler and chiller have minimum and maximum operating setpoints which allow for finetuning of the unit to work more efficiently. This function is termed "turn-down" and allows the operator to adjust the specific unit to the needed heating or cooling required on campus.

The fact is, all major equipment but the two newest chillers, and the new boiler currently being installed, are well past their expected service life. Technological advancements in boiler and chiller design over the last 20 to 60 years makes operating both the older and newer equipment in parallel difficult. For example, while the new units have a large "turn down" range, the older units do not have much range and this limitation tends to waste energy. "Energy efficiency" was not a concern in the 1960's when most of our boilers were built. Today, energy efficiency is one of the most important aspects of boiler and chiller design, and selection.

Needs, Central Steam Production - Appendix B provides information on each boiler, the year built, the safe operating capacity, a condition description, and the year if/when the boiler was replaced. As can be seen in the table and considering the three highest output existing boiler combinations (#1, #4, #5) the plant capacity is approximately 50% above average peak campus heating loads (60,000pph). The addition of new boiler #3 (currently in construction) begins the replacement of these old boilers which will modernize the plant and alleviate several concerns: energy usage and efficiency, maintenance and repair, and plant stability.

This mission critical system has major components that are over 60 years old, with many parts that are no longer produced which further complicates proper maintenance and repair. Although the steam plant is well maintained it should be made very clear that the stability and longevity of our system is very close to being compromised.

Benefits, Central Steam Production – Using FY 2021-23 funds the university is under contract and replacing boiler #3. The current schedule has construction completing in December 2022. This funding request will replace existing boiler #2 as it is the oldest and smallest boiler in the train. A new boiler #2 of approximately the same size but with all the benefits of new technology will allow for a much more energy efficient operation. Considering "**Plant Operations**" as noted above, having a new smaller boiler will increase operator flexibility as weather forecasts change and campus heat loads need to be adjusted. There are several code requirements related to safety, energy management and sustainability that will be implemented with each boiler upgrade. These upgrades facilitate the departments' requirement of providing the required campus heating for many years into the future in an energy efficient, safe, and consistent manner.

Needs, Chilled Water Production – Appendix B also provides information on each chiller, the year built, the safe operating capacity, a condition description, and the year if/when the chiller was replaced. The plant typically experiences summer cooling loads of between 3,500 tons to 3,800 tons in July and August. This represents spare capacity as low as 5% when operating three chillers and towers (#1, #2, #3) for cooling with a reserve chiller on standby. Because two of the five towers are out of service the maximum capacity is limited to 4,000 tons. Additionally, there is no flexibility or backup to perform maintenance at this point which is very concerning to/for the plant.

Using FY 2021-23 funds the university is under a design contract for the replacement of the remaining chillers and towers. The university will use FY 2023-25 allocated funds to execute a contract to change out a chiller and at least one tower, depending on the final funding allocation

As with the boiler plant replacement these old chillers will modernize the plant and alleviate several concerns: energy usage and efficiency, maintenance/repair, and plant stability. This mission critical system has major components that are over 24 years old and are exceeding their expected lifecycle.

Benefits, Chilled Water Production – Using FY2023-25 funds the university's goal is to replace at least one of the remaining chillers, and two of the towers due to their physical tie to one another. The preferred plan is to replace #3 chiller and cooling towers #4 & #5 during that timeframe. A future funding request would follow on with the replacement of the last two old chillers (#4 & #5). It will be important to replace #4 & #5 at the same time due to physical space limitations. As noted in the past these new chillers would be equipped with the same technology and energy saving features as those that installed in 2017/2018.

Needs, Medium Voltage Electrical Distribution - University electricians operate, perform preventative maintenance, and make repairs to a 13,200 KvA Medium Voltage Electrical System. The system is aged but fortunately has been well maintained minimizing wear on critical components that are commonly considered out of date by current electrical code. Now is the time for these major components to be replaced. The report identified in Appendix A recommended six (6) electrical projects. Project **EL-3 Distribution Switching** generated the engineering study **Appendix C1 – Electrical Capacity Upgrade.** This study and report conducted in August 2016 provided a "Load Model" validating existing campus loads and the projected load increases related to the new Interdisciplinary Science Center and the needed electrical capacity increase associated with the needed increased chilled water capacity. Appendix C was the focus of previous biennium requests and continues to be a part of this, and future requests until all needed upgrades are accomplished.

Upon completion of design for the first phase of the switch upgrades, the university executed a contract to replace two of the switches **See Appendix D2**. Unfortunately supply chain issues and market conditions have changed, and the original estimate provided in FY 2021-23 to be inaccurate. For example, the cost to purchase the switches alone was estimated at $20,000/switch. What has been found to date is that switch costs are approaching $40,000/switch. **Appendix G** includes an updated price quote dated July 2022 from one switch manufacturer (Federal Pacific) as support for the revised estimate for the Medium Voltage work.

Since 2021, supply chain issues have impacted all projects and this first phase of switch upgrades is no different. Originally, the delivery for the two new switches was at 16 weeks but has recently been extended out to 27 weeks. This creates project execution issues and prolongs contract time. As a workaround to this, the university intends on using remaining FY21-23 allocated funds to purchase and securely store as many of the switches as possible to use on the future phases of this project. Once the switches are in university possession future projects will be re-evaluated for advertisement, and construction dependent on available future funding. As stated in the opening paragraphs, this represents the incremental biennium-based capital request aspect.

Benefits, Medium Voltage Electrical Distribution – As noted in **Appendix C1**, and using funds provided in previous biennia, design was completed, and contracts were executed to accommodate the immediate needs of the Interdisciplinary Science Center (ISC) which was under construction at that time. Attention was then directed at the "Recommendations" section of Appendix C wherein life safety, environmental considerations, code compliance and preventive maintenance issues were addressed and are being incrementally corrected. The specific project included in this request is the Medium-voltage Vacuum Switch Replacement, **Appendix C2**.

These Medium-Voltage projects being referenced are required due to life-safety issues with respect to the components of the existing medium voltage system within the tunnel system. **See Appendix E.** The existing switches were installed in 1989 making them approximately 33 years old. The expected useful life of these type of switches is between 15 and 20 years, even assuming optimal conditions this equipment has exceeded its useful life and failures are imminently expected. The gas within these large switches is comprised of SF_6 Sulfur Hexafluoride, a potent greenhouse gas and excellent electrical insulator. Again, due to the reduced funding received in FY 2019-2021 this need still exists. Updating and relocating these switches from our tunnels to the surface will provide energy efficiency, environmental sustainability, increased system longevity, and the latest in life-safety and electrical worker safety features for university electrical shop personnel.

- History of the Project or facility:

Eastern Washington University's Cheney campus consists of approximately 70 individual buildings comprising almost 3,000,000 gross square feet of academic and student support facilities whereby university-owned infrastructure provides all heating, cooling, electrical, and other building utility needs to these facilities. University plant operators have operated and maintained the boilers (some over 62 years old) and chillers (24 years old) with great care, and as a result this major investment has functioned well beyond their expected lifecycle. However regardless of the professional care and maintenance given to these major pieces of equipment we have begun the process of cyclic replacement of the older inefficient boilers, chillers, and electrical components.

This infrastructure includes: Steam generation and distribution (Campus Building Heat); Chilled water production and distribution (Campus Building Air Conditioning and constant cooling for specialty systems); Fire protection and Domestic Water production and delivery (To 70 campus buildings); Sanitary sewer and storm sewer water collection and disposal to the City of Cheney; Central building automation and energy management systems (Energy efficiency and GHG reductions); And, Emergency vehicle access and other campus site improvements required by Code or other Statute (Federal, State and Local Building Code). These infrastructure systems are mission critical to daily life at Eastern Washington University and support the university's primary goal of student success. The Rozell Central Energy Facility is located at the north end of campus and was originally constructed in 1967. This plant is the heart of the campus where all steam heat, chilled water cooling, and electrical power distribution originate. Once produced, auxiliary systems distribute these services through approximately 3 miles of utility tunnels across campus.

Central Steam Production – The plant is equipped with five (5) high-pressure steam boilers with a maximum operating capacity of approximately 105,000 PPH (Pounds Per Hour) at 100psig steam. Once produced the steam is then distributed through a network of tunnels to the various campus classrooms, office buildings, sports facilities, and residence halls. The university also supplies steam heat to the Washington State Patrol Crime Lab and the Washington State Digital Archives facilities, both of which are based on this campus. Steam is used for both space heat and domestic hot water purposes. Because the Rozell steam plant provides domestic hot water for the campus it must operate continuously 24/7/365.

According to steam plant records, the largest campus demand for steam occurred during the winter of 2014 where sub-zero temperatures were experienced for an extended period. The historical peak demand observed during this period was 75,000 PPH, or approximately 75% of the existing plant capacity.

Using funds allocated in the FY 2021-23 Capital request, a new boiler #3 which replaces the older inoperable boiler #3 is currently under contract and being installed, meeting in part a portion of the Master Plan requirement for facilities. See **Appendix D1.**

Chilled Water Production – The chilled water plant consists of five water-cooled centrifugal chillers located in the lower level of the plant. Three of these chillers were installed in 1996 as a part of a major plant upgrade. Using funds allocated in the FY 2015-17 Capital request, two new chiller packages Chillers & Towers, #'s 1&2 respectively, were purchased and installed under construction contracts accomplished in 2017 and 2018, helping to meet a part of the Master Plan.

These two new chillers and auxiliary equipment are equipped with the newest in technology which allow for on-demand monitoring and adjustment of all components of the new chillers. The "state of the art" command and control systems include over 350 new monitoring points on the new chillers which create very flexible and energy efficient chilled water production, stabilizing system operations while meeting sustainability desires. Part of this project included a major change to the chilled water piping and how the different pieces of equipment may work with one another. Prior to this project, each chiller was "coupled" to a dedicated cooling tower, and a set of three (3) high horsepower pumps that were solely "coupled" to that chiller and tower. This setup offered no flexibility, and in effect took an entire chiller/tower/pump combination offline when any one of those pieces of equipment required maintenance or repair.

The redesign in 2017/2018 of the chilled water plant placed an emphasis on allowing for the greatest flexibility within the major components and operations which eliminated the "coupled" arrangement discussed above. A large part of this increased flexibility was addressed through extensive plant re-piping. Due to limited technology of the existing chillers and towers (#3, #4, & #5) the contract was not able to be upgraded with the necessary communications upgrades or the energy saving "on demand" flexible power ramping capabilities based on daily campus cooling load demand. At that time, the only modifications that could be made to the remaining existing chillers/towers were attributed to re-piping. Much was learned regarding the overall plant stability during the first construction contract and some good design information was subsequently included in that construction contract that will help reduce costs in the next phase of chiller/tower replacement. While AE1484-G4 has increased the overall plant capacity, existing chillers, and towers (both #3, #4, and #5) each have specific issues generally related to the age left in each piece of equipment. The tower issues reduce our capacity down to 4,000 tons. **(See Appendix E.2.a.i.)**.

Medium Voltage Electrical Distribution – Electrical power is distributed throughout the campus from its origin at the EWU substation located at the Rozell Central Energy Facility. The City of Cheney's

13,200Y/7620 VAC service provides the electrical power to the two primary meters located just ahead of the campus substation. Within the substation electrical power is segregated and distributed through switchgear to campus buildings by a selective-parallel feeder system (Bus #1, Bus #2, and Feeders 1A, 2A, and 1B, 2B) and routed through the campus by way of the university underground tunnel network which is about 3.0 miles long across campus. Original tunnel construction started in the 1960's. The tunnel system contains 27 vacuum switches which allow electric shop personnel the ability to switch between Main Bus #1 or Main Bus #2 depending on conditions. These switches are highly aged and are not code compliant for a couple of reasons: <u>The first reason relates to the switch's locations, in the tunnels.</u> EWU electrical shop staff are required to enter the tunnel (a confined space) to operate the switches when adjusting and balancing loads. At the time of installation, the switches were considered code compliant but have since been deemed unsafe for electrical staff due to their physical surroundings **<u>(See Photos - Appendix D2)</u>**, and the need to evacuate the tunnel if equipment were to fail during a switching operation. <u>The second reason relates to the actual materials used in the building these switches.</u> Again, at the time of original installation a common insulating material for these switches was SF_6, or Sulfur hexafluoride. This compound is an excellent electrical insulator, but also a potent greenhouse gas with high global warming potential. Studies indicate its concentration in the earth's atmosphere is rapidly increasing. During its working cycle, SF_6 decomposes under electrical stress, forming toxic byproducts that are a health threat for working personnel in the event of exposure. **<u>(See Appendix E.3.a.i.1-4.)</u>**.

- University programs addressed or encompassed by the project:

Literally all the programs on the Cheney campus are reliant on the utilities and infrastructure systems that are described in this request. The central energy plant operations provide all the heating, cooling, building power, domestic and sanitary sewer water for use in all the buildings on campus as well as the Washington State Patrol Crime Laboratory and the Washington State Archives, both located on campus. The various forms of network communications are transported through the tunnel system on campus. Facilities staff operate and maintain all the various pieces of equipment that are required to deliver these utilities, providing a safe and comfortable academic atmosphere for instruction and other campus activities.

These infrastructure systems are by their very nature tied to each facility and support every program on campus. Eastern's goal of student success and as an "Institution of Innovation" are fully represented with this project which promotes student success through a safe, healthy, and supportive environment.

This Capital Budget Request reflects the additional design effort based on the above noted strategy which was initially requested in the FY 2015-17 Capital Budget Request Cycle, and biennial requests since then. With the partial funding received; a phase of the Master Plan design was accomplished, and construction contracts for some of the infrastructure needing replacement accomplished.

This current FY 2023-25 request continues with the work of replacement of major infrastructure required to support the new Interdisciplinary Science Center, which is now in use, the proposed remodel of the existing Science building, currently under construction, as well as the other listed project funding needs noted in the combined EWU proposal.

This funding request aligns with EWU's Academic Strategic Plan 2018-2025, Core Theme: Access + Learning + Completion = Student Success, in that by providing fully functioning, energy efficient and environmentally considerate modern facilities students will have the best opportunity for access to centers for learning which, in turn, provides an environment for course completion and student success.

CATEGORY-SPECIFIC SCORING CRITERIA

1. Significant Health, Safety and Code Issues

Appendix E provides some of the specific references pertaining to life safety, energy efficiency, and greenhouse gas reduction associated with daily plant operations.

Our engineering consultants are required to follow all current building, mechanical, plumbing, fire, and life safety codes in the development of the design. A review of **Appendices C, D, H, and I** is offered as support documentation for this criterion as all work noted for Central Steam Production, Chilled Water Production, and Medium Voltage Electrical Distribution in those appendices is within current code for its specific element to the project.

2. Evidence of increased repairs/service interruption

As can be seen in **Appendix B,** Boiler No. 3 has had an interruption of service since 2008 when it was taken out the steam train due to numerous mechanical issues. Also, please note that since late 2018 Chiller No. 4, and Towers No. 4 & 5 are currently offline and out of service. **Appendix F** contains summaries of O&M and repair work that has occurred since 2018 related to the Central Steam and Chiller plants, after a detailed list of work orders performed by facilities personnel between 2018 to 2022.

3. Impact on operations without Project

All the systems and operations at the Rozell central energy plant are mission critical to the university simply by the very nature of their existence and relationship to the campus. As noted earlier, most of these systems components are over twenty to sixty (20 to 60) years old with some replacement parts no longer being produced. Although the plant and its systems are well maintained, it should be made clear that the stability and longevity of our systems are very close to being compromised. In the case of a catastrophic failure, the resultant needed capacity of plant systems may not cover existing campus heating or cooling needs and does not meet the anticipated future campus needs. Please refer to the "Executive Summary" of **Appendix A** as the basis document supporting the work of this repeated biennial request. The follow-on appendices further support the necessary engineering study concluding with the completed, in-progress, and proposed projects. Without these upgrade projects the university would be seriously impacted in fulfilling its existing campus operations.

The lack of infrastructure to support these new/remodeled facilities would greatly affect Eastern's Strategic Plan, its Comprehensive Campus Master Plan, and the ability for Eastern to grow enrollments, increase undergraduate rates in general education and STEM fields, and increase growth in graduate degrees.

This project request continues the improvements to existing operations by increasing efficiency and reducing energy consumption through technology advancements, and by providing the opportunity to consider alternate design applications and potentially, alternate fuels for operations. Our engineering professionals have assessed and noted specific areas of each utility that are at or beyond their expected useful life and in need for replacement or major renewal. There are potential failures in these old systems that will be very costly and could affect the university's ability to operate until major emergency repairs were to be made should an actual failure be experienced.

These projects allow EWU to better be in alignment with the Washington State Greenhouse inventory requirements and by their very nature align well with the President's Climate Commitment policy.

Central Steam Production - The potential impact to campus heating capabilities is wide ranging and dependent on which boiler failed and in what season that failure occurred in. Considering a worst-case scenario such as the complete loss of one or more of the remaining boilers during the middle of January or February with extremely cold temperatures as is the referenced norm. The university would need to enact emergency measures, and contract with a boiler rental company to provide a compatible temporary boiler that could be connected to our system. From searching for, to finalizing and signing rental contracts, delivery, setup, and "building" a physical connection point between the rental boiler and the plant just to be able to begin to produce and distribute heat to campus instruction, living and working spaces based on the following:

- Rental steam equipment compatibility, availability, and distance from campus.
  - Purchase Order, signed contract, and insurance provisions to resolve prior to rental.
  - Daily rental costs for such equipment can be expected to be somewhere up to $5,000/day not including delivery each way, fuel, chemical treatment and permitting.
- Construction of a temporary tie-in to our permanent steam distribution system.
- During this timeframe and dependent on weather conditions the university may have to shut down.
  - For example, see **Appendix E.1.a.i** – Life Safety code – Heating Public Facilities.
  - Even though an emergency, this could take several weeks.
  - This would have a severe impact on institutional operations.

The impact to the university by having to contract rented temporary heating has other costs as well which cannot be defined until such an emergency arises. Beyond this, the origin of the catastrophic event would still need to be repaired/replaced to fully resolve the emergency.

Chilled Water Production – In similar manner to central steam production, the potential impact to losing cooling capability is wide ranging. A similar summertime worst case scenario could be realized as described above should any of the remaining older chillers fail at the wrong time. Sensitive systems such as data storage rooms, the animal vivarium in the Science building, WSP crime lab equipment (DNA & chemistry refrigerators, evidence freezers), and all other temperature critical systems around campus would be at risk of loss should a catastrophic failure occur. With the completion of the first phase of upgrades to the chilled water plant, some stability and longevity has been brought back to the system. However, the upgrade is only partially complete. This project is needed to continue the renewal of aged equipment that have operated beyond their effective lifecycle. The new chillers installed in 2017/2018 was the first step in bringing this plant and system up to date with state-of-the-art energy efficient equipment and systems. Once all chillers are replaced the university will experience many years of efficient operations saving precious State dollars.

Medium Voltage Electrical Distribution – Consistent and stable electrical power to the halls and facilities on campus is essential to the very operation of the university. An unplanned outage from a failure occurring at any of the vacuum switches or within sections of the Medium Voltage (MV) electrical conductor cable may render large portions of the campus without electrical power for an extended period. Efforts to minimize this have been accomplished with the recently completed electrical upgrade projects through revised switching and load balancing. The weakest link(s) in the system are currently at the vacuum switch locations and with some of the aged conductor cable, which provide the "Pathway" around the campus for all electrical power. Along some pathways the impact of a conductor/switch failure is greater with respect to systems with critical power needs, such as the campus datacenter, WSP Crime lab, and the vivarium. The cost of repairing an unplanned outage can be several times the cost of planned outages.

4. Reasonableness of cost

Detailed cost estimates from each engineering consultant for Central Steam Production, Chilled Water Production, and Medium Voltage Electrical Distribution Switch Upgrades are sequentially located in Appendix G.

5. Engineering Study

In 2014 when Eastern partnered with mechanical, electrical, and civil professional engineering consultants to examine each major utility system, a condition evaluation report was provided See **Appendix A**. This schematic level report formed the basis for more in-depth engineering studies of each specific utility. see descriptions below:

Central Steam Production – A more focused study specifically for the steam system was also commissioned in 2014. The results of this study are contained in the report located in **Appendix H1**. This report identifies plant deficiencies and lists five (5) steam plant projects, and four (4) steam distribution projects which will alleviate the problems identified. In 2020 a final in-depth engineering study was completed for the replacement of Boiler No. 3, **see Appendix H2**. Included in this study were recommendations for future boiler replacements.

Chilled Water Production – While the existing steam system was being studied, the existing campus chilled water system was also studied in 2014 from a schematic design level of view. The results identified four (4) chiller plant projects and one (1) chilled water distribution project to bring this plant back up to the proper operating level. See Appendix I1. A more in-depth engineering study completed in 2016 resulted in the contract plans for the replacement of Chillers No. 1 & 2, and laid groundwork for future chiller replacement projects. See Appendix I2. A post-construction efficiency study with actual dollar savings based on power data for the new chillers installed in 2018 is included at the end of this section. This study indicates that this upgrade is saving the university approximately $45,000/year with this upgrade. It is expected that further savings will be realized after additional upgrades are in place.

Medium Voltage Electrical Distribution – The initial study listed in Appendix A provided direction for further study. In 2016 EWU commissioned the second study which is identified in Appendix C1. A more in-depth engineering study completed in 2020 provided for a series of phased contract plans for the replacement of approximately 25 medium voltage switches. Please see Appendix C2.

6. Support by planning

The current edition (2014) of Eastern Comprehensive Campus Master Plan states that the University's top priorities are the expansion of Eastern's Science Technology Engineering and Math (STEM) programs. The growth and increased graduation rates in these programs tie directly to the construction of the Interdisciplinary Science Center, the science building remodel, and a new Engineering building. As stated in the engineer's report, the current university infrastructure (steam, chilled water, and medium voltage electrical) will not support these new facilities without updating and expansion of these systems. See Appendices A, C, H & I.

Eastern's Facilities Master Plan is available at:

https://tinyurl.com/y4vbxn83

Eastern's Strategic Plan "Inspiring the Future" (2012-2017) is available at the following link:

https://in.ewu.edu/strategic-planning/wp-content/uploads/sites/127/2017/03/Strategic-Plan-2012-2017-Inspiring-the-Future.pdf

Eastern's Sustainability Master Plan and American College and University Presidents' Climate Commitment (ACUPCC) Climate Action Plan in conjunction with State of Washington's requirement for reduction of greenhouse gas emissions and reduction of the university carbon footprint, these projects also align with Eastern's Climate Action Plan and the University Sustainability Master Plan. Those plans can be viewed at the following link:

American College and University President Climate Commitment Climate Action Plan 2012

https://secondnature.org/signatory-handbook/the-commitments/

Eastern's Sustainability Master Plan 2012:

https://in.ewu.edu/facilities/wp-content/uploads/sites/191/2017/01/EWU-Climate-Action-Plan.pdf

7. Resource Efficiency and Sustainability

Central Steam Production - The existing boilers and auxiliary systems were built and installed approximately ten (10) years prior to the creation of the U.S. EPA, at a time when energy and resource conservation were not a concern. Boiler technology in the fifty (50) plus years since our boilers were installed has been directed at efficiency, reducing greenhouse gas emissions, and sustainability. The U.S. EPA Office of Air Quality, Planning and Standards has set National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. These standards are contained in 40 CFR Part 63 and form the constraints by which modern boiler fabrication and operation are governed by.

Chilled Water Production - The advancements in chiller and controls technology that were installed during the first phase of new chiller plant construction in 2017-2018 were in part designed to improve energy and resource conservation. The new portions of the plant provide increased flexibility to meet the demands of daily temperature fluctuations through for example, the addition of Variable Frequency Drives (VFD) at all feasible locations. VFD's provide demand based electrical energy adjustment thereby saving electrical energy consumption. The post-construction efficiency study and cost savings referenced in **Appendix I2** provide documented energy and resource conservation.

Medium Voltage Electrical Distribution – Completed past construction projects based on **Appendix C1 – Electrical Capacity Upgrade** fulfilled the selected design for Distribution System Options – Option C. Selective switchgear improvements provided more capacity within the existing system which increases system efficiency and increases resource conservation. **Medium-voltage Vacuum Switch Replacement:** First noted in Appendix C1, this project reduces greenhouse gas emissions by replacement of aged environmentally harming switches (Sulfur-hexafluoroethane filled) placed in close, potentially unsafe tunnels with safe, modern "Air-insulated" switch technology placed in locations complying with current safety and electrical codes. **Appendix C2.**

APPENDICES

Supporting Reference Data

Appendix Table of Contents

Appendix	Title	Description	Total # of **Full Appendix** Pages	Number of Pages Used in **Abbreviated Appendix**
A	2014 Campus Infrastructure Renewal	Overall engineering study of various campus systems	91	19
B	Plant Major Equipt Information	Specifics on boilers, chillers, towers	2	2
C1	2016 Electrical Capacity Upgrade	Schematic Design Various Medium Voltage Elec. Improvements	24	5
C2	2021 Medium Voltage Study	Schematic Design of MV Switch Replacements	82	15
D1	2021 New Boiler Project Plans	Portions of Plans	86	20
D2	2022 Ph. 1 Electrical Switch Upgrades	Portions of Plans	20	14
E	Significant Life Safety, and Code Issues	Code Issues	3	3
F	Evidence of failure/ability to defer	Noted repairs	15	15
G	Cost Estimates	Estimates	15	15
H1	2014 C.I.R.-Steam	Schematic level Steam System Evaluation	133	39
H2	2020 Install New Boiler	Engineering Pre-Design Study	223	22
I1	2014 C.I.R.-ChilledWater	Chilled Water System Evaluation	141	29
I2	2016	Chilled Water System Evaluation	400	40
			1235	238

Appendix A – Campus Infrastructure Renewal 2014

The full document can be viewed at this link:

- https://inside.ewu.edu/facilities/2014-ewu-infrastructure-renewal/

APPENDIX A

EASTERN WASHINGTON UNIVERSITY

Campus Infrastructure Renewal

AUGUST 1, 2014

Contents

EXECUTIVE SUMMARY

Eastern Washington University has undertaken this study as the first step to insure that campus infrastructure is able to support the long term growth goals of the University as reflected in the recently updated capital master plan. The report evaluates and makes recommendations for the following systems:

Central Campus Steam Plant	Campus Steam Distribution System
Central Camps Chiller Plant	Campus Chilled Water Distribution System
Campus Energy Management & Control System (EMCS) Network	
Snowmelt System	Potable water
Sanitary sewer	Storm sewer
Irrigation	Medium-voltage electrical
Outside plant communications	Landscaping
Roads, walkways and site lighting	

The recommendations support the sequential implementation of the Comprehensive Campus Master Plan dated September 27, 2013. Schematic-level costs are presented for each recommendation in 2014 dollars. The Master Plan recognizes the significant capital expenditures required to facilitate the University's growth. This study augments the necessary modifications and associated costs required to support that growth.

The suggested infrastructure projects have been grouped in two categories: Those directly affecting the University's capital master plan and those projects which will improve operational efficiencies and maintenance procedures.

MASTER PLAN PROJECT COSTS

CW-1	Sewer System #1	$ 105,000
CW-2	Sewer System #2	$ 100,000
CW-3	Sewer System #3	$ 170,000
CW-4	Sewer System #4	$ 500,000
LI-1	Irrigation Master Control System	$ 175,000
LI-2	Storm System Wastewater Reuse #1	$ 373,000
LI-3	Storm System Wastewater Reuse #2	$ 742,000
LI-4	Storm System Wastewater Reuse #3	$ 715,000
LI-5	Streeter Hall Irrigation Replacement	$ 20,000
LS-1	Pedestrian Safety Improvements: Washington St.	$ 995,000
LS-2	Pedestrian Safety Improvements: ADA	$ 373,000
LS-3	Pedestrian Safety Improvements: Pavers	$ 550,000
SP-1	Repair/Replace Boiler #3	$ 3,500,000
SP-3	Upgrade Boiler Feedwater Pumps	$ 200,000
CP-1	Add Chiller Capacity	$ 3,600,000
CP-2	Upgrade Campus Chilled Water Pumps	$ 200,000
CD-1	Replace West-side Chilled Water Piping	$ 1,000,000
SN-1	Expansion of Snow Melting System Ph 1	$ 2,000,000
SN-2	Expansion of Snow Melting System Ph 2	$ 2,500,000
SN-3	Expansion of Snow Melting System Ph 3	$ 4,000,000
SN-4	Expansion of Snow Melting System Ph 4	$ 2,500,000
SN-5	Expansion of Snow Melting System Ph 5	$ 1,800,000
EL-3	Electrical Switch Replacement	$ 1,800,000
EL-4	Electrical Distribution System Expansion	$ 1,800,000
EL-5	Site Lighting Improvements, Phase 2	$ 3,500,000

MAINTENANCE EFFICIENCES PROJECT COSTS

CR-1	Emergency Vehicle Access #1	$ 60,000
CR-2	Emergency Vehicle Access #2	$ 22,000
CR-3	Emergency Vehicle Access #3	$ 31,000
CR-4	Emergency Vehicle Access #4	$ 40,000
CR-5	Emergency Vehicle Access #5	$ 82,000
CR-6	Emergency Vehicle Access #6	$ 46,000
CR-7	Emergency Vehicle Access #7	$ 240,000
CR-8	Emergency Vehicle Access #8	$ 20,000
CR-9	Emergency Vehicle Access #9	$ 60,000
CR-10	Emergency Vehicle Access #10	$ 30,000
CR-11	Emergency Vehicle Access #11	$ 12,000
SP-2	Boiler Feedwater Stack Economizers	$ 350,000
SP-4	Repair Rozell Heating Plant Boiler Stack	Unknown*
SP-5	Upgrade Natural Gas Service	Unknown**
SD-1	Replace Utility Tunnel Condensate Piping	$ 1,225,000
SD-2	Replace Utility Tunnel Condensate Pumps	$ 200,000
SD-3	Label Utility Tunnel Piping and Valves	$ 150,000
SD-4	Upgrade Piping in Plant Utilities Building	$ 125,000
CP-3	Install VFDs on Chiller Compressors and Cooling Towers	$ 1,250,000
CP-4	Install (2) New Energy Efficient Cooling Towers	$ 450,000
EM-1	Migrate BAS Network to BACnet Network	$ 3,350,000
EL-1	Medium-voltage Electrician	$100,000/year
EL-2	Electrical System Modeling	$ 56,000
EL-6	Optical Fiber Network	$ 2,200,000
Total cost of proposed capital projects:		$43,217,000

* Requires special evaluation of existing conditions to determine scope of work.

** Requires negotiations with service provider to determine feasibility.

The above estimates include the direct costs of materials and labor plus contractor overhead and profit. The estimates do not include escalation, Washington State sales tax, design fees, administrative fees and other "soft" costs.

REPORT APPROACH

This report is the combined efforts of the following design organizations:

Meulink Stauffenberg, Inc. – Mechanical Engineers

David Evans & Associates – Civil Engineers

Michael Terrell - Landscape Architecture, PLLC

NAC|Engineering – Electrical & Communications Engineers.

Also contributing to this report were representatives of the various organizations within the EWU facilities umbrella responsible for operating and maintaining the systems evaluated herein. Their understanding and insight provided a unique perspective regarding the condition and reliability of the existing infrastructure systems.

Design organizations met with respective EWU representatives to tour the campus, review existing conditions, discuss operational problems and brainstorm alternatives. The recommendations in this report are primarily the result of observations by the design organizations and operational information provided by EWU personnel.

STEAM PLANT PROJECTS

SP-1: Replace Boiler #3

Project Description: Replace existing 25,000 pph steam Boiler #3.

- Install a new 40,000 pph high pressure steam boiler with dual fuel (oil & gas) low NOX burner. Install new correctly sized stack economizer (boiler feedwater pre-heater).

Project Justification: The existing steam Boiler #3 has been out of service for a number of years due to several outstanding breakdowns and lack of repair funds. Boiler #3 is almost 50 years old and parts are difficult to find. Despite being maintained in excellent condition over the years by the EWU staff, this boiler is basically near the end of its life expectancy.

Future campus growth will increase expected plant steam loads by over 30%, which will start to impact boiler plant redundancy & operational flexibility. A new boiler will allow plant operation and redundancy to be maintained in to the future. A new boiler would increase steam plant operational efficiencies.

According to the EWU operations staff, the historical peak campus heating load, seen this last winter, is approximately 75,000 lbs/hr.

Based on the anticipated master plan campus growth for the New Science I & II projects, the new Gateway Athletic Project, the expected addition of future campus steam load is approximately 34%. Based on a peak historic load of 75,000 pph, a 34% increase would put the future campus steam load at over 100,000 pph, which is approximately 50% of the steam plant's present total capacity 217,000 pph.

Sequence / Category:

Capital Master Plan.

Cost:

SP-1: $3,500,000

SP-2: Install Boiler Feedwater Stack Economizers on Boilers #2 & #4.

Project Description: Install new boiler feedwater stack economizers on existing steam boilers #2 & #4. This installation would allow these boiler configurations to match boilers #1 & #5, which already have stack economizers in operation.

Project Justification: The existing steam Boilers #2 and #4, which are mostly operated in the shoulder and summer seasons, are not provided with boiler feedwater stack economizers, which are present on the other plant boilers. As a result, the operational efficiencies of these boilers are not a high as is possible, thereby reducing the plant's overall energy efficiency.
Also, because of the different feedwater configuration that these two boilers use, compared to the other boilers, the feedwater pumping loop must be run at differing pressures, which complicates plant operation.
New boiler feedwater stack economizers would increase boiler plant operational efficiencies, and simplify feedwater system operation.

Sequence / Category:
Improve Operational Efficiencies.

Cost:
SP-2: $350,000

SP-3: Upgrade Boiler Feedwater Pumps

Project Description: Replace the aging feedwater tank transfer pumps and upgrade or supplement the undersized Deaerator unit boiler feedwater pumps.

Project Justification: The existing single speed feedwater transfer pumps that provide feeddwater from the condensate return storage tank to the deaerator tank, are old and in questionable condition. This project would replace these pumps with new high efficiency pumps with improved controls for staging and monitoring.

The existing VFD driven boiler feedwater pumps that are part of the deaerator unit were recently installed as part of an energy retrofit to the plant, but, according to the plant operators, are having trouble keeping up with the feedwater demands of the boilers. These newer VFD driven pumps were downsized to 30 hp each, from the original single speed 50 hp feedwater pumps. Capacity reduction is unknown, but appears to be a factor in plant operation, requiring the operators to run the auxiliary steam-driven feedwater pump during peak loads. Redundancy is questionable with this configuration, so it is proposed that the new feedwater pumps be replaced with larger pumps or supplemented with an additional pump.

Sequence / Category:
Capital Master Plan.

Cost:
SP-3: 200,000

SP-4: Repair Rozell Heating Plant Boiler Stack

Project Description: Repair the existing Rozell Heating Plant concrete/masonry boiler stack.

Project Justification: The condition of the existing exterior concrete/masonry boiler stack at the Rozell heating plant is the subject of some concern. According to EWU staff, there is reason to suspect some of the interior lining material has started to fail and/or fall off. Further, it is unknown if the original construction and/or present condition of this stack is up to present seismic standards.
A full analysis of the existing boiler stack condition is not in the scope of this study. Further analysis is recommended.

Sequence / Category:
Maintenance & Repair.

Cost:

SP-4: Unknown (Further study required).

SP-5: Upgrade Natural Gas Service from AVISTA

Project Description: Increase the natural gas supply capacity to the Central Campus Steam Plant from the utility provider, AVISTA.

Project Justification: The existing steam boilers are limited in the amount of natural gas that they are allowed to consume at a given peak instant by agreement with the gas utility provider, AVISTA. Reportedly the high pressure gas supply distribution to the City of Cheney is limited based on AVISTA transmission gas line capacity. This issue is limits the steam boiler plant to a maximum consumption rate of approximately 56,000 lbs/hr, at which point the plant has to supplement its capacity by burning #2 fuel oil (diesel). Because it is not beneficial to fire the boilers on fuel oil due to emission concerns, efficiency reductions and added wear and tear, the ability to fire a greater percentage of the boiler plant on natural gas is desired.

Sequence / Category:

Unknown. Pending the timing of AVISTA natural gas infrastructure upgrades to the City of Cheney.

Cost:

SP-5: Unknown. (Further study required. Capital costs for gas capacity increase to Campus would presumably be paid for by AVISTA as part of their normal growth plans.)

STEAM DISTRIBUTION PROJECTS

SD-1: Replace Utility Tunnel Condensate Piping

Project Description: Replace aging gravity condensate piping system & components in utility tunnels. New piping to be heavier wall thickness, Sched. 80, compared to the existing standard wall Sched. 40 piping presently installed. New steam trap stations and valves would be provided.

Project Justification: Although the existing gravity condensate drainage piping system, that serves the high pressure steam distribution within the utility tunnels, appears to be in good condition and has been well maintained, most of this piping is around 40 years old. Although there have not been reports of major leaks or failures, this piping system is nearing the end of its useful life.

Because the condensate piping system is subjected to more severe service than the steam supply piping, on account of the presence of oxygen and other condensed gases, such as carbolic acid, internal corrosion is much more likely. This leads to premature pipe wall failure and leaks, as well as damage to components, such as valve and steam traps.

Sequence / Category:

Improved Maintenance & Operational Efficiencies.

Cost:

SD-1: $1,225,000

SD-2: Replace Utility Tunnel Electric Condensate Pumps with Steam-Powered Pumps

Project Description: Replace existing simplex type electric condensate pumps in the utility tunnel with new steam-powered condensate pumps.

CHILLED PLANT PROJECTS

CP-1: Add Chiller Plant Capacity, 2,000 tons

Project Description: Install additional 2,000 ton chiller plant capacity.

The following elements would be installed or upgraded:

- New 2000 ton water-cooled centrifugal chiller with VFD drive.
- New 2000 ton induced-draft open cooling tower with VFD drive.
- New chiller (evaporator) pump.
- New condenser water (tower) pump.
- Upgrade/Replace Campus Loop chilled water pumps with new capacity pumps with VFDs.
- Controls.
- Rozell plant expansion, electrical work and ventilation.

Project Justification: The existing Central Campus Chiller Plant has a total capacity of 4,000 tons (3-1000 ton chillers & 2-500 ton chillers), which matching capacity cooling towers and pumps.
According to the EWU operations staff, the historical peak campus cooling load is somewhere between 3,500 tons (per Dumais & Romans in their 2009 *Campus Chilled Water System Study*) and 2,500 tons (per McKinstry in their *2012 Energy Efficiency & Sustainability Report).* In our interview with the EWU staff, they reported a historical peak cooling load of about 3,000 tons, which is the value that is used in our analysis.
Based on the anticipated master plan campus growth for the New Science I & II projects, the new Gateway Athletic Project and the modernization of the legacy residence halls to include air conditioning, the expected addition of campus chilled water load is approximately 40%.

Based on a peak historic capacity of 3,000 tons, a 40% increase would put the future campus load at over 4,200 tons, which is greater than the present total plant capacity of only 4,000 tons.

In order to meet the future cooling needs of the campus growth plan, it will be necessary to add cooling capacity, with sufficient redundancy to allow operational flexibility and to allow for break-downs. At minimum a 1000 ton chiller plant expansion would be needed, although a larger, 2000 ton expansion, as proposed here, would provide a higher degree of redundancy, future growth allowance and flexibility, at only a slightly greater incremental cost.

Sequence / Category:
Capital Master Plan.

Cost:
CP-1: $3,600,000

CP-2: Upgrade Campus Chilled Water Pumps

Project Description: Upgrade campus distribution loop chilled water pumps to increase system capacity and to provide VFD control for each pump.

- Upgrade/Replace Campus Loop chilled water pumps CWP-2 & CWP-3 with new capacity pumps with VFDs. Existing CWP-1 is already controlled by a VFD.
- New Delta Controls.

Project Justification: Depending upon the priority and timing of the above proposed chiller plant expansion, the upgrade of the existing campus distribution pumps may not be necessary, as they are also included in the above scope.

However, until such time as the chiller plant capacity is increased, it would be beneficial to upgrade the existing campus distribution chilled water pumps for two reasons.

First of all, these existing pumps (CWP-2 & 3) are two-speed pumps, without VFD speed/capacity control. Two-speed pumps are not as efficient as pumps that are run with VFDS, and controllability is not as good for varying flow demands.

Secondly, based on the results of the chilled water system flow model that was prepared with this report, there are likely times when the existing campus chilled water distribution piping system is being "under pumped". In other words, it appears at times there may be a shortage of campus chilled water flow to some of the remote buildings. This is indicated by the results of the flow model that suggests that during times of peak historic campus cooling demand, that drop-off pressures (and therefore flows) to many of the buildings is greater than the capacity of the existing pumping plant (based on available flow and head pressures).

The present operational setpoint of 15 psig (35 ft head) pressure differential between the campus supply main and return main, does not seem to produce sufficiently strong flow conditions to necessarily satisfy all flow demands. This condition of possible under-pumping is also indicated by a reported high Delta T (nearly 20 deg. F) on the campus chilled water loop, compared to a design Delta T for most buildings of around 10 deg. F. Further analysis of the chilled water distribution system is needed to better understand the dynamics suggested by the flow model and field observations, however, the recommendation to upgrade the existing chilled water distribution pumps (install VFDs and possibly increase capacity with larger pumps) is still valid.

Sequence / Category:

Capital Master Plan.

Cost:

CP-2: $300,000

CP-3: Install VFDs on the Chiller Compressors and on the (3) 1,000 ton Cooling Towers

Project Description: Upgrade the existing centrifugal chiller compressors to add new VFD drives. Replace the 2-speed fan motors on the (3) largest cooling towers with VFD duty motors and install new VFD drives. Update controls to map drives to building automation system.

Project Justification: Per *McKinstry 2012 Energy Efficiency & Sustainability Report, Item 2.00-ROZ*, analysis: Annual electrical energy savings due to more efficient part load operation of equipment. Better able to match equipment capacity with campus cooling loads.

Sequence / Category:
Improved Operational Efficiencies.

Cost:
CP-3: $1,000,000

CP-4: Install 2 New Energy Efficient Cooling Towers

Project Description: Replace the existing, aging and inefficient 500 ton cooling towers with new, energy efficient, open circuit, induced draft cooling towers, with VFDs on their fan motors.

Project Justification: Per *McKinstry 2012 Energy Efficiency & Sustainability Report, Item 2.40-ROZ*, analysis: The new cooling towers will be sized for supplying 75 deg F water to the chillers during peak load conditions, thereby improving chiller efficiency. Annual electrical energy savings are anticipated.

Sequence / Category:
Improved Operational Efficiencies.

Cost:
CP-4: $500,000

ELECTRICAL & COMMUNICATIONS PROJECTS

EL-1 Medium-voltage Electrician

Project Description: While this proposal is not a capital expenditure, it is seen as an operating necessity. Because the University owns its 15-kV electrical distribution system, it is responsible for operating and maintaining the system. Special procedures and skills are required of electricians responsible for electrical systems greater than 600-VAC. The University should consider filling one of its Electric Shop positions with a licensed electrician experienced in the operation and maintenance of 15-kV, medium-voltage power distribution equipment and circuits.

Project Justification: This proposal is driven by the need for operational efficiencies and worker safety.

Sequence: This proposal should be implemented as soon as possible.

Cost: There is no capital cost associated with this proposal. All costs are operational related to the employment of the specialty electrician.

EL-2 Electrical System Modeling

Project Description: Each time EWU submits a new or remodeled building for electrical plan review, the Department of Labor & Industries requires a load analysis of the entire medium-voltage distribution system associated with the project. EWU should commission an electronic model of the distribution system and should obtain software capable of updating the model as projects are completed on the campus. The model should document information such as load flow and short-circuit information. The model could also contain information related to arc-flash hazard levels which are important for worker safety. Currently, EWU does not have this information available.

Project Justification This proposal is driven by the need for operational efficiencies related to electrical calculations for new capital projects and major renovations to existing facilities. Having an up-to-date model with Arc-Flash data would also improve worker safety.

Sequence: This proposal should be implemented prior to the next major capital project.

Cost: There are no capital costs associated with this proposal. Retaining an engineering firm to prepare the initial model would cost approximately $50,000. Software to maintain the model would cost approximately $6,000. EWU should allocate funds to update the model each time a capital project is executed.

EL-3 Distribution Switching

Project Description: EWU should plan for the eventual replacement of the medium-voltage vacuum switches with above-ground, fusible air switches. Air switches provide a number of advantages over the existing vacuum switches. Because air switches are not insulated with an inert gas, there is no environmental concern as there is with the existing SF_6 insulating gas. Located on concrete pads on grade, air switches provide better worker safety with respect to approach clearances and exit routes. Air switches can be provided in multiple configurations with up to two (2) input/outputs and four (4) branch connections thus increasing the quantity of connection points available on the distribution system.

Project Justification: This proposal is driven by the need of the Master Plan to eventually require more connections to the medium-voltage distribution system. It also addresses worker safety issues and possible future environment restrictions related to the existing insulating gas.

Sequence: The conversion to above-grade air-insulated switches can be accomplished in small increments or as new building projects dictate.

Cost: The cost to implement this proposal for any segment of the campus is obviously proportional to the amount of switches being replaced at any one time. The cost to replace a single vacuum switch with a single above-grade air switch is approximately $70,000. The cost to replace all 27 existing switches is approximately $1,800,000.

EL-4 Distribution System Expansion

Project Description: The existing switchgear feeds the entire campus with four (4) feeders; two (2) 'A' feeders connected to Service #1 and two (2) 'B' feeders connected to Service #2. Each half of the switchgear has provisions for one (1) new circuit breaker. This would allow for the establishment of two (2) 'C' feeders.

Project Justification: Providing a third set of medium-voltage feeders for the campus will support large future loads, such as the proposed science complex and the Gateway project, without adding load to the existing two sets of medium-voltage feeders. This addition to the electrical distribution system will support the Master Plan.

Sequence: The distribution system expansion should occur before or in conjunction with the planned science building project and prior to the Gateway project.

Cost: $1,800,000

EL-5 Site Lighting Upgrade

Project Description: EWU previously developed a master plan for replacing existing site lighting with new, more efficient luminaires. The first phase of the master plan, which was primarily road lighting improvements, has been implemented. This project would continue the implementation of the site lighting master plan which is subdivided into parking lot lighting, plaza and walkway lighting, building perimeter lighting and centralized lighting controls.

Project Justification: Continuing the implementation of the site lighting master plan benefits the University in two ways. New luminaires will save maintenance and operational costs due to higher efficiencies and longer lamp life. Enhanced lighting will also address safety concerns in areas identified as having insufficient lighting levels.

Sequence: Site lighting upgrades can occur when convenient to the University. New site lighting installed as part of new facilities or building renovations should conform to the recommendations of the lighting master plan.

Cost: Costs identified in the lighting master plan are as follows:

Phase 2 $ 3,500,000
Phase 3 $12,000,000
Phase 4 $ 3,500,000

EL-6 Optical Fiber System Upgrade

Project Description: EWU wins and operated an optical fiber, outside-plant system for distributing of voice and data to campus buildings. A separate optical fiber network for acquiring building data and for automated systems control exists on the campus. A

Appendix B – Major Equipment

APPENDIX B

ROZELL CENTRAL ENERGY PLANT MAJOR EQUIPMENT INFORMATION

Existing Boilers – Condition Description and Capacity Ratings

Boiler No.	Year Built/Original Installation	Safe Operating Capacity (PPH)	Condition Description	Year Replaced
1	1974	32,000		
2	1960	15,000	Oldest boiler, smallest capacity	
~~3~~	~~1966~~	~~18,000~~	~~Inoperable since 2008~~	2021-2022
3A	2022	24,000	New as of 2022	On line Dec. 2022
4	1969	27,000		
5	2001	42,000	Natural Gas limits **	

Total Safe Operating Capacity	**140,000**	**PPH**

** - Capacity limited by availability and line size of the natural gas service to the Cheney area.

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APPENDIX B

ROZELL CENTRAL ENERGY PLANT MAJOR EQUIPMENT INFORMATION

Existing Chillers and Towers – Condition Description and Capacity Ratings

Chiller No.	Year Built/Installed	Safe Operating Capacity (Tons)	Condition Description	Year Replaced
1	2017/2018	1,500	New	2017/2018
2	2017/2018	1,500	New	2017/2018
3	1998	1,000	Operable (24yo)	
~~4~~	~~1998~~	~~1,000~~	~~Inoperable, out of service~~	
5	1998	1,000	Operable (24yo)	
Total Rated Capacity Tons				

Total Safe Operating Capacity	**5,000**	**Tons**

Tower No.	Year Built/Installed	Safe Operating Capacity (Tons)	Condition Description	Year Replaced
1	2017/2018	1,500	New	2017/2018
2	2017/2018	1,500	New	2017/2018
3	2004	1,000	Operable with issues	
~~4~~	~~1998~~	~~1,000~~	~~Down, out of service, needs replacement~~	
~~5~~	~~1998~~	~~1,000~~	~~Down, out of service, needs replacement~~	
Total Rated Capacity Tons				

Total Safe Operating Capacity	**4,000**	**Tons**

Appendix C1 – 2016 Electrical Capacity Upgrade

The full document can be viewed at this link:

- https://inside.ewu.edu/facilities/2016-electrical-capacity-upgrade-report/

Appendix C2 – 2021 Medium Voltage Study

The full document can be viewed at this link:

https://inside.ewu.edu/facilities/wp-content/uploads/sites/191/2022/08/APPENDIX-C2-2021-Medium-Voltage-Study.pdf

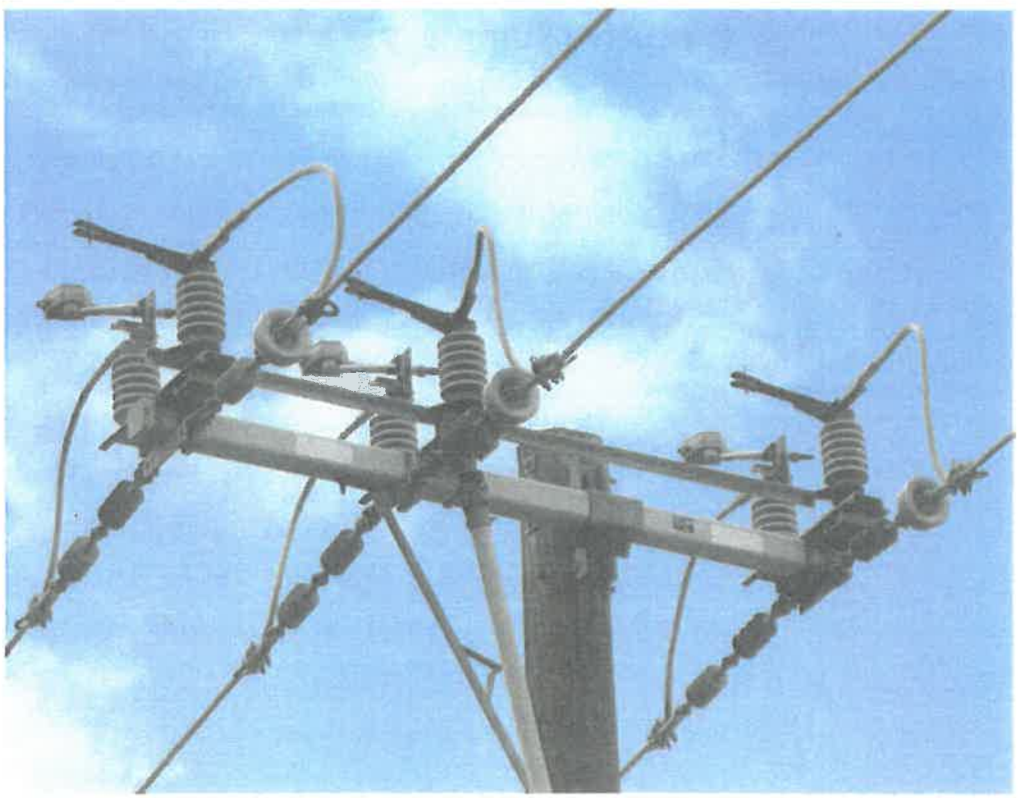
APPENDIX C1

NAC
ENGINEERING

ELECTRICAL CAPACITY UPGRADE

AE 1483 AE
Eastern Washington University
Cheney, WA

August 12, 2016



>1203 West Riverside Avenue, Spokane, WA 99201-1107
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Seattle / Spokane / Los Angeles

Purpose

Eastern Washington University has undertaken this analysis and report for three main reasons. First, to address the adequacy of the existing 13.2-kV electrical distribution system to support three major projects currently being planned:

Pence Union Building (PUB) Renovation

Interdisciplinary Science Center (ISC)

Central Chiller Plant Expansion

Secondly, to evaluate the impact of the next 10-years of projected campus growth on the electrical distribution system. Lastly, to address improvements to the campus electrical distribution system to enhance operation, maintenance and worker safety.

Executive Summary

The medium-voltage distribution system at EWU is well maintained and adequately supports the current electrical load. In order to continue to provide a reliable electrical infrastructure, EWU should incorporate the recommendations of this report into its long-range infrastructure planning program. Two proposed capital projects will significantly increase the campus electrical load and actions must be taken to support the increase. As part of an upgrade plan, EWU should incrementally replace existing vacuum switches and 15-kV conductors to enhance future reliability and improve worker safety. EWU should also continue to develop its arc flash safety program. This report discusses existing conditions, expected future loads and recommended actions. The most immediate need is to accommodate the large capital projects planned for the next two years.

effort to estimate the chiller electrical demand, the Bus #1 demand values provided by EWU were subtracted from the City of Cheney demand values.

The following estimated demand values are the result.

Chiller demand: 2,888-kVA
127-amperes @13,200-VAC

A graph of the resultant is included at the back of this report. The graph closely matches load estimates evaluated in the *Chiller Plant Capacity Upgrade AE1368* report prepared for EWU by MSI Engineers, Spokane, WA.

Electrical System Deficiencies

No significant deficiencies requiring immediate attention were noted. The medium-voltage distribution system appears to be in good condition and has been well maintained. Most of the existing vacuum switches are feeding two pad-mounted transformers, the maximum possible amount. This means that while the campus feeders have spare capacity, portions of the feeder would have to be reconfigured in order to use that capacity. Initiatives have been identified to accommodate load growth, maintain reliability and enhance worker safety. Proactive planning for implementation of the initiatives indicated below will help insure a reliable and safe electrical system.

- Implement one of the options for addressing the additional chiller load.
- Incremental replacement of medium-voltage cable over 20-years old.
- Make recommended changes to the controls and relaying in the medium-voltage switchgear.
- Incremental replacement of medium-voltage vacuum switches.
- Expand the arc flash program to the 480-VAC and 208-VAC systems

Switchgear Relays and Control

The existing medium-voltage switchgear contains electronic relays for providing

All three options will require the City of Cheney to increase the size of the overhead service conductors, particularly those coming from the Cheney Substation located south of the campus. The City of Cheney may require EWU to pay part or all of the costs for increasing the conductor size.

Recommendations

Medium-voltage Conductor Replacement: EWU should plan for the incremental replacement of the 15-kV feeders beginning with the conductors installed in the early 1990's. A proactive approach to conductor replacement will help minimize the possibility of conductor failure interrupting campus service. Conductor replacement should occur in conjunction with the replacement of the vacuum switches as suggested below.

Medium-voltage Vacuum Switch Replacement: EWU should plan for the incremental replacement of the existing 13.2-kV, below-grade vacuum switches with above-grade, air-insulated, pad-mounted switches. Replacing the vacuum switches will significantly improve safety during switch operation be moving switching operations to above grade. Air-insulated switches will eliminate possible environment requirements and constraints that may be imposed in the future. The above-grade switches, when used in conjunction with pad-mounted sectionalizing cabinets offer increased flexibility for distribution system reconfiguration to accommodate future buildings.

Distribution System Capacity Upgrade: EWU should consider implementing Option B as described in the *Medium-voltage Distribution System Options* section above. This option address the needed capacity for the first step of the chiller plant increase and allows the University to plan for the eventual implementation of Option C prior to adding the second chiller load step.

Medium-voltage Switchgear Adjustments: The recommendations of Schneider Electric regarding the automatic transfer system and the protection scheme of the existing medium-voltage switchgear should be considered and

Costs

The following schematic level costs are intended to provide a guide for budgeting future projects. The costs are expressed in year 2016 dollars. Not included in the costs are possible utility connection charges that may be levied by the City of Cheney.

Medium-voltage conductor replacement: $4,000,000

Medium-voltage vacuum switch replacement: $1,600,000

Distribution system capacity upgrade, Option A: $ 100,000
Option B: $ 250,000
Option C: $1,700,000

Medium-voltage switchgear adjustments: $100,000

Arc flash modeling: $400,000

BRUCE B. TURNER
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APPENDIX C2

Eastern Washington University – Medium Voltage Study

Final Report

EASTERN
WASHINGTON UNIVERSITY
start something big

MW
CONSULTING ENGINEERS

Report By MW Consulting Engineers

Engineer: Dean Algeo, PE

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Owner Representatives:
Craig Opsal – Director | Facilities Maintenance
Steve Schmedding – Senior Project Manager | Facilities

1115 Cedar ST
Rozell Plant
Cheney, WA 99004

October 2, 2020

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SECTION 1 – EXECUTIVE SUMMARY

EWU takes medium voltage(MV) electrical service from the city of Cheney and distributes that service throughout their underground tunnel system via MV cable and sub-grade, MV vacuum switches which feed grade-level pad mounted(PM) transformers, which in-turn serve individual campus buildings and loads. The purpose of this study is to document the existing MV switches in detail and evaluate the current conditions of each switch, note any code deficiencies and safety concerns as well as provide cost estimates to replace each switch with a grade-level pad mounted switch and produce a priority list that identifies the order in which switches should be replaced for maximum benefit.

Most of the existing switches are approximately 31 years old and well past their expected useful life of 15 to 20 years. Potential consequences of MV switch failure include lengthy unscheduled outages, emergency repairs, equipment damage and injury to personnel. The cost to repair unplanned equipment failure can be several times the cost of planned outages/equipment replacements.

The location of the MV switches in the sub-grade tunnel system poses inherent safety risks to maintenance personnel. These include the presence of water, limited egress from equipment, and limited first responder access to switch locations. In addition to itemizing latent deficiencies, this report includes specific actions to mitigate these deficiencies. Refer to **Section 3** for a detailed discussion of the existing conditions for each switch location. Refer to the **Exhibits Section** for photographs of each switch location.

MW reviewed existing tunnel drawings and oneline diagrams showing the medium voltage distribution system throughout campus. MW then visited all existing MV vacuum switches on campus and documented each location for the purposes of this report. Finally, all pad-mounted transformers on campus which are served from the existing MV vacuum switches were visited to evaluate the feasibility of installing pad-mounted switches above grade to re-feed the transformers.

Based on the review of the existing conditions noted above, it is recommended that each existing vacuum switch in the tunnel system be replaced as soon as practicable with a pad-mounted, grade-level, air insulated switch. Existing vacuum switches should be replaced according to their 'priority number' in descending order as listed in **Exhibit 3.5 'Switch Priority List'**. Switches with the highest priority number are those with the most safety and maintenance concerns and replacing those switches first will maximize the benefits of switch replacement.

The average cost to replace a single existing submersible vacuum switch in the tunnel system with a new pad-mounted, grade level switch is expected to be approximately **($164,000)**. The expected cost to replace all 27 switches is **($4,428,000)**. Switches can be replaced in increments of one or several switches at once and spread out over time to match project costs to budget constraints. Refer to **Section 4** for a more detailed discussion of recommendations and associated costs along with possible phasing and other strategies to minimize the impact of outages. Refer to the **Exhibits Section** in the back of the report for diagrams and information which illustrate the intended modifications to the system.

Refer to **Section 5** for definitions of technical terms used throughout this report.

SECTION 2 – INTRODUCTION

MW was contacted by EWU regarding their existing sub-grade, medium voltage vacuum switches. MW met with EWU facilities personnel onsite to discuss the existing switches and review their concerns and desired outcomes. Based on discussions during the meeting, it was determined that MW would perform a study to document the existing medium voltage switches in detail and evaluate the current conditions of each switch, note any code deficiencies and safety concerns as well as provide cost estimates to replace each switch with a grade-level pad mounted switch and produce a priority list that identifies the order in which switches should be replaced for maximum benefit.

EWU takes medium voltage electrical service from the city of Cheney and distributes that service throughout their underground tunnel system via medium voltage cable and sub-grade, medium voltage vacuum switches which feed grade-level pad mounted transformers, which in-turn serve individual campus buildings and loads. Most of the existing switches are well past their useful life, and failures are imminently expected.

Potential consequences of MV switch failure include lengthy unscheduled outages, emergency repairs, equipment damage and injury to personnel. The cost to repair an unplanned outage can be several times the cost of planned outages/equipment replacements. In addition, the location of the MV switches in the tunnel system poses inherent safety risks to maintenance personnel. Refer to **Exhibit 3.1** for a Map of the tunnel system and switch locations and **Exhibit 3.2** for a oneline diagram showing the medium voltage distribution throughout campus).

MW reviewed existing tunnel drawings and oneline diagrams showing the medium voltage distribution system throughout campus. MW then visited all existing medium voltage vacuum switches on campus and documented each location for the purposes of this report. Finally, all pad-mounted transformers on campus which are served from the existing medium voltage vacuum switches were visited to evaluate the feasibility of installing pad-mounted switches above grade to re-feed the transformers.

In addition to itemizing latent deficiencies, this report includes specific actions to mitigate these deficiencies. Refer to **Section 3** for a detailed discussion of the existing conditions for each switch location.

Refer to **Section 4** for a discussion of recommendations, associated costs along with possible phasing and other strategies to minimize impact of outages. Refer to the Exhibits section for diagrams and information which illustrate the intended modifications to the system.

Throughout this report, specific terminology is used to discuss equipment, some of which is unique to the electrical industry and not widely used elsewhere, refer to **Section 5** for definitions of technical terms used throughout this report.

SECTION 3 - FINDINGS

Existing Conditions

EWU takes medium voltage electrical service from the city of Cheney and distributes that service throughout their underground tunnel system via medium voltage cable and sub-grade, medium voltage(MV) vacuum switches which feed grade-level pad mounted(PM) transformers, which in-turn serve individual campus buildings and loads. Most of the existing switches are dated 1989 placing them at approximately 31 years old. The expected useful life of a MV vacuum circuit breaker is between 15 and 20 years. Equipment life varies based on conditions of maintenance, temperature, moisture, number of switch cycles, etc. Even assuming optimal conditions, this equipment is well past its useful life, and failures are imminently expected.

Potential consequences of MV switch failure include lengthy unscheduled outages, emergency repairs, equipment damage and injury to personnel. The cost to repair an unplanned outage can be several times the cost of planned outages/equipment replacements.

There are 27 active switches included in the campus MV distribution system. There are 28 switches total in the system but switch #5 is not presently serving any load. The average number of transformers fed from each switch is 2. The significance here, is that a switch failure is most likely to disable (2) buildings. For example, if switch #21 were to fail unexpectedly, both Dressler and Pearse Halls would be without power until the switch could be replaced or a temporary solution could be implemented.

The location of the MV switches in the sub-grade tunnel system poses inherent safety risks to maintenance personnel. Most switch locations are constantly wet which increases safety risks when working with electrical equipment. Almost all switch locations have gates that swing into the switch area and a large chilled water pipe blocking egress away from the switches. This severely limits personnel's ability to get to a safe distance in the event of non-passive equipment failure. The tunnel itself limits access by first responders as entry points are often several hundred feet from switch locations and some entrances involve narrow ladders or spiral staircases. This would make it difficult for emergency responders to reach, treat and extract injured personnel in the event of an accident. Grade level, pad mounted equipment would provide ready access to emergency responders as well as safe working distances and egress paths for personnel and limit the presence of standing water in proximity to the switches. Refer to the following section for a detailed review of each switch location and the associated areas of concern.

Switch Locations

This section provides a detailed description of each switch location and the conditions of installation including specific areas of concern for each switch. Refer to **Exhibits 3.7** through **3.27** for photographs of each switch installation to supplement the descriptions. Refer to **Exhibit 3.5** for a ranking of switches by priority of replacement.

General Tunnel Condition Comments

- Cellular signal was intermittent in vault.
- Maintenance radios appeared to work throughout.
- The tunnel overall had adequate lighting.

SECTION 4 – RECOMMENDATIONS

REPLACE EXISTING VACUUM SWITCHES IN TUNNEL

Based on review of the existing tunnel drawings and oneline diagrams, visiting all existing medium voltage vacuum switches and pad-mounted transformers on campus and documenting each location, it is recommended that each existing vacuum switch in the tunnel system be replaced as soon as practicable with a pad-mounted, grade-level, air insulated switch. Switches can be replaced in increments of one or several switches at once and spread out over time.

Existing vacuum switches should be replaced according to their 'priority number' in descending order as listed in **Exhibit 3.5** Switch Priority List. Switches with the highest priority number are those with the most safety and maintenance concerns and replacing those switches first will maximize the benefits of switch replacement.

It should be noted that there are (8) switches mounted at grade level where many of the safety and maintenance concerns noted for the other switches do not exist and therefore the main factor driving replacement of these switches in the age of the equipment and their expected failure. For these switches, their priority number is low as it is expected that mitigating the safety and maintenance concerns associated with the other switches would provide more benefit.

All of the PM transformers are mounted in exterior equipment yards with fenced in areas. Many of these have space for a future generator and almost all of them have the opportunity to extend the concrete and fenced enclosure to accommodate the addition of a new PM switch.

Refer to **Section 3** for a detailed description of the cutover process for the (2) types of scenarios and the associated expected outages.

Exhibit 3.5

Termination Point (TER)	Switch Number	Priority Number (1-100)	Building(s) Served	Building(s) Served	Building(s) Served
15	24	100	STREETER	MORRISON	
14	1	75	ROTC	CEB XFMR#2	CEB XFMR#1
4	25	58	PUB	ISC #1	ISC #2
11	7	55	MAR	WLM	
21	16	48	PEA		
2	26A	45	SNYMANCUT	SNYMANCUT	
11A	6	43	JFK		
17	20	43	LOWER ROOS CONCESSION	WWF LTS EAST	WWF LTS WEST
19A	19	33	CHN	SCI	SCI
17	21	30	DRE	PRC	
13	4	28	TUNNEL	RTV	
6	10	28	PAT	ISLE	
20	15	20	PEC		
22	17	20	PAV	PLYF	
22	18	20	FLDH	AQT	
3	26	20	L. ANDERSON		
9A	12A	20	MON	HAR	
15	23	15	DRYDEN	URC	
OLD PLANT UTILITIES	12	13	PUMP (PL UTILITY)	SHW	
OLD PLANT UTILITIES	13	13		PL AUX	
OLD PLANT UTILITIES	14	13	KGS	SNR	
13B	2	10	MUSIC	CHILDCARE	SPEECH
13B	3	10	ART	DRAMA	
1B	22	8	WSP	AEC	
12	5	0	SERVED DEMOD CAMPUS SCHOOL BLDG		
Computer Science Vault	8	0	HUS		
Computer Science Vault	9	0	SUT	TAW	
OLD SUB #2	11	0	RED BARN	HOUSING / MAINT	STREET LTG

NOTE: HIGHLIGHTED SWITCHES ARE INSTALLED AT GRADE LEVEL AND NOT IN THE TUNNEL.

Exhibit 3.6

Termination Point (TER)	Switch Number	Priority Number (1-100)	Building(s) Served	Building(s) Served	Building(s) Served
14	1	75	ROTC	CEB XFMR#2	CEB XFMR#1
13B	2	10	MUSIC	CHILDCARE	SPEECH
13B	3	10	ART	DRAMA	
13	4	28	TUNNEL	RTV	
12	5	0	SERVED DEMOD CAMPUS SCHOOL BLDG		
11A	6	43	JFK		
11	7	55	MAR	WLM	
Computer Science Vault	8	0	HUS		
Computer Science Vault	9	0	SUT	TAW	
6	10	28	PAT	ISLE	
OLD SUB #2	11	0	RED BARN	HOUSING/MAINT	STREET LTG
OLD PLANT UTILITIES	12	13	PUMP (PL UTILITY)	SHW	
OLD PLANT UTILITIES	13	13		PL AUX	
OLD PLANT UTILITIES	14	13	KGS	SNR	
20	15	20	PEC		
21	16	48	PEA		
22	17	20	PAV	PLYF	
22	18	20	FLDH	AQT	
19A	19	33	CHN	SCI	SCI
17	20	43	LOWER ROOS CONCESSION	WWF LTS EAST	WWF LTS WEST
17	21	30	DRE	PRC	
1B	22	8	WSP	AEC	
15	23	15	DRYDEN	URC	
15	24	100	STREETER	MORRISON	
4	25	58	PUB	ISC #1	ISC #2
3	26	20	L. ANDERSON		
9A	12A	20	MON	HAR	
2	26A	45	SNYMANCUT	SNYMANCUT	
1	N/A	N/A			
7	N/A	N/A			
9	N/A	N/A			
8	N/A	N/A			
16	N/A	N/A			
10	N/A	N/A			
1A	N/A	N/A			

NOTE: HIGHLIGHTED SWITCHES ARE INSTALLED AT GRADE LEVEL AND NOT IN THE TUNNEL.

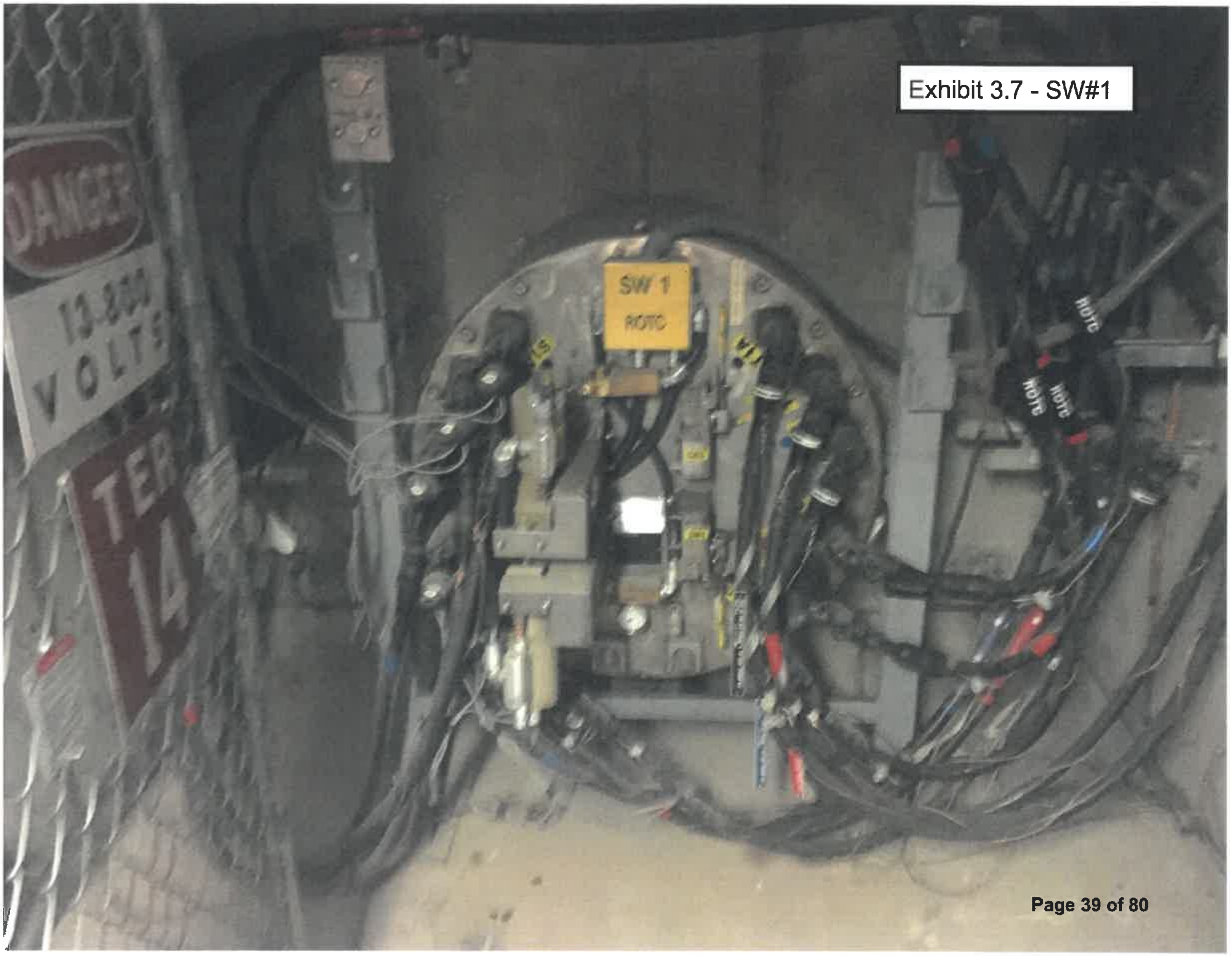

Exhibit 3.7 - SW#1


Exhibit 3.7 - SW#1
2
1B
Page 40 of 80


Exhibit 3.7 - SW#1
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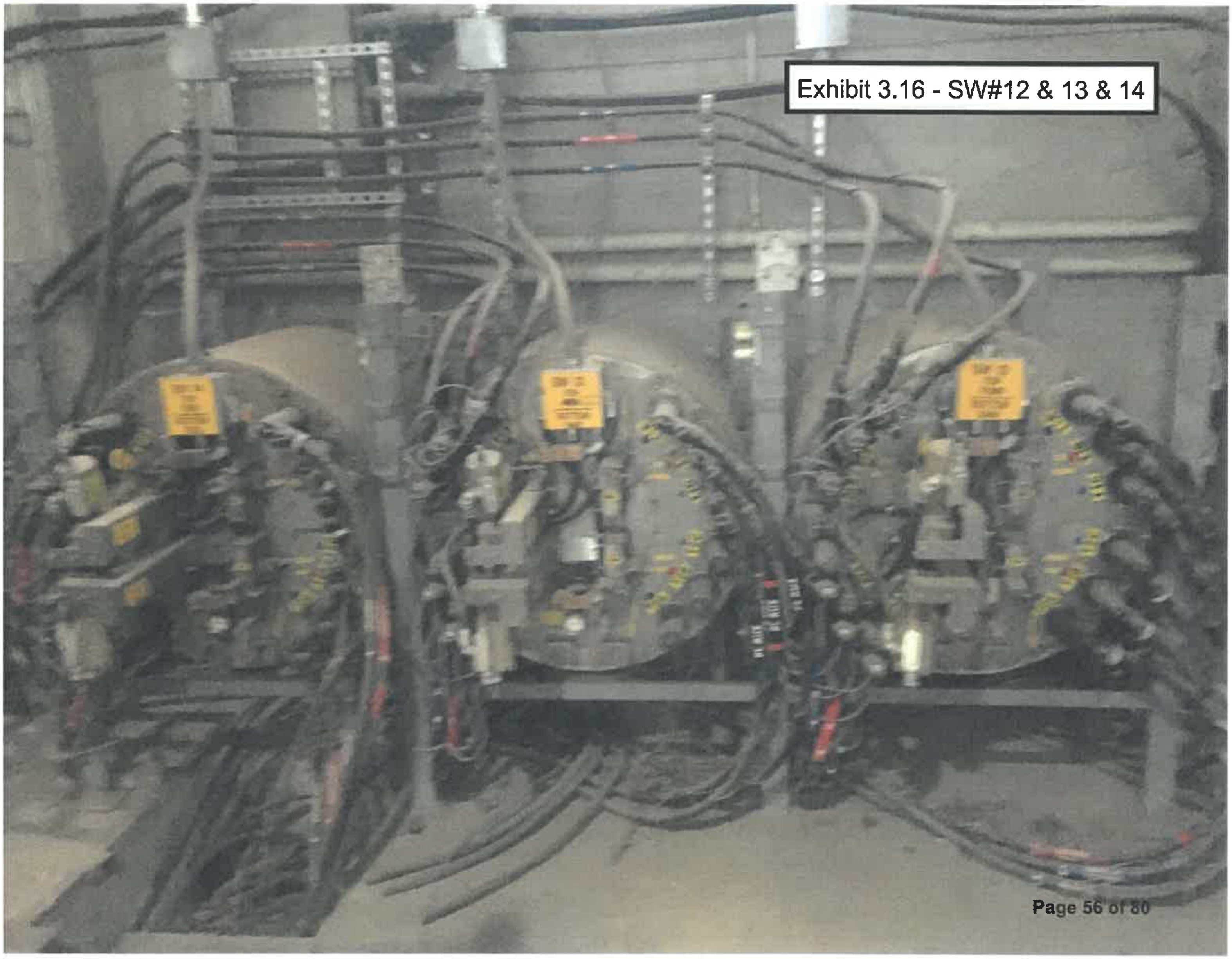
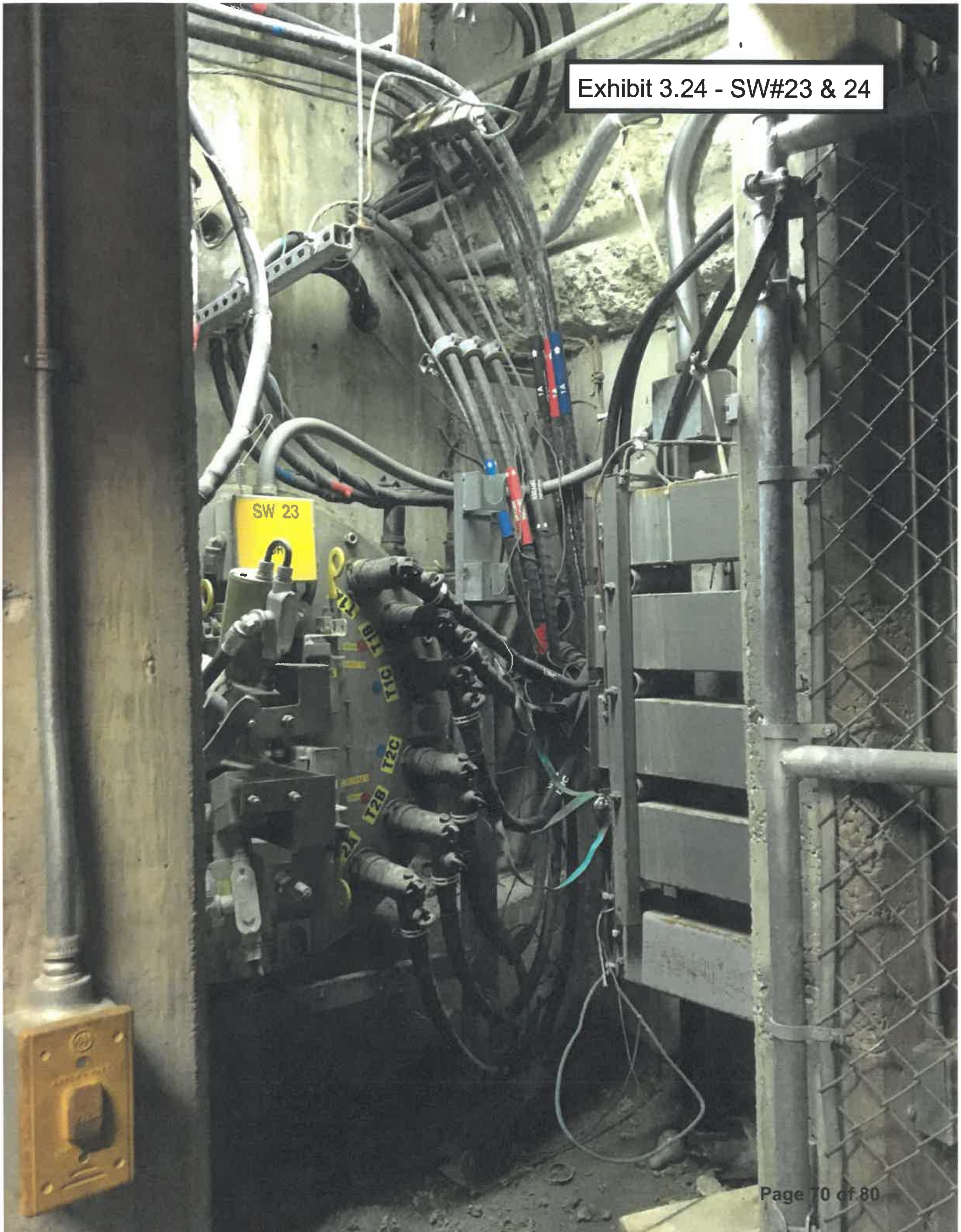


Exhibit 3.16 - SW#12 & 13 & 14

Exhibit 3.24 - SW#23 & 24



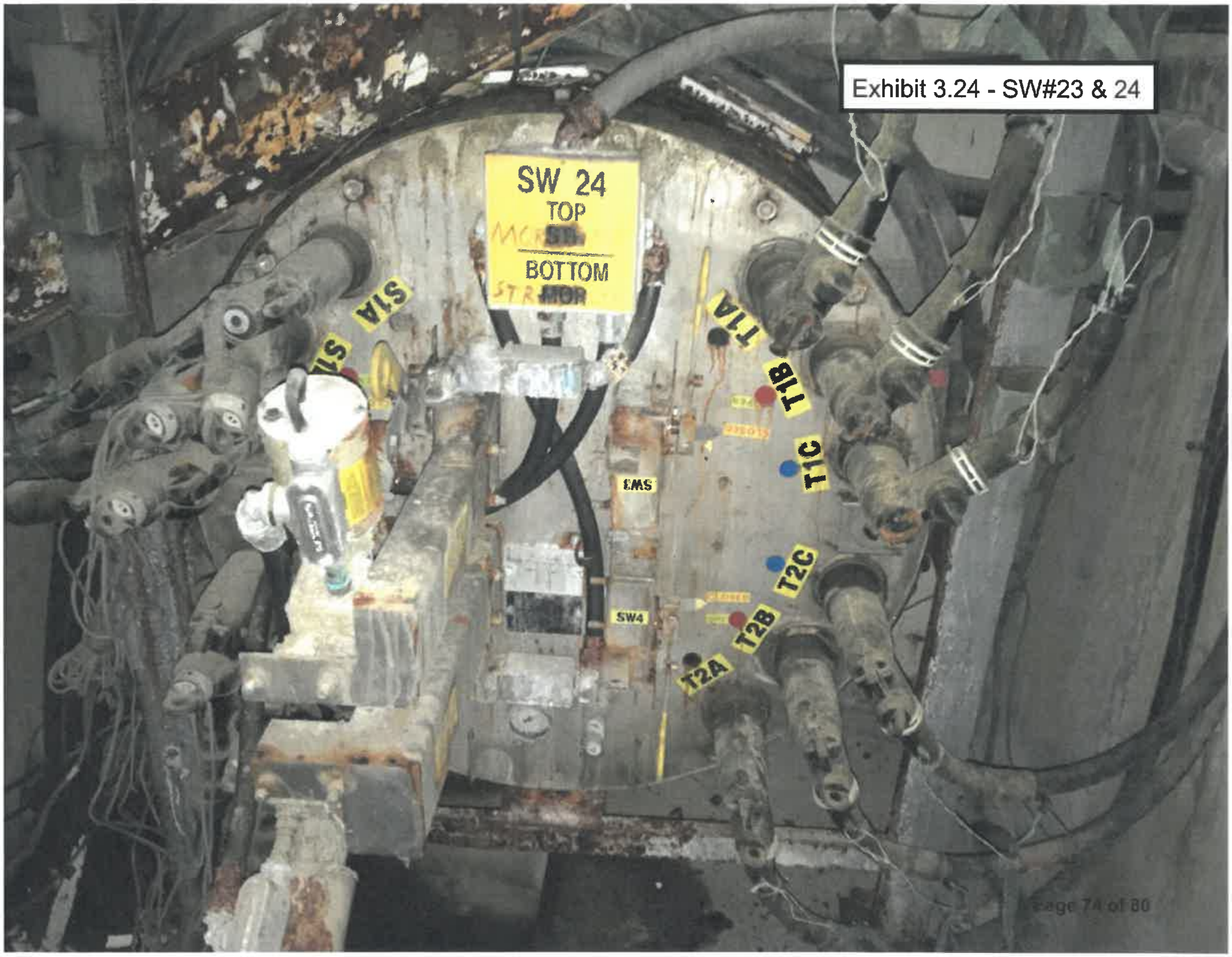


Exhibit 3.24 - SW#23 & 24

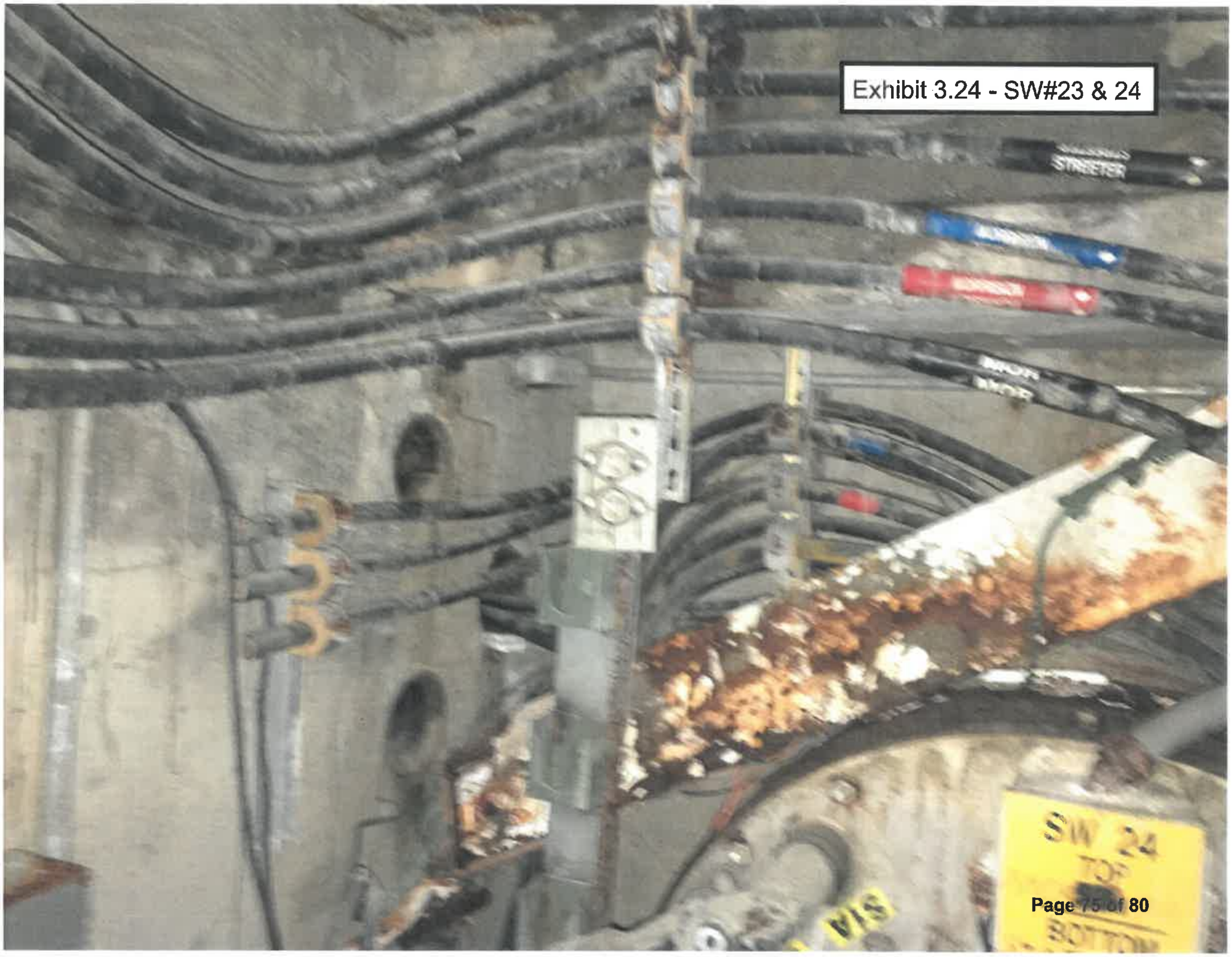


Exhibit 3.24 - SW#23 & 24

Appendix D1 – 2021 New Boiler Project Plans

The full document can be viewed at this link:

https://inside.ewu.edu/facilities/appendix-d1-2021-new-boiler-project-plans/

Appendix D2 – 2022 Ph.1 Electrical Switch Upgrade Project Plans

The full document can be viewed at this link:

https://inside.ewu.edu/facilities/wp-content/uploads/sites/191/2022/08/APPENDIX-D2-2022-Ph1.-Electrical-Switch-Upgrades.pdf

APPENDIX D1

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT

EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON 99004
PROJECT NO. CP-1056

INDEX OF DRAWINGS

INDEX OF DRAWINGS

OWNER

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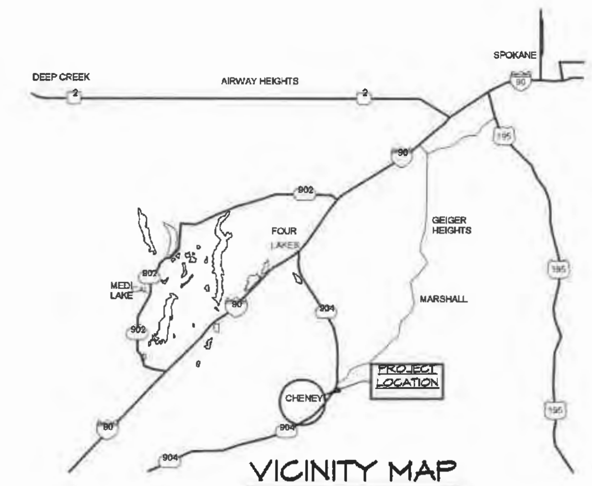
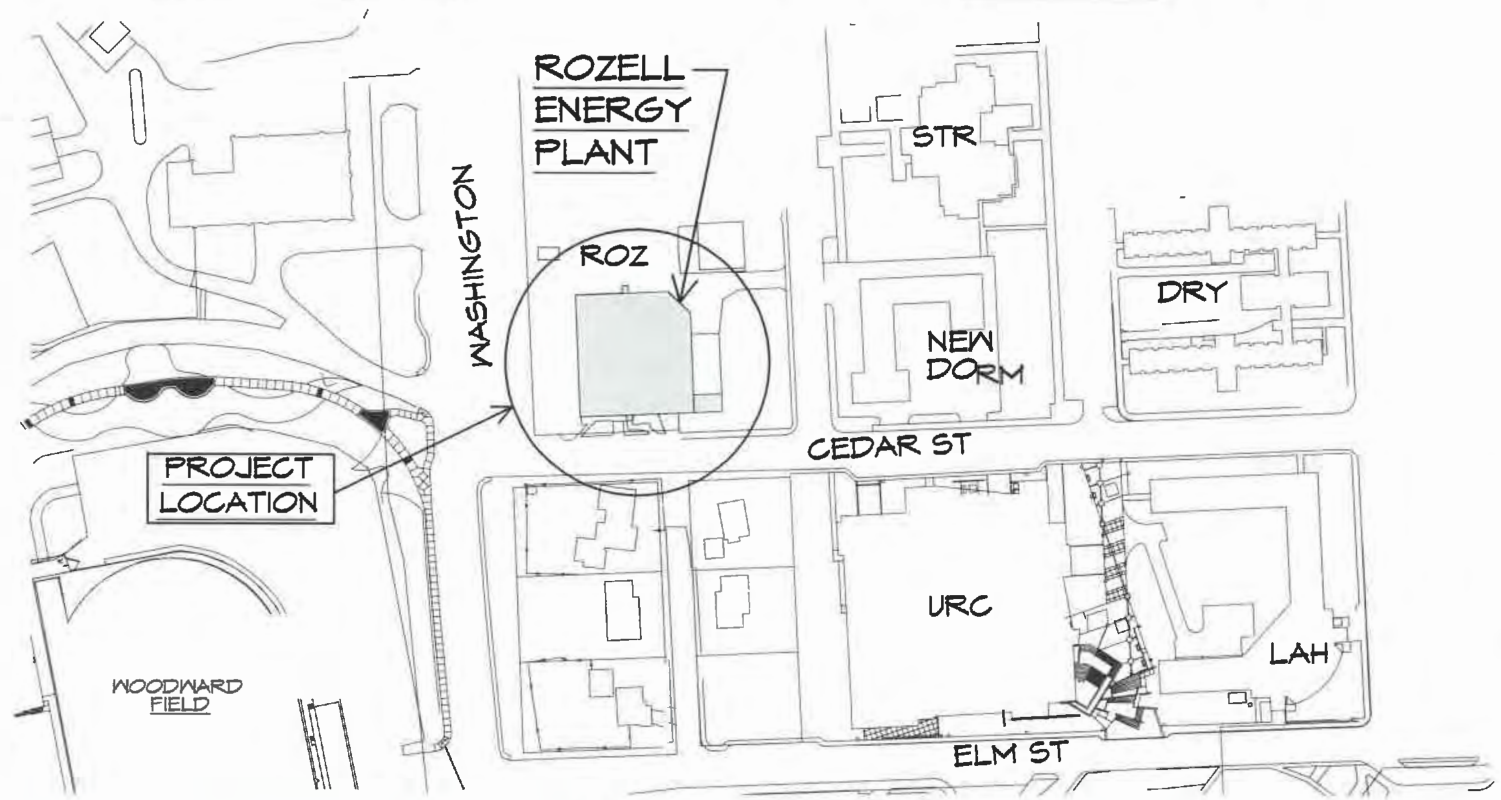
WASHINGTON STATE



VICINITY MAP



EWU CAMPUS MAP
Scale: NTS

The Conformed Set is provided as an aid to the Contractor to help consolidate many of the major changes and updates to the project drawings since the original Bid Set was issued. Notable changes include:

COP-2: L&I Electrical Revisions: New Electrical drawings.
COP-3: Boiler Foundation Revisions: New Structural drawings.

Please be aware that these drawings do not necessarily indicate other changes or revisions that have been made and issued in other COPs, ASIs, RFIs, etc. It is still the Contractor's responsibility to keep track of all relevant changes and communicate said changes to all subcontractors vendors etc.

CONFORMED SET
12-31-21

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA
COVER SHEET

PROJECT NO:	18,59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

G-1.0

VICINITY MAP

PARCEL NUMBER: 13123.2401 & 13123.2402
SITE ADDRESS: 120 N 11TH ST. & 1115 CEDAR ST., CHENEY, WA 99004

PERMANENT SEEDING NOTES

LOCATIONS TO BE APPLIED:

1. GRADED, FINAL GRADED OR CLEARED AREAS WHERE PERMANENT VEGETATIVE COVER IS NEEDED TO ESTABLISH THE SOIL.
2. AREAS WHICH WILL NOT BE BROUGHT TO FINAL GRADE FOR A YEAR OR MORE.
3. VEGETATION-LINED CHANNELS, DRAINAGE SWALES AND AS SHOWN ON THE PLANS.

PROVIDE FRESH, CLEAN NEW CROP SEED COMPLYING WITH TOLERANCE FOR PURITY AND GERMINATION ESTABLISHED BY OFFICIAL SEED ANALYSTS OF NORTH AMERICA. PROVIDE SEED MIXTURE COMPOSED OF GRASS SPECIES AND AND NATIVE SPECIES AT PERCENTAGES AS FOLLOWS:

GRASS SEED: FRESH, CLEAN, DRY, NEW CROP SEED COMPLYING WITH THE ASSOCIATION OF OFFICIAL ANALYSTS' "RULES FOR TESTING SEEDS" FOR PURITY AND GERMINATION TOLERANCE. PROVIDE THE FOLLOWING EROSION SEED MIX FOR THE HYDROSEEDING: CANADA BLUEGRASS, 30%; SHEEP FESCUE, 30%; HARD FESCUE, 30%; ANNUAL RYE, 10%. SEED SHALL BE APPLIED TO FLAT GROUND AT A MINIMUM RATE OF 40 POUNDS PER ACRE.

PROVIDE HYDROSEEDING AS FOLLOWS:

HYDROSEEDING: MIX SPECIFIED SEED AT THE RATE REQUIRED ABOVE, FERTILIZER AT THE RATE OF 400 LBS./ACRE OF 16-16-16 AND FIBER MULCH IN WATER, USING EQUIPMENT SPECIFICALLY DESIGNED FOR HYDROSEED APPLICATION. CONTINUE MIXING UNTIL UNIFORMLY BLENDED INTO HOMOGENOUS SLURRY SUITABLE FOR HYDRAULIC APPLICATION.

1. MIX SLURRY WITH NONASPHALTIC TACKIFIER, PER MANUFACTURER'S RECOMMENDATION.
2. APPLY SLURRY UNIFORMLY TO ALL AREAS TO BE SEEDED IN A 1-STEP PROCESS. APPLY MULCH AT THE MINIMUM RATE OF 2500 LBS./ACRE (16.5 KG PER 100 SQ.M) DRY WEIGHT BUT NOT LESS THAN THE RATE REQUIRED TO OBTAIN SPECIFIED SEED-SOWING RATE.

ALL SEEDING OF SLOPES SHALL BE DONE IN ACCORDANCE WITH W.S.D.O.T. STANDARD SPECIFICATIONS.

PERMANENT SEEDING SHALL OCCUR BETWEEN THE DATES OF OCTOBER 1 TO NOVEMBER 15. ANY AREAS THAT ARE NOT SEEDED AND ARE EXPOSED FOR MORE THAN 10 DAYS SHALL HAVE A TEMPORARY CONTROL BLANKET, OR MULCH. MULCHING OPERATIONS SHALL BE PER W.S.D.O.T. SPECIFICATIONS SECTION 8-01.3(2).

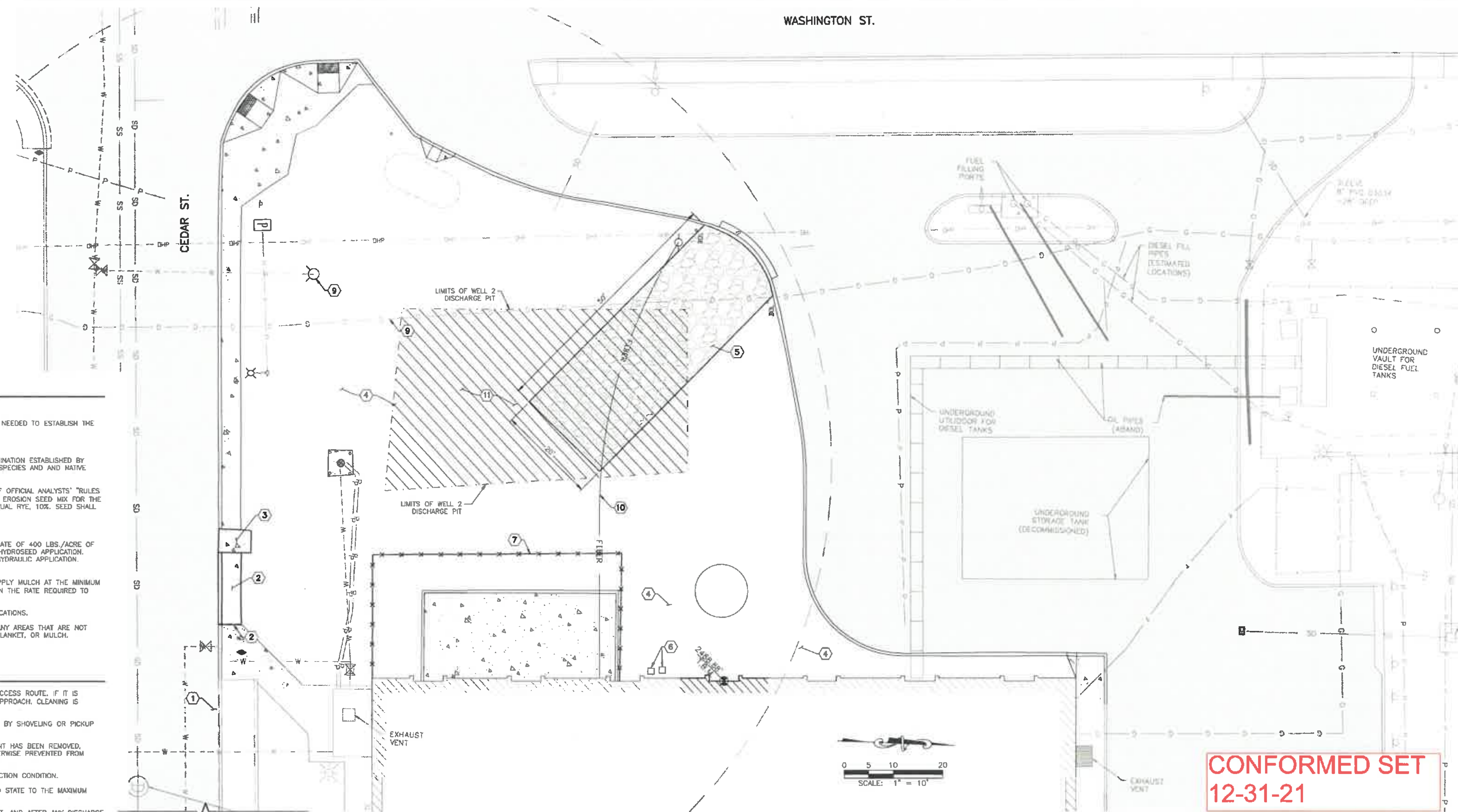
EROSION AND SEDIMENT CONTROL NOTES

1. INSPECT ALL ROADWAYS, AT THE END OF EACH DAY, ADJACENT TO THE CONSTRUCTION ACCESS ROUTE. IF IT IS EVIDENT THAT SEDIMENT HAS BEEN TRACKED OFF SITE AND/OR BEYOND THE ROADWAY APPROACH, CLEANING IS REQUIRED.
2. IF SEDIMENT REMOVAL IS NECESSARY PRIOR TO STREET WASHING, IT SHALL BE REMOVED BY SHOVELING OR PICKUP SWEEPING AND TRANSPORTED TO A CONTROLLED SEDIMENT DISPOSAL AREA.
3. IF STREET WASHING IS REQUIRED TO CLEAN SEDIMENT TRACKED OFF SITE, ONCE SEDIMENT HAS BEEN REMOVED, STREET WASH WASTEWATER SHALL BE CONTROLLED BY PUMPING BACK ON-SITE OR OTHERWISE PREVENTED FROM DISCHARGING INTO SYSTEMS TRIBUTARY TO WATERS OF THE STATE.
4. RESTORE CONSTRUCTION ACCESS ROUTE EQUAL TO OR BETTER THAN THE PRE-CONSTRUCTION CONDITION.
5. RETAIN THE DUFF LAYER, NATIVE TOPSOIL, AND NATURAL VEGETATION IN AN UNDISTURBED STATE TO THE MAXIMUM EXTENT PRACTICAL.
6. INSPECT SEDIMENT CONTROL BMPS WEEKLY AT A MINIMUM, DAILY DURING A STORM EVENT, AND AFTER ANY DISCHARGE FROM THE SITE (STORMWATER OR NON-STORMWATER). THE INSPECTION FREQUENCY MAY BE REDUCED TO ONCE A MONTH IF THE SITE IS STABILIZED AND INACTIVE.
7. CONTROL FUGITIVE DUST FROM CONSTRUCTION ACTIVITY IN ACCORDANCE WITH THE STATE AND/OR LOCAL AIR QUALITY CONTROL AUTHORITIES WITH JURISDICTION OVER THE PROJECT AREA.
8. STABILIZE EXPOSED UNWORKED SOILS (INCLUDING STOCKPILES), WHETHER AT FINAL GRADE OR NOT, WITHIN 10 DAYS DURING THE REGIONAL DRY SEASON (JULY 1 THROUGH SEPTEMBER 30) AND WITHIN 5 DAYS DURING THE REGIONAL WET SEASON (OCTOBER 1 THROUGH JUNE 30). SOILS MUST BE STABILIZED AT THE END OF A SHIFT BEFORE A HOLIDAY WEEKEND IF NEEDED BASED ON THE WEATHER FORECAST. THIS TIME LIMIT MAY ONLY BE ADJUSTED BY A LOCAL JURISDICTION WITH A "QUALIFIED LOCAL PROGRAM," IF IT CAN BE DEMONSTRATED THAT THE RECENT PRECIPITATION JUSTIFIES A DIFFERENT STANDARD AND MEETS THE REQUIREMENTS SET FORTH IN THE CONSTRUCTION STORMWATER GENERAL PERMIT.
9. PROTECT INLETS, DRYWELLS, CATCH BASINS AND OTHER STORMWATER MANAGEMENT FACILITIES FROM SEDIMENT, WHETHER OR NOT FACILITIES ARE OPERABLE.
10. KEEP ROADS ADJACENT TO INLETS CLEAN.
11. INSPECT INLETS WEEKLY AT A MINIMUM AND DAILY DURING STORM EVENTS.
12. CONSTRUCT STORMWATER CONTROL FACILITIES (DETENTION/RETENTION STORAGE POND OR SWALES) BEFORE GRADING BEGINS. THESE FACILITIES SHALL BE OPERATIONAL BEFORE THE CONSTRUCTION OF IMPERVIOUS SITE IMPROVEMENTS.
13. STOCKPILE MATERIALS (SUCH AS TOPSOIL) ON SITE, KEEPING OFF OF ROADWAY AND SIDEWALKS.
14. COVER, CONTAIN AND PROTECT ALL CHEMICALS, LIQUID PRODUCTS, PETROLEUM PRODUCT, AND NON-INERT WASTES PRESENT ON SITE FROM VANDALISM (SEE CHAPTER 173-304 WAC FOR THE DEFINITION OF INERT WASTE). USE SECONDARY CONTAINMENT FOR ON-SITE FUELING TANKS.
15. CONDUCT MAINTENANCE AND REPAIR OF HEAVY EQUIPMENT AND VEHICLES INVOLVING OIL CHANGES, HYDRAULIC SYSTEM REPAIRS, SOLVENT AND DE-GREASING OPERATIONS, FUEL TANK DRAIN DOWN AND REMOVAL, AND OTHER ACTIVITIES THAT MAY RESULT IN DISCHARGE OR SPILLAGE OF POLLUTANTS TO THE GROUND OR INTO STORMWATER RUNOFF USING SPILL PREVENTION MEASURES, SUCH AS DRIP PANS. CLEAN ALL CONTAMINATED SURFACES IMMEDIATELY FOLLOWING ANY DISCHARGE OR SPILL INCIDENT. IF RAINING OVER EQUIPMENT OR VEHICLE, PERFORM EMERGENCY REPAIRS ON SITE USING TEMPORARY PLASTIC BENEATH THE VEHICLE.
16. CONDUCT APPLICATION OF AGRICULTURAL CHEMICALS, INCLUDING FERTILIZERS AND PESTICIDES, IN SUCH A MANNER, AND AT APPLICATION RATES, THAT INHIBITS THE LOSS OF CHEMICALS INTO STORMWATER RUNOFF FACILITIES. AMEND MANUFACTURER'S RECOMMENDED APPLICATION RATES AND PROCEDURES TO MEET THIS REQUIREMENT, IF NECESSARY.
17. INSPECT ON A REGULAR BASIS (AT A MINIMUM WEEKLY, AND DAILY DURING/AFTER A RUNOFF PRODUCING STORM EVENT) AND MAINTAIN ALL EROSION AND SEDIMENT CONTROL BMPS TO ENSURE SUCCESSFUL PERFORMANCE OF THE BMPS. NOTE THAT INLET PROTECTION DEVICES SHALL BE CLEANED OR REMOVED AND REPLACE BEFORE SIX INCHES OF SEDIMENT CAN ACCUMULATE.
18. REMOVE TEMPORARY ESC BMPS WITHIN 30 DAYS AFTER THE TEMPORARY BMPS ARE NO LONGER NEEDED. PERMANENTLY STABILIZE AREAS THAT ARE DISTURBED DURING THE REMOVAL PROCESS.

CONSTRUCTION SEQUENCE

THE FOLLOWING CONSTRUCTION SEQUENCE SHALL BE FOLLOWED IN ORDER TO BEST MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENTATION CONTROL PROBLEMS:

A) CLEAR AND GRUB SUFFICIENTLY FOR INSTALLATION OF TEMPORARY ESC BMP'S;
B) INSTALL TEMPORARY ESC BMP'S; CONSTRUCTING SEDIMENT TRAPPING BMP'S AS ONE OF THE FIRST STEPS PRIOR TO GRADING;
C) CLEAR, GRUB AND ROUGH GRADE FOR ROADS, TEMPORARY ACCESS POINTS AND UTILITY LOCATIONS;
D) STABILIZE ROADWAY APPROACHES AND TEMPORARY ACCESS POINTS WITH THE APPROPRIATE CONSTRUCTION ENTRY BMP;
E) CLEAR, GRUB AND GRADE INDIVIDUAL LOTS OR GROUPS OF LOTS;
F) TEMPORARILY STABILIZE, THROUGH RE-VEGETATION OR OTHER APPROPRIATE BMP'S, LOTS OR GROUPS OF LOTS IN SITUATIONS WHERE SUBSTANTIAL CUT OR FILL SLOPES ARE A RESULT OF THE SITE GRADING;
G) CONSTRUCT ROADS, BUILDINGS, PERMANENT STORMWATER FACILITIES (I.E. INLETS, PONDS, UIC FACILITIES, ETC.);
H) PROTECT ALL PERMANENT STORMWATER FACILITIES UTILIZING THE APPROPRIATE BMP'S;
I) INSTALL PERMANENT ESC CONTROLS, WHEN APPLICABLE; AND,
J) REMOVE TEMPORARY ESC CONTROLS WHEN;
 - PERMANENT ESC CONTROLS, WHEN APPLICABLE, HAVE BEEN COMPLETELY INSTALLED;
 - ALL LAND-DISTURBING ACTIVITIES THAT HAVE THE POTENTIAL TO CAUSE EROSION OR SEDIMENTATION HAVE CEASED; AND,
 - VEGETATION HAD BEEN ESTABLISHED IN THE AREAS NOTED AS REQUIRING VEGETATION ON THE ACCEPTED ESC PLAN ON FILE WITH THE LOCAL JURISDICTION.



CONFORMED SET
12-31-21

LEGEND

- UTILITY MANHOLE
- SANITARY SEWER MANHOLE
- SANITARY SEWER MANHOLE RIM OVER PVC CLEANOUT
- STORM SEWER MANHOLE OR DRYWELL
- CATCH BASIN
- GAS METER OR VALVE
- WATER METER
- IRRIGATION HEAD
- WATER VALVE
- IRRIGATION CONTROL VALVE
- FIRE HYDRANT
- CLEAN OUT
- ELECTRICAL METER BOX
- ELECTRICAL TRANSFORMER
- POWER VAULT
- UTILITY/POWER POLE
- POLE WITH STREET LUMINAIRE
- MD = MEASURE DOWN DISTANCE FROM RIM TO BOTTOM SURFACE
- FF = FINISH FLOOR ELEVATION
- GUY ANCHOR
- TELEPHONE RISER
- GUARD POST OR BOLLARD
- CONIFEROUS TREE 3 = 12"-23" 4 = 24"-39" 5 = 40"+
- ASPHALT
- CONCRETE
- BUILDING
- SW = SIDEWALK
- SMALL BUSH
- HEDGE ROW
- CONC. = CONCRETE
- SIGN AS NOTED
- DECIDUOUS TREE 1 = 1"-3" 2 = 4"-11" 3 = 12"-23" 4 = 24"-39" 5 = 40"+
- 2468.88' T.B.M. = TEMPORARY BENCHMARK FINISHED FLOOR OF EXISTING BUILDING
- OU = OVERHEAD UTILITY LINES
- E = UNDERGROUND ELECTRICAL LINE
- G = UNDERGROUND GAS LINE
- SS = UNDERGROUND SANITARY SEWER LINE
- SD = UNDERGROUND STORM SEWER LINE
- W = UNDERGROUND WATER LINE
- T = UNDERGROUND TELEPHONE LINE
- U = UNDERGROUND LINE AS NOTED
- CHAIN LINK FENCE LINE
- RG = RECORD UNDERGROUND GAS LINE
- RSS = RECORD UNDERGROUND SANITARY SEWER LINE
- RSD = RECORD UNDERGROUND STORM SEWER LINE
- RWA = RECORD UNDERGROUND WATER LINE
- RIRR = RECORD UNDERGROUND IRRIGATION LINE

CONSTRUCTION NOTES

1	PROVIDE INLET PROTECTION ON ALL EXISTING AND PROPOSED STORM DRAINAGE STRUCTURES PER DETAIL 2 THIS SHEET. PROVIDE INLET PROTECTION ON DOWNSTREAM STRUCTURES EAST OF PROJECT LIMITS AND AT NORTHWEST CORNER OF CEDAR AND WASHINGTON.
2	SAWCUT AND REMOVE EXISTING SIDEWALK AND CURB.
3	REMOVE EXISTING TYPE 2 CURB INLET.
4	CLEAR AND GRUB EXISTING ORGANIC MATTER WITHIN PROJECT AREA.
5	ROCK CONSTRUCTION ENTRY PER DETAIL 1 THIS SHEET.
6	RELOCATE EXISTING VALVES PER SHEET C2.1.
7	REMOVE AND DISPOSE OF EXISTING FENCE.
8	PROVIDE INLET PROTECTION ON CATCH BASIN ON NORTHWEST CORNER OF CEDAR & N. 11TH STREET. PER DETAIL 2, THIS SHEET.
9	PROTECT EXISTING FEATURE DURING CONSTRUCTION.
10	EXISTING UNDERGROUND FIBER. CONTRACTOR SHALL PROTECT IN PLACE. FUTURE RELOCATION BY OTHERS.
11	UNSUITABLE FILL FROM WELL 2 DISCHARGE PIT. SHOWN FOR INFORMATION PURPOSES.

SHEET INDEX

SUMMARY OF BMP'S UTILIZED

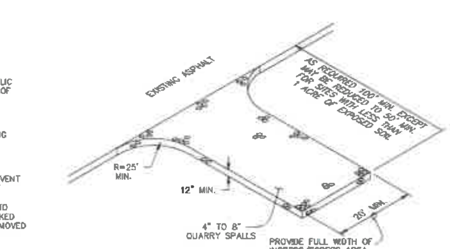
BMP C101: PRESERVING NATURAL VEGETATION
BMP C105: STABILIZED CONSTRUCTION ENTRANCE
BMP C220: STORM DRAIN INLET PROTECTION
BMP C233: SILT FENCE

DEFINITION:
A TEMPORARY STONE-STABILIZED PAD LOCATED AT POINTS OF VEHICULAR INGRESS AND EGRESS ON A CONSTRUCTION SITE.

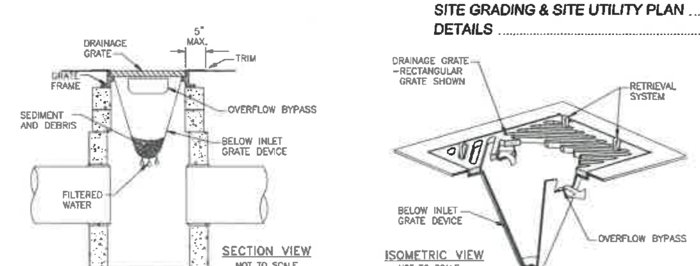
PURPOSE:
TO REDUCE THE AMOUNT OF MUD, DIRT, ROCKS, ETC. TRANSPORTED ONTO PUBLIC ROADS BY MOTOR VEHICLES OR RUNOFF BY CONSTRUCTING A STABILIZED PAD OF ROCK SPALLS AT ENTRANCES TO CONSTRUCTION SITES AND WASHING OF TIRES DURING EGRESS.

CONDITIONS WHERE PRACTICE APPLIES:
- WHENEVER TRAFFIC WILL BE LEAVING A CONSTRUCTION SITE AND MOVING DIRECTLY ONTO A PUBLIC ROAD OR OTHER PAVED AREAS.

MAINTENANCE:
- THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OF FLOW OF MUD ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH 2-INCH STONE, AS CONDITIONS DEMAND, AND REPAIR AND/OR CLEANOUT OF ANY STRUCTURES USED TO TRAP SEDIMENT. ALL MATERIALS SPILLED, DROPPED, WASHED, OR TRACKED FROM VEHICLES ONTO ROADWAYS OR INTO STORM DRAINS MUST BE REMOVED IMMEDIATELY.



1/C1.1 ROCK CONSTRUCTION ENTRY DETAIL
SCALE: NTS



NOTES:
1. SIZE THE BELOW INLET GRATE DEVICE (BIGD) FOR THE STORM WATER STRUCTURE IT WILL SERVICE.
2. THE BIGD SHALL HAVE A BUILT-IN HIGH-FLOW RELIEF SYSTEM (OVERFLOW BYPASS).
3. THE RETRIEVAL SYSTEM MUST ALLOW REMOVAL OF THE BIGD WITHOUT SPILLING THE COLLECTED MATERIAL.
4. PERFORM MAINTENANCE IN ACCORDANCE WITH STANDARD SPECIFICATION 8-01.3(15).

2/C1.1 STORM DRAIN INLET PROTECTION DETAIL
SCALE: NTS

BOWIE D. McCANNA STATE OF WASHINGTON 48200 REGISTERED PROFESSIONAL ENGINEER
3/27/2021

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

MCCANNA ENGINEERING
9401 E APPLEWAY BLVD
SPOKANE VALLEY, WA 99206
PH: (509) 954-6604
MCCANNA PROJECT# 2020-27

BID SET

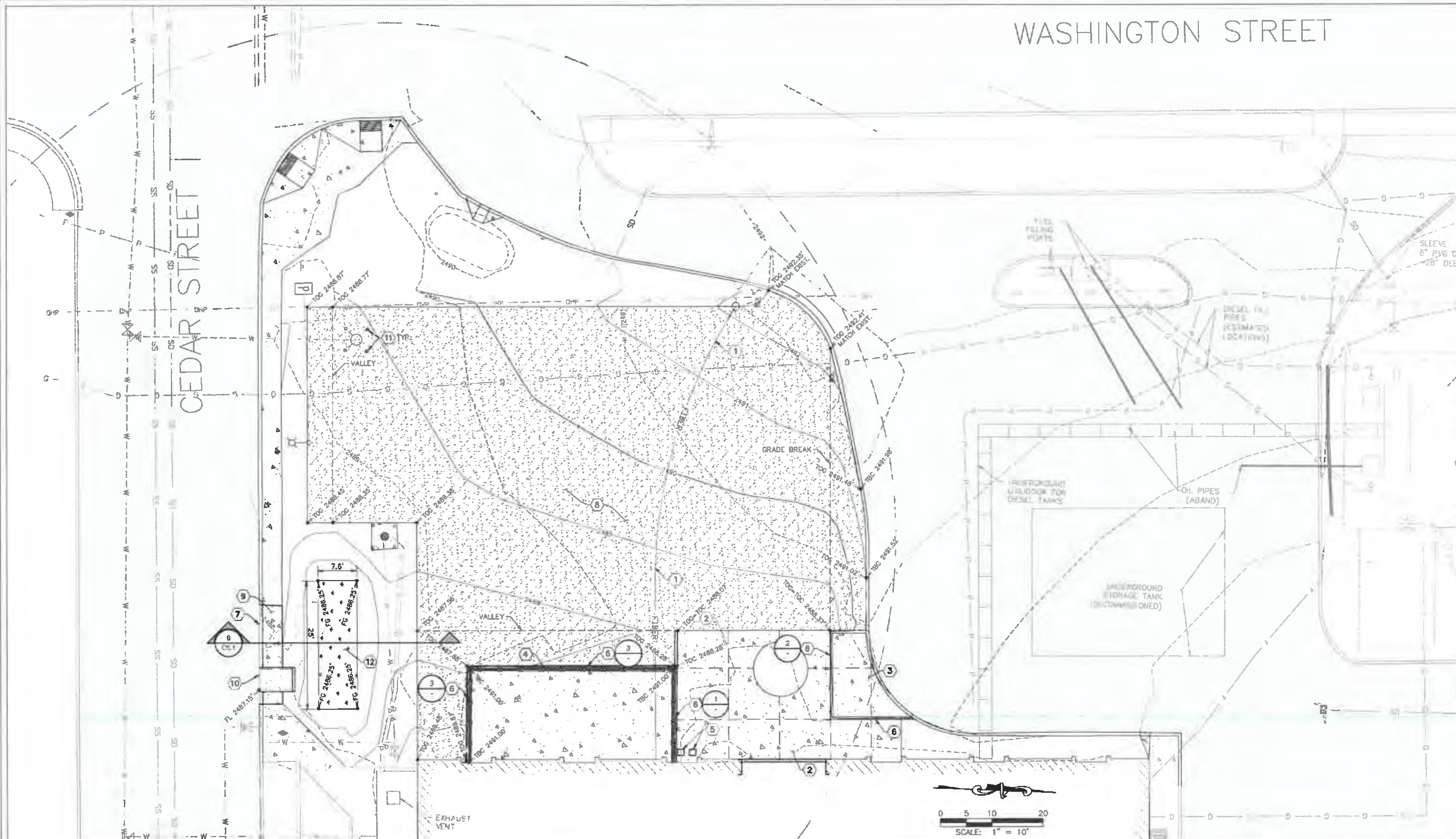
No:	Date:	Description:
1	04/07/2021	FIBER-OPTIC LOCATION REVISED.

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA
Site Demolition & TESC Plan

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	2020-27
DRAWN BY:	JG
CHECKED BY:	BDM
DATE:	03-27-2021

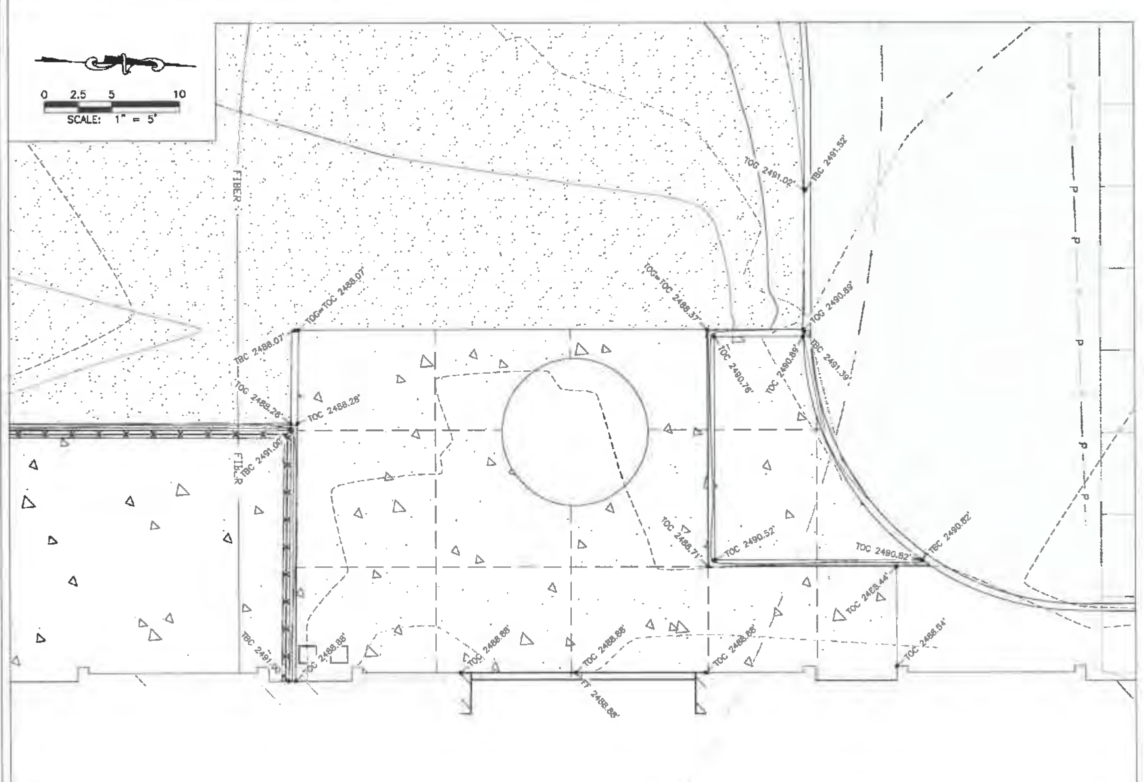
C1.1

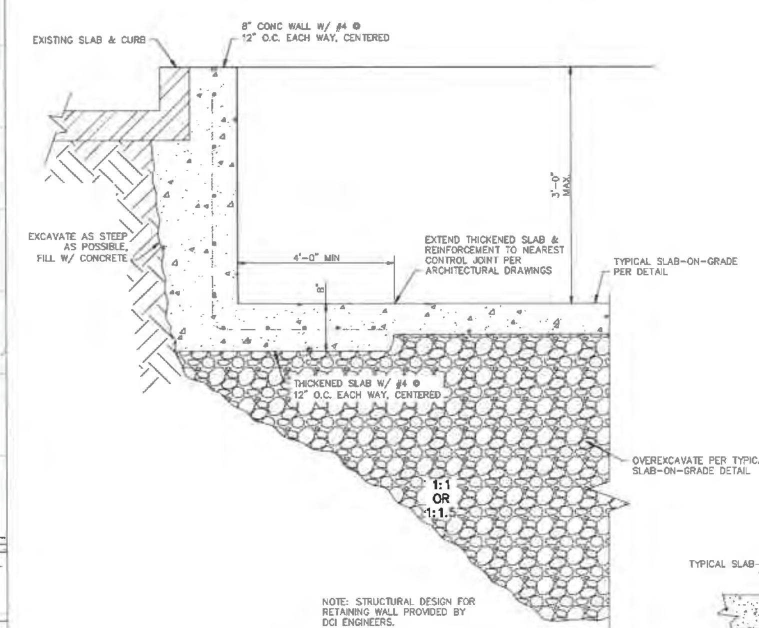


CONSTRUCTION NOTES	
ITEM No.	DESCRIPTION
1	EXISTING UNDERGROUND FIBER. CONTRACTOR SHALL PROTECT IN PLACE. FUTURE RELOCATION BY OTHERS.
2	PCC PAVEMENT PER DETAIL 1 SHEET C5.1.
3	4" THICK CONCRETE SLAB PER DETAIL 2 SHEET C5.1.
4	CHAIN LINK FENCE ATTACHED TO TOP OF EXISTING CURB PER ARCHITECTURAL PLANS.
5	RELOCATE EXISTING ABOVEGROUND VALVES AND BACKFLOW PREVENTER. UNDERGROUND LINE LOCATIONS UNKNOWN. CONTRACTOR TO COORDINATE RELOCATION WITH OWNER DURING CONSTRUCTION.
6	CONCRETE RETAINING WALL PER DETAILS 1, 2 OR 3 THIS SHEET.
7	TYPE "A" CURB PER CITY OF CHENEY STANDARD PLAN A-2. PLACE #4 REBAR AT 3" AND 6" BELOW TOP OF CURB. PLACE 4" OF CRUSHED SURFACING BASE COURSE BELOW ALL PROPOSED CURBS.
8	GRAVEL SURFACING PER DETAIL 3, SHEET C5.1
9	SIDEWALK PER CITY OF CHENEY STANDARD PLAN A-6
10	TYPE 2 CURB INLET PER DETAIL 7 SHEET C5.1. SET BOTTOM ELEVATION AT BIORETENTION AREA OUTLET 2487.25'. INLET TO BE CONSTRUCTED AS OVERFLOW TO CITY RIGHT OF WAY.
11	BOLLARD PER DETAIL 4 SHEET C5.1.
12	BIORETENTION AREA PER DETAIL 5 SHEET C5.1.

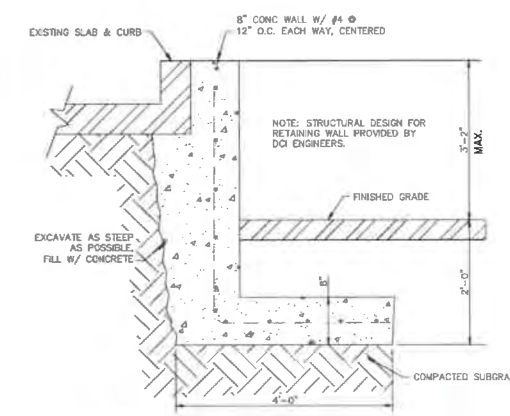
ABBREVIATIONS

TOC = TOP OF CONCRETE
TBC = TOP BACK OF CURB
TOA = TOP OF ASPHALT
TOG = TOP OF GRAVEL
FL = FLOW LINE

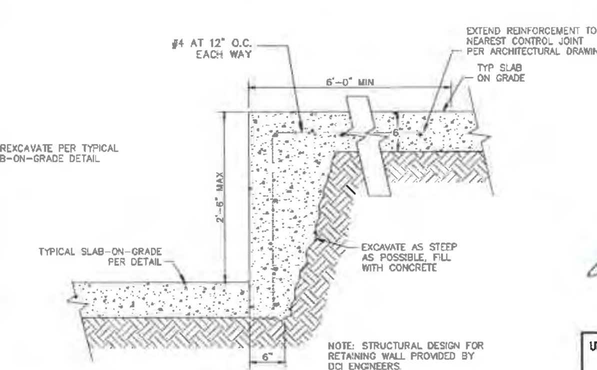




1 C2.1 EQUIPMENT PAD SECTION (NORTH)
SCALE: NTS



3 C2.1 EQUIPMENT PAD SECTION (WEST, SOUTH)
SCALE: NTS



2 C2.1 SECTION AT SLAB STEP
SCALE: NTS

CONFORMED SET
12-31-21

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

3/27/2021

MCCANNA ENGINEERING
9401 E APPLEWAY BLVD
SPOKANE VALLEY, WA 99206
PH: (509) 954-6604
PROJECT # 2020-27

BID SET

No:	Date:	Description:
1	04/07/2021	FIBER-OPTIC LOCATION REVISED.

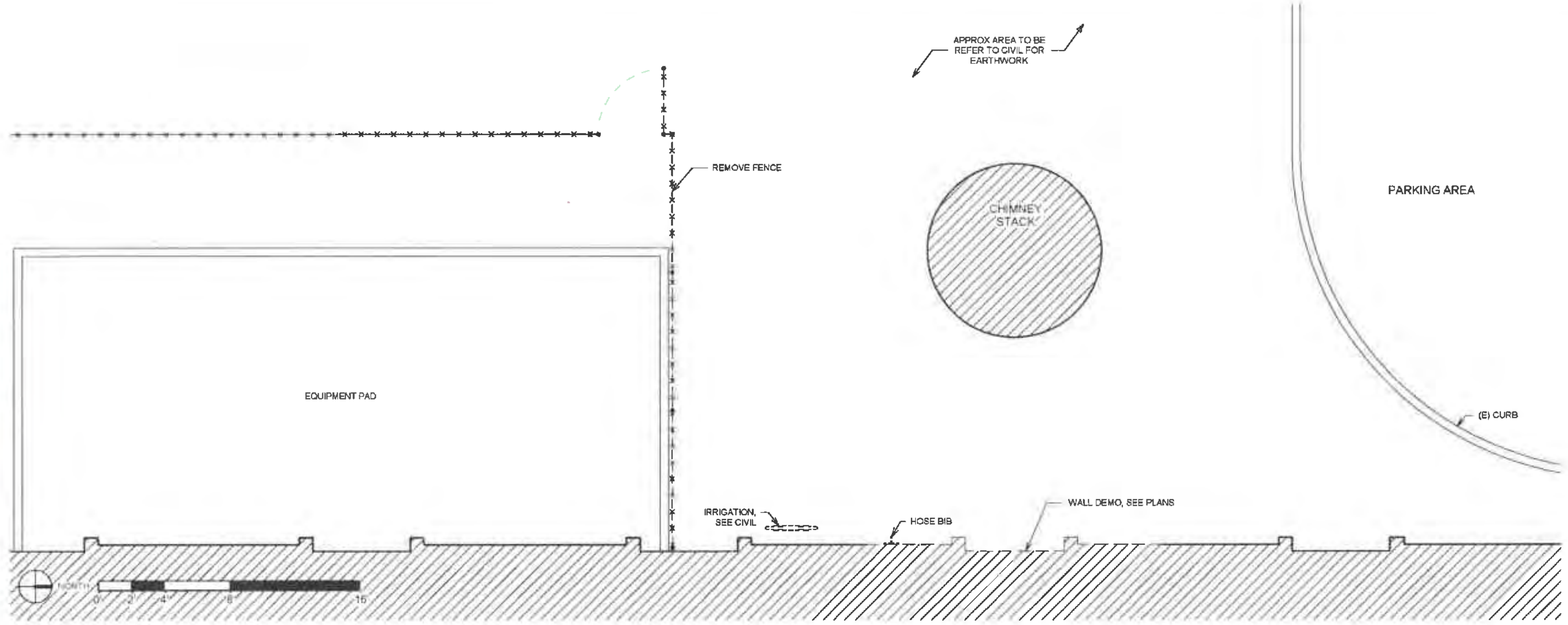
INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA
Site Grading & Site Utility Plan

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	2020-27
DRAWN BY:	JG
CHECKED BY:	BDM
DATE:	03-27-2021

C2.1

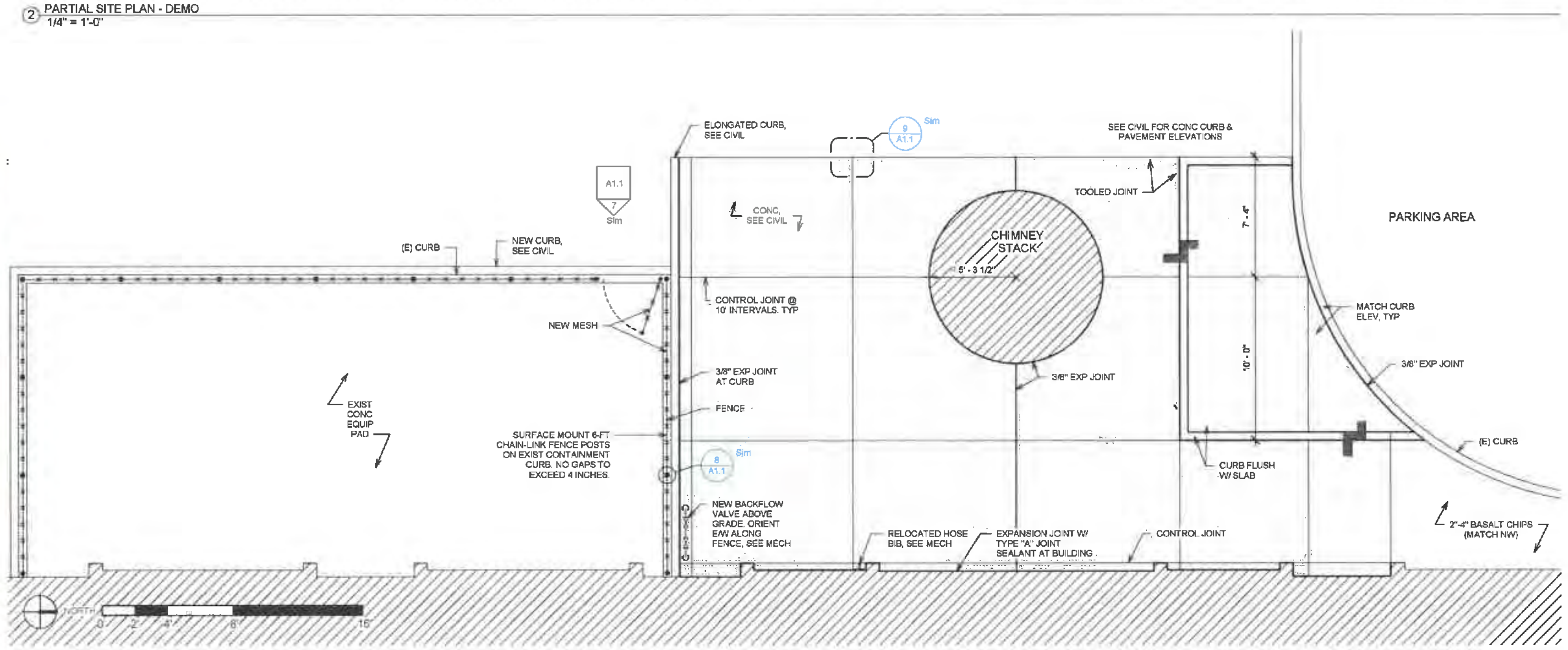
1 RENDERING - EXTERIOR
1" = 1'-0"



2 PARTIAL SITE PLAN - DEMO
1/4" = 1'-0"

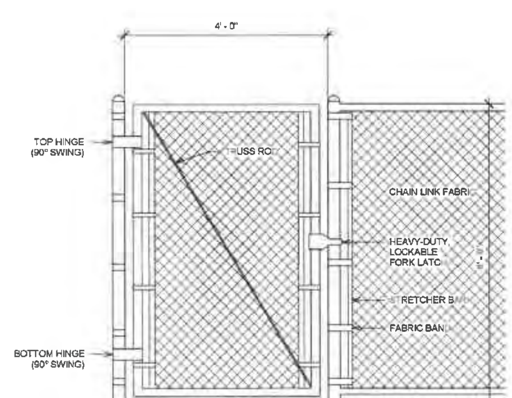
3 FACADE FROM PARKING LOT
1/8" = 1'-0"

4 FACADE FROM SW
1/8" = 1'-0"

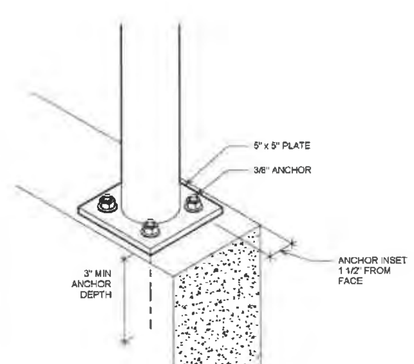


5 PARTIAL SITE PLAN
1/4" = 1'-0"

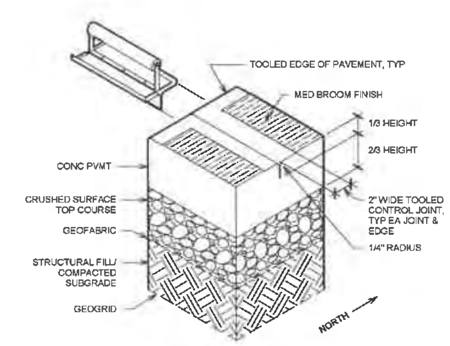
6 FACADE FROM NORTH
1/8" = 1'-0"



7 FENCE ELEVATION
3/4" = 1'-0"



8 FENCE POST
3" = 1'-0"



9 CONTROL JOINT
1 1/2" = 1'-0"

EXISTING CONDITIONS
1. CONTRACTOR TO PHOTOGRAPH AND/OR VIDEOTAPE IN SUFFICIENT DETAIL ALL EXISTING AREAS THAT WILL BE AFFECTED BY CONSTRUCTION AND HAUL ROUTES TO SUBSTANTIATE EXISTING CONDITIONS THAT MIGHT OTHERWISE BE CONSTRUED AS DAMAGE CAUSED BY THE CONTRACTOR.
2. ANY DAMAGE WITHIN THE LIMITS OF CONSTRUCTION OR AREAS USED BY THE CONTRACTOR OUTSIDE THE LIMITS OF CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR UNLESS THE DAMAGE CAN BE POSITIVELY IDENTIFIED BY PHOTOGRAPH OR VIDEOTAPE AS BEING A PREVIOUSLY EXISTING CONDITION.

SITE IMPROVEMENTS
1. PROTECT REMAINING LANDSCAPE TURF, PLANTINGS AND IRRIGATION FROM DAMAGE.
2. REPAIR TO DAMAGED IRRIGATION SYSTEMS ARE TO BE COMPLETED BY A QUALIFIED IRRIGATION INSTALLER.

SITE CLEARING
1. REMOVE EXISTING SOIL AND MATERIALS AS NECESSARY TO FACILITATE NEW CONSTRUCTION.
2 PROPERLY DISPOSE OF WASTE MATERIALS, INCLUDING TRASH, AND DEBRIS, OFF PROPERTY.

EARTH MOVING

PREPARATION
1. CALL 811 BEFORE YOU DIG. LOCATE BURIED UTILITIES BEFORE STARTING WORK.
2. PROVIDE AND MAINTAIN EROSION AND SEDIMENT CONTROL MEASURES DURING WORK.

UTILITY TRENCHES
1. EXCAVATE AND SHAPE TRENCH BOTTOMS TO UNIFORM DEPTH, FREE FROM PROJECTING STONES AND SHARP OBJECTS.
2. PLACE AND COMPACT BEDDING COURSE TO PROVIDE CONTINUOUS SUPPORT FOR CONDUIT, PIPES, JOINTS AND FITTINGS

FILL AND COMPACTION
1 PLACE BACKFILL IN LAYERS NOT MORE THAN 8 INCHES IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HEAVY COMPACTION EQUIPMENT, AND NOT MORE THAN 4 INCHES IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HAND-OPERATED TAMPERS.
2 UNDER WALKWAYS, SCARIFY AND RE-COMPACT TOP 6 INCHES BELOW SUBGRADE AND COMPACT EACH LAYER OF BACKFILL OR FILL SOIL MATERIAL AT 95 PERCENT.
3. FOR UTILITY TRENCHES, COMPACT EACH LAYER OF INITIAL AND FINAL BACKFILL SOIL MATERIAL AT 90 PERCENT.

GRADING, BASE COURSE AND DRAINAGE COURSE
1 UNIFORMLY GRADE AREAS TO A SMOOTH SURFACE, FREE OF IRREGULARITIES.
2. SLOPE GRADES AWAY FROM BUILDINGS AND TO PREVENT PONDING.
3. PLACE AND COMPACT BASE COURSE UNDER PAVEMENTS AND WALKS

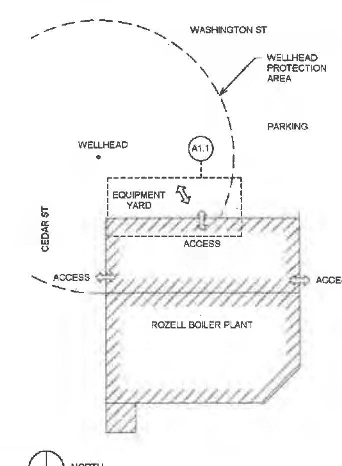
CONCRETE PAVING (SITE WALKS, PAVEMENT AND CURBS)
1. PROVIDE STEEL REINFORCING BARS WHERE INDICATED.
2. INSTALL ISOLATION JOINTS AND CONSTRUCTION JOINTS WHERE INDICATED OR REQUIRED.

PLACING CONCRETE
1 MOISTEN SUBBASE TO PROVIDE UNIFORM DAMPENED CONDITION AT TIME CONCRETE IS PLACED.
2. DEPOSIT AND SPREAD CONCRETE IN A CONTINUOUS OPERATION. DO NOT USE VIBRATORS TO MOVE CONCRETE INTO PLACE.
3. SCREED PAVING SURFACE WITH A STRAIGHTEDGE AND COMMENCE INITIAL FLOAT.
4. SET CONSTRUCTION JOINTS

CONCRETE FINISH AND PROTECTION
1. BEGIN SECOND FLOAT WHEN BLEED-WATER HAS DISAPPEARED.
2. APPLY MEDIUM TEXTURED BROOM FINISH UNLESS NOTED OTHERWISE.
3. APPLY 2-INCH WIDE TROWEL WITH 1/4-INCH RADIUS TO ALL EDGES AND JOINTS
4. PROTECT FRESHLY PLACED CONCRETE FROM PREMATURE DRYING AND EXCESSIVE COLD OR HOT TEMPERATURES AND CURE.

CHAIN LINK FENCES AND GATE
1 SURFACE-MOUNT POSTS TO EXISTING CURB PLUMB, ALIGNED AND AT CORRECT HEIGHT AND SPACING.
2. INSTALL RAILS AND GATE SUPPORT POSTS PLUMB AND IN ALIGNMENT.
3. APPLY CHAIN-LINK FABRIC TO OUTSIDE OF FRAMEWORK, PULL TAUGHT AND TIE TO POSTS AND RAILS.

CONFORMED SET
12-31-21



REGISTERED ARCHITECT
JAMES D. CORTNER
STATE OF WASHINGTON

CAC

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA
Architectural Site Plan

MSI ENGINEERS
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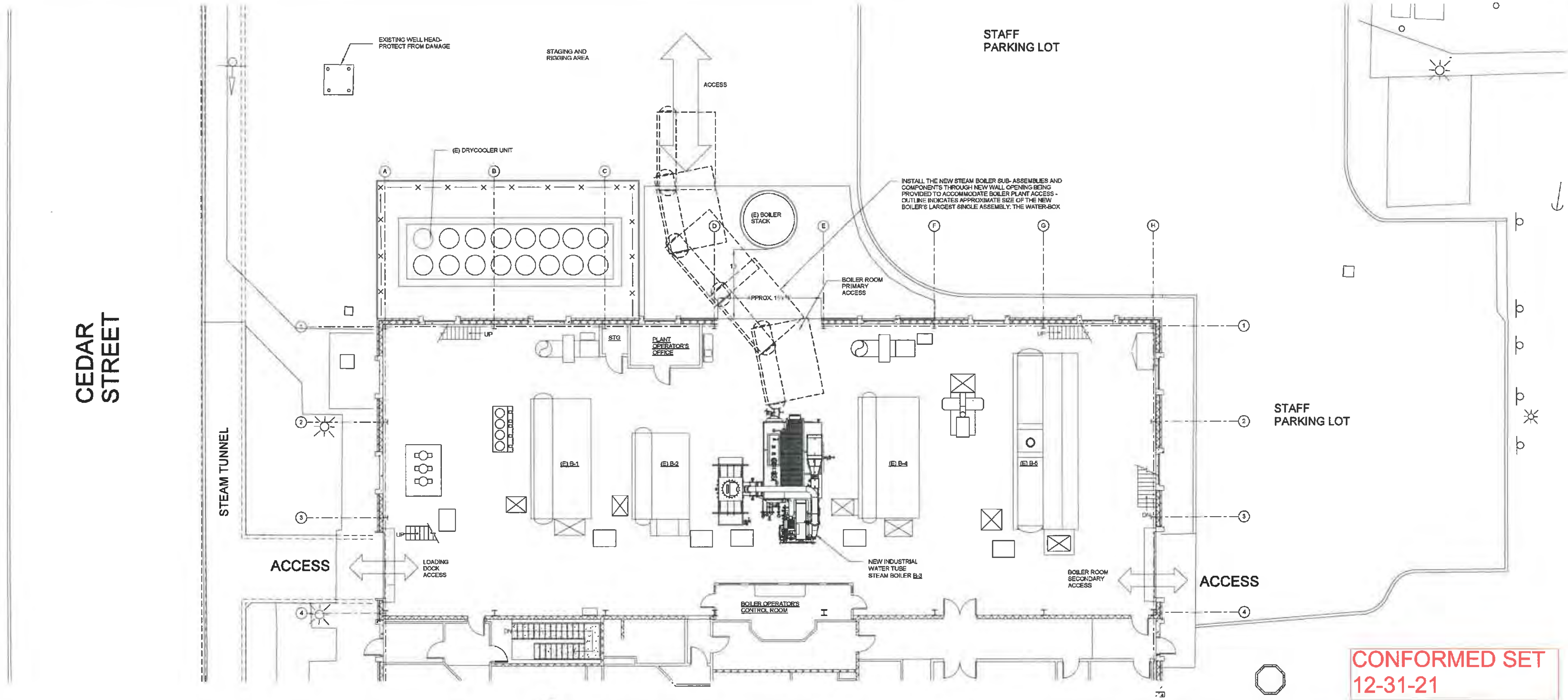
PROJECT NO:	19-59
DRAWN BY:	APW
CHECKED BY:	JDC
DATE:	03-27-2021

A1.1



CONFORMED SET
12-31-21

PARTIAL OPERATING LEVEL - GENERAL ARRANGEMENT PLAN - NEW WORK
Scale: 1/8"=1'-0"

GENERAL PHASING NOTES

BOILER #3 REPLACEMENT AND GENERAL PHASING NOTES:

GENERAL REQUIREMENTS:

IT IS THE INTENT THAT THE EXISTING EWU STEAM PLANT REMAIN IN OPERATION AND FUNCTIONAL THROUGHOUT THE ENTIRE DURATION OF THIS PROJECT. TO THAT EXTENT, ALL EXISTING STEAM PRODUCTION EQUIPMENT, SYSTEMS, PIPING, POWER, COMMUNICATIONS AND CONTROLS, SHALL REMAIN OPERATIONAL DURING THE COURSE OF THE WORK AS RELATED TO THE REMOVAL AND REPLACEMENT OF BOILER #3, AS WELL AS ALL OTHER ASSOCIATED TASKS.
PLANT SYSTEMS AND PIPING SHALL BE ISOLATED AND/OR TEMPORARILY REROUTED AS REQUIRED TO MAINTAIN CRITICAL STEAM PRODUCTION TO THE EWU CAMPUS.

CUT-OVER/DOWNTIME SCHEDULING:

ALL STEAM HEATING SYSTEM AND/OR PLANT ELECTRICAL SYSTEM INTERRUPTIONS FOR SYSTEM MODIFICATIONS, CUT-OVERS, CUT-INS, START-UP, TESTING, ETC., SHALL BE SCHEDULED AND APPROVED IN ADVANCE WITH EWU PLANT OPERATORS. PROVIDE A MINIMUM OF ONE WEEK ADVANCE NOTICE OF ANTICIPATED INTERRUPTION SCHEDULE AND DOWNTIME DURATION.

GENERAL INSTALLATION NOTES

GENERAL:

1. REFER TO MD-SERIES DRAWINGS FOR DEMOLITION WORK.

2. REFER TO MP-SERIES DRAWINGS FOR NEW WORK.

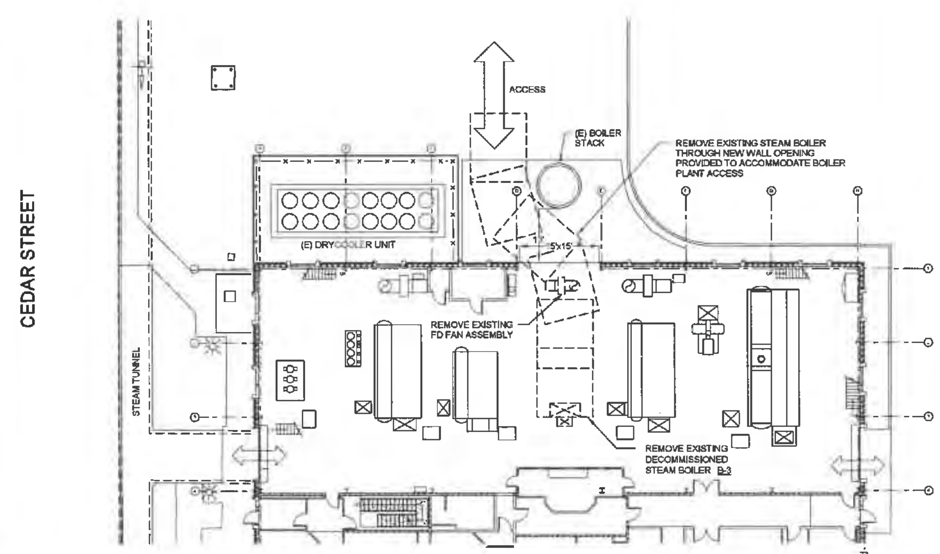
3. REFER TO MI-SERIES DRAWINGS FOR NEW INSTRUMENTATION WORK.

4. ACCESS WALL OPENING AND ACCESS PATHWAY RESTRICTIONS: IN ORDER TO ACCOMMODATE THE REMOVAL OF THE EXISTING DECOMMISSIONED STEAM BOILER, B-3, THE PROJECT WILL INCLUDE THE REMOVAL OF A PORTION OF THE EXISTING BOILER PLANT EXTERIOR WALL ON THE WEST SIDE, WHICH WILL PROVIDE LIMITED ACCESS INTO THE OPERATING LEVEL OF THE PLANT (APPROX. 15ft WIDE BY 15ft TALL), AND A RESTRICTED ACCESS PATHWAY BETWEEN THE PLANT AND THE EXISTING ROZELL PLANT SMOKE STACK (APPROX. 13ft). ALL MAJOR MOVEMENT OF NEW COMPONENTS AND REMOVAL OF EXISTING COMPONENTS SHALL UTILIZE THIS ACCESS OPENING AND PATHWAY, AND INDIVIDUAL COMPONENTS AND ASSEMBLIES SHALL BE STAGED, PREPARED, OR PROCURED IN A MANNER TO ACCOMMODATE THIS ACCESS ROUTE.

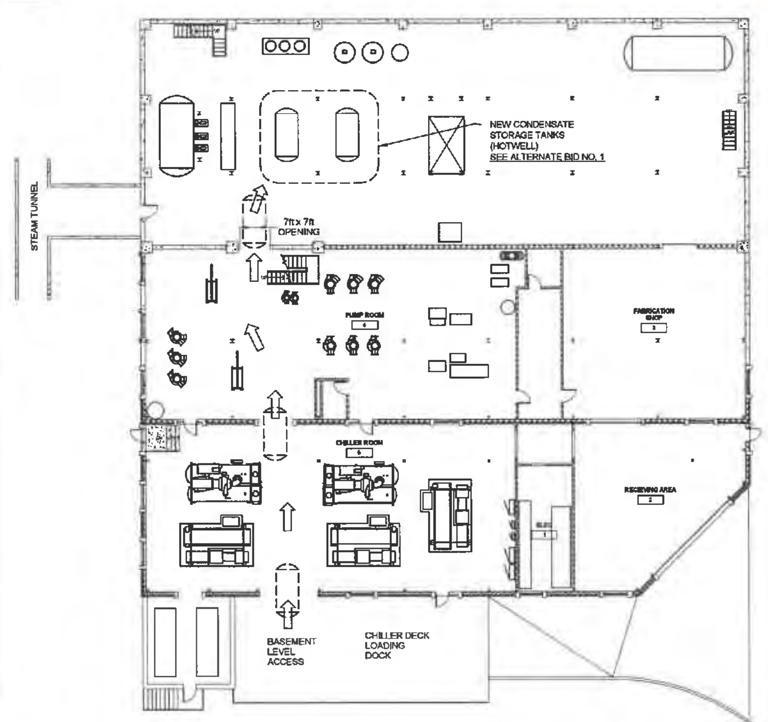
5. NEW STEAM BOILER INSTALLATION: THE NEW INDUSTRIAL WATER TUBE BOILER, B-3, WILL NEED TO INSTALLED IN MANNER THAT WILL ACCOMMODATE THE BOILER PLANT'S NEW ACCESS WALL OPENING SIZE LIMITATIONS, WHICH MAY INCLUDE PARTIALLY DISASSEMBLING COMPONENTS AND/OR ASSEMBLIES, AND RE-ASSEMBLING/FIELD ERECTION OF THE BOILER INSIDE THE PLANT.

6. RIGGING AND CRANE WORK: PROVIDE ALL NECESSARY RIGGING, CRANE WORK, ETC. AS NECESSARY FOR DEMOLITION OF THE EXISTING BOILER AND INSTALLATION OF THE NEW BOILER.

7. PROTECTION AND SHORING: SEE GENERAL NOTES ON SHEET G-1.1, AND THE PROJECT SPECIFICATIONS FOR PROTECTION AND SHORING REQUIREMENTS.



PARTIAL OPERATING LEVEL - GENERAL ARRANGEMENT PLAN - DEMOLITION
Scale: 1/16"=1'-0"



BASEMENT LEVEL - GENERAL ARRANGEMENT PLAN
Scale: 1/16"=1'-0"

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

OPERATING LEVEL - GENERAL ARRANGEMENT PLAN

MSI ENGINEERS
www.msi-engineers.com

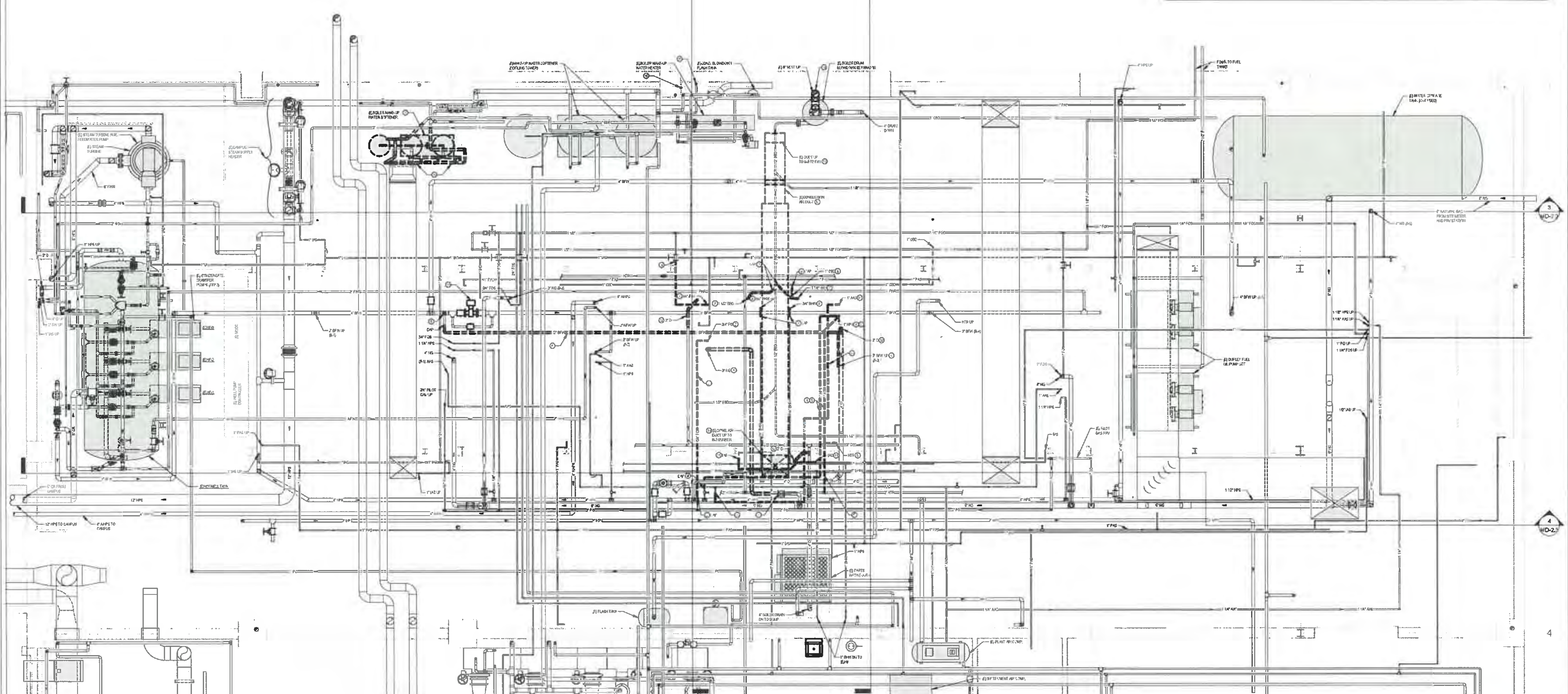
PROJECT NO:	19,59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

M-0.3


3210

GENERAL NOTES – MECHANICAL DEMOLITION

1. FIELD VERIFY ALL EXISTING CONDITIONS, GEOMETRY, LOCATIONS, SERVICES, LABELS, VALVE LOCATIONS, ETC., BEFORE PROCEEDING WITH THE WORK. PIPING, SYSTEMS AND EQUIPMENT SHOWN ON THESE DRAWINGS ARE PARTIALLY DIAGRAMMATIC AND HAVE BEEN SHOWN IN A MANNER FOR BETTER CLARITY. PIPING ELEVATIONS AND CROSSINGS MAY NOT ALWAYS BE ACCURATE, DUE TO THE COMPLEX NATURE OF THE EXISTING CONDITIONS, BUT ARE GENERALLY IN THE APPROXIMATE ARRANGEMENT SHOWN. NOT ALL EXISTING PIPING, CONDUITS, CABLE TRAYS, HANGERS, ETC. ARE SHOWN IN ORDER TO MAINTAIN CLARITY, BUT SHOULD BE ACCOUNTED FOR DURING FIELD VERIFICATION EFFORTS, WHERE THEY ARE IN PROXIMITY TO THE WORK. PIPE SIZES AND SERVICES, WHERE INDICATED, SHOULD BE FIELD VERIFIED.
2. EXISTING HANGER AND SUPPORTS ARE GENERALLY NOT SHOWN BUT MUST BE ACCOUNTED FOR AND FIELD VERIFIED IN THE VICINITY OF THE WORK. WHERE PIPING AND EQUIPMENT IS SHOWN TO BE REMOVED, IT SHALL ALSO INCLUDE DEMOLITION OF ALL ASSOCIATED HANGERS, SUPPORTS, ETC.
3. EXISTING SMALL PIPING, SUCH AS DRAINS, VENT AND INSTRUMENTATION TUBING, ETC. AND ASSOCIATED VALVES ARE NOT NECESSARILY SHOWN BUT MUST BE ACCOUNTED FOR AND FIELD VERIFIED IN THE VICINITY OF THE WORK.
4. DUE TO THE CONGESTED NATURE OF MUCH OF THE EXISTING PIPING, AND ELECTRICAL DISTRIBUTION SYSTEMS, PARTICULARILY AT THE BASEMENT CEILING LEVEL, THE CONTRACTOR SHALL USE UTMOST CARE IN PERFORMING THE WORK IN AND AROUND THESE AREAS, IN ORDER TO AVOIDE DAMAGING OR DISRUPTING ACTIVE SYSTEMS.
5. PHASING OF THE DEMOLITION WORK AND NEW INSTALLATION WORK SHALL BE CAREFULLY COORDINATED, IN ADVANCE, WITH THE EWU BOILER PLANT OPERATORS, SO AS TO AVOID DISRUPTION TO THE STEAM GENERATION ACTIVITIES OF THE PLANT. WHERE ISOLATION VALVES ARE AVAILABLE TO ISOLATE SYSTEMS BEING IMPACTED, THEY SHALL BE UTILIZED. WHERE SUCH ISOLATION VALVES ARE NOT AVAILABLE, AND SYSTEM SHUT-DOWNS ARE UNAVOIDABLE, THEY SHALL BE APPROVED AND SCHEDULED IN ADVANCE, AND HELD TO A MINIMUM DURATION. TEMPORARY PIPING AND/OR VALVES, WHICH MAY NOT BE SHOWN ON THE DRAWINGS, MAY BE REQUIRED TO FACILITATE THE SHUT-DOWN AND/OR CUT-OVER ACTIVITIES.
6. THE EWU BOILER PLANT OPERATORS MAY DESIRE TO SALVAGE SELECT PIECES OF EQUIPMENT AND SYSTEMS, VALVES, CONTROLLERS, ETC. FOR REUSE OR SPARE PARTS. WHERE SUCH ITEMS ARE DESIGNATED DURING THE DEMOLITION ACTIVITIES, THE CONTRACTOR SHALL REMOVE SAID ITEMS AND DELIVER TO THE DESIGNATED OWNER'S STORAGE LOCATION WITHIN THE ROZELL PLANT FACILITY.
7. REFER ALSO TO THE MECHANICAL SYSTEM FLOW DIAGRAMS – DEMOLITION, FOR ADDITIONAL INFORMATION AND VIEW OF THE OVERALL WORK INVOLVED.



B E F G

CONFORMED SET
12-31-21

1 BASEMENT LEVEL - MECHANICAL DEMOLITION
SCALE: 1/4" = 1'-0"

KEY NOTES - DEMOLITION

1. REMOVE MAIN NATURAL GAS SERVICE PIPING FROM BASEMENT LEVEL SHUT-OFF VALVE UP THRU GAS VALVE ASSEMBLY ON BOILER B-3, MAINTAIN BRANCH TAKE-OFF SHUT-OFF GAS VALVE FOR RECONNECTION TO NEW SYSTEM.
2. REMOVE PILOT GAS SERVICE PIPING FROM BASEMENT LEVEL SHUT-OFF VALVE UP THRU PILOT GAS ASSEMBLY ON BOILER B-3, CAP PILOT LINE BRANCH TAP AT SHUT-OFF VALVE (NEW BOILER HAS ITS OWN PILOT SERVICE).
3. REMOVE FUEL OIL SUPPLY LINE FROM BRACH TAKE-OFF VALVE UP THRU FUEL OIL PIPING ASSEMBLY ON BOILER B-3, MAINTAIN BRANCH TAKE-OFF SHUT-OFF VALVE FOR RECONNECTION TO NEW SYSTEM.
4. REMOVE HPS (ATOMIZING STEAM) SUPPLY LINE FROM BASEMENT LEVEL HPS BRANCH TAKE-OFF UP THRU BOILER B-3 BURNER ASSEMBLY. CAP BRANCH TAKE-OFF AT VALVE.
5. REMOVE HTR (CONDENSATE) DRIP PIPING FROM BASEMENT LEVEL BRANCH TAKE-OFF UP THRU BOILER B-3 BURNER PIPING.
6. REMOVE BOILER FEEDWATER PIPING FROM BASEMENT LEVEL BRANCH TAKE-OFF UP THRU BOILER B-3 FEEDWATER/ECONOMIZER PIPING ASSEMBLY. CAP PIPING AT BRANCH TAKE-OFF POINT.
7. REMOVE SECTIONS OF ABANDONED BOTTOM BLOW-DOWN PIPING FROM BRANCH TAKE-OFF POINTS (2) UP TO BOILER B-3. CAP BOTH BRANCH TAKE-OFFS.
8. REMOVE PORTION OF CONTINUOUS BLOW-DOWN PIPING FROM BRANCH TAKE-OFF POINT UP THRU BOILER B-3 CONNECTIONS. CAP PIPE AT BRANCH TAKE-OFF POINT.
9. REMOVE PORTIONS OF BOILER HEAT-UP WATER (SUPPLY & RETURN) UP TO BOILER B-3 CONNECTIONS, MAINTAIN EXISTING BRANCH FEEDER PIPING FOR RECONNECTION TO NEW SYSTEM.
10. REMOVE ATOMIZING AIR SUPPLY LINE FROM BASEMENT BRANCH TAKE-OFF VALVE UP THRU BOILER B-3 BURNER CONNECTION. MAINTAIN TAKE-OFF VALVE FOR RECONNECTION TO NEW SYSTEM.
11. REMOVE PORTIONS OF INSTRUMENT AIR SUPPLY PIPING FROM BASEMENT BRANCH TAKE-OFF VALVE UP THRU BOILER B-3 BURNER & VALVE ASSEMBLIES, MAINTAIN BRANCH TAKE-OFF VALVE FOR RECONNECTION TO NEW SYSTEM.
12. REMOVE PORTIONS OF MISC. BOILER INDIRECT DRAIN RECEIVER PIPE RISERS UP THRU FLOOR TO BOILER B-3, MAINTAIN SECTIONS OF PIPING FOR RECONNECTION TO NEW SYSTEM.
13. REMOVE COMBUSTION AIR DUCT FROM OUTLET OF FORCED DRAFT FAN ON THE OPERATING LEVEL, THRU THE BASEMENT CEILING AREA, AND UP TO BOILER B-3 BURNER INLET.
14. REMOVE PORTION OF VERTICAL VENT PIPING FROM DISCHARGE OFF OF BLOW-DOWN TANK UP THRU OPERATING LEVEL (TO AVOID CONFLICT WITH UPPER LEVEL NEW BOILER ROOM ACCESS OPENING). PROVIDE NEW REROUTED VENT PIPING AS SHOWN ON PIPING PLANS.
15. REMOVE AND REROUTE 3/4" DCW RISER PIPE UP TO WALL HYDRANT ON OPERATING LEVEL.
16. REMOVE AND REROUTE 2" PLUMBING VENT RISER PIPE UP TO VENT LINE ON OPERATING LEVEL.
17. REMOVE EXISTING DUPLEX WATER SOFTENER SKID AND ASSOCIATED PIPING.
18. REMOVE WATER SOFTENER PIPING AND VALVES. RETAIN TIE-IN POINTS FOR RECONNECTION TO NEW SOFTENER, COORDINATE CUT-OVER AND PHASING WITH OWNER. UTILIZE COOLING TOWER SOFTENER FOR BOILER MAKE-UP WATER DURING CUT-OVER DURATION.
19. REMOVE EXISTING UNUSED CONTROL VALVE & REPLACE WITH NEW 4" SPOOL PIECE.

BID SET

No:	Date:	Description:

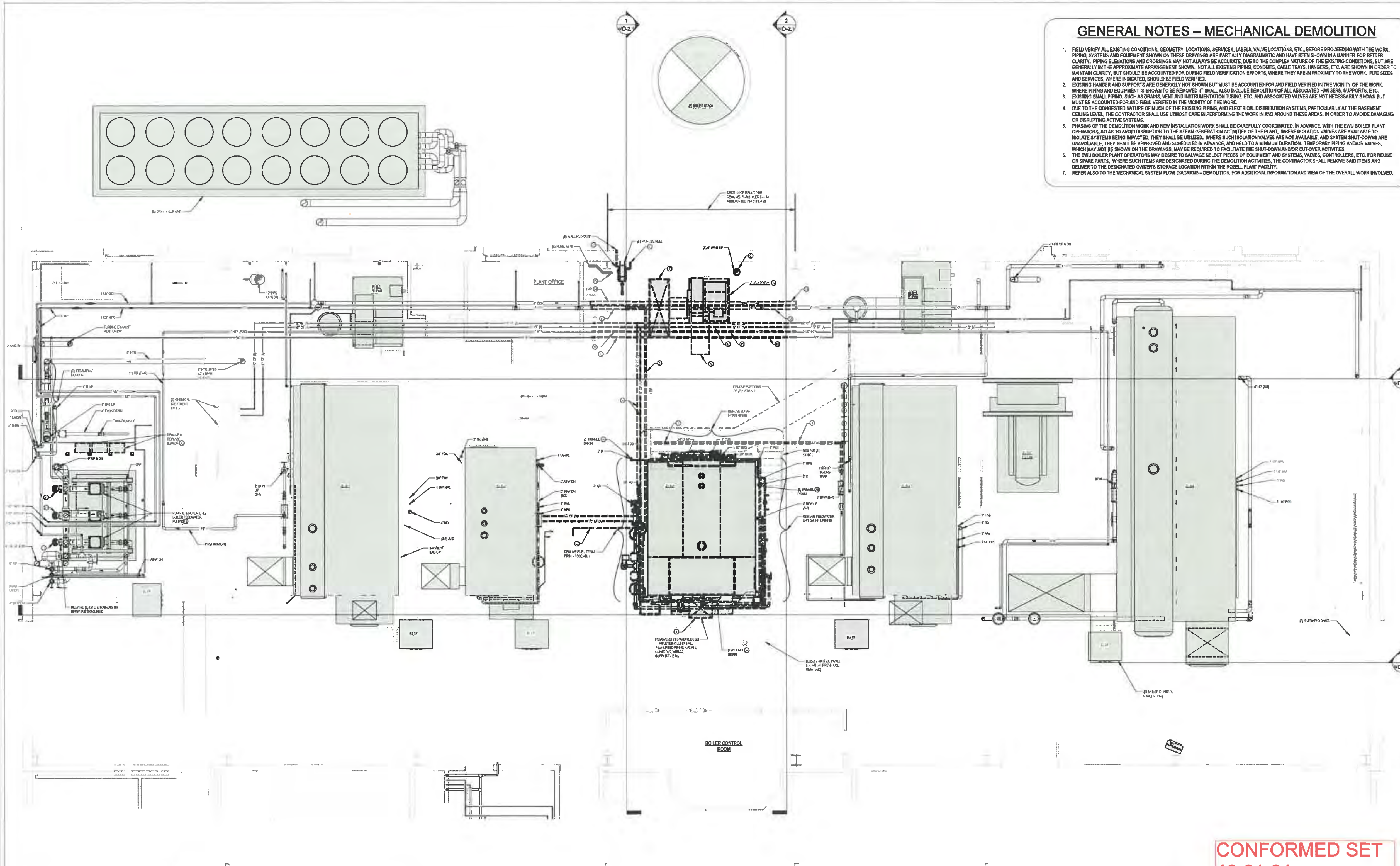
INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

BASEMENT LEVEL - MECHANICAL DEMOLITION

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19,59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

MD-1.1



1 OPERATING LEVEL - MECHANICAL DEMOLITION
SCALE: 1/4" = 1'-0"

GENERAL NOTES – MECHANICAL DEMOLITION

1. FIELD VERIFY ALL EXISTING CONDITIONS, GEOMETRY, LOCATIONS, SERVICES, LABELS, VALVE LOCATIONS, ETC., BEFORE PROCEEDING WITH THE WORK. PIPING, SYSTEMS AND EQUIPMENT SHOWN ON THESE DRAWINGS ARE PARTIALLY DIAGRAMMATIC AND HAVE BEEN SHOWN IN A MANNER FOR BETTER CLARITY. PIPING ELEVATIONS AND CROSSINGS MAY NOT ALWAYS BE ACCURATE, DUE TO THE COMPLEX NATURE OF THE EXISTING CONDITIONS, BUT ARE GENERALLY IN THE APPROXIMATE ARRANGEMENT SHOWN. NOT ALL EXISTING PIPING, CONDUITS, CABLE TRAYS, HANGERS, ETC. ARE SHOWN IN ORDER TO MAINTAIN CLARITY, BUT SHOULD BE ACCOUNTED FOR DURING FIELD VERIFICATION EFFORTS, WHERE THEY ARE IN PROXIMITY TO THE WORK. PIPE SIZES AND SERVICES, WHERE INDICATED, SHOULD BE FIELD VERIFIED.
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4. DUE TO THE CONGESTED NATURE OF MUCH OF THE EXISTING PIPING, AND ELECTRICAL DISTRIBUTION SYSTEMS, PARTICULARILY AT THE BASEMENT CEILING LEVEL, THE CONTRACTOR SHALL USE UTMOST CARE IN PERFORMING THE WORK IN AND AROUND THESE AREAS, IN ORDER TO AVOIDE DAMAGING OR DISRUPTING ACTIVE SYSTEMS.
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7. REFER ALSO TO THE MECHANICAL SYSTEM FLOW DIAGRAMS – DEMOLITION, FOR ADDITIONAL INFORMATION AND VIEW OF THE OVERALL WORK INVOLVED.

CONFORMED SET
12-31-21

KEY NOTES - DEMOLITION

1. REMOVE COMBUSTION AIR DUCT FROM BOTTOM OF BURNER & DOWN THRU FLOOR.
2. REMOVE PORTION OF HTR PIPING FROM B-2 STEAM DRIP TRAP TO CONNECTION AT B-3 PIPING.
3. REMOVE PORTION OF AUXILIARY FEEDWATER PIPING FROM B-2 TO B-4 TIE-IN POINT.
4. REMOVE CHEMICAL FEED PIPING FROM MAIN LINE BRANCH TAP LOCATED BELOW CATWALK TO B-3 CONNECTION.
5. REMOVE HTR PIPING FROM B-3 STEAM DRIP TRAP TO MAIN LINE BRANCH TAP LOCATED BELOW CATWALK.
6. REMOVE COMBUSTION AIR DUCT FROM DISCHARGE OFF OF B-3 F.D. FAN & DOWN THRU FLOOR.
7. REMOVE COMBUSTION AIR INTAKE DUCT ASSEMBLY ON INLET SIDE OF B-3 F.D. FAN.
8. REMOVE B-3 FORCED DRAFT FAN, MOTOR & DRIVE ASSEMBLY, INCLUDING VFD & CONTROLS.
9. REMOVE VERTICAL PORTIONS OF 8" VENT PIPE RISER OFF OF BASEMENT BLOW-DOWN SEPARATOR UP TO GALLERY LEVEL (REROUTE AROUND NEW BOILER ROOM ACCESS WALL OPENING.
10. REMOVE SECTION OF INSTRUMENT AIR SUPPLY PIPING LOCATED BELOW CATWALK, TO PROVIDE ACCESS CLEARANCE FOR REMOVAL AND REINSTALLATION OF BOILERS. REROUTE AS INDICATED ON MECH. PIPING PLAN.
11. REMOVE PORTION OF HTR PIPING (B-5 BFW RECIRC.) LOCATED BELOW CATWALK, TO PROVIDE ACCESS CLEARANCE FOR REMOVAL & REINSTALLATION OF BOILERS. REROUTE AS INDICATED ON MECH. PIPING PLAN.
12. REMOVE PORTION OF CHEMICAL FEED PIPING LOCATED BELOW CATWALK, TO PROVIDE ACCESS CLEARANCE FOR REMOVAL AND REINSTALLATION OF BOILERS. REROUTE AS INDICATED ON MECH. PIPING PLAN.
13. REMOVE PORTION OF HTR PIPING (DRIP TRAP CONDENSATE) LOCATED BELOW CATWALK, TO PROVIDE CLEARANCE FOR REMOVAL AND REINSTALLATION OF BOILERS. REROUTE AS INDICATED ON MECH. PIPING PLAN.
14. REMOVE PORTION OF ABANDONED GCR PIPING LOCATED BELOW CATWALK AND CAP NEAR GRID-D.
15. REMOVE PORTION OF PLUMBING VENT PIPING AND REROUTE TO AVOID CONFLICT WITH NEW WALL OPENING ACCESS PATH.
16. REMOVE COMPRESSED AIR HOSE REEL & PIPING DOWN THRU FLOOR & CAP IN BASEMENT.
17. REMOVE WALL HYDRANT AND PIPING DOWN THRU FLOOR & CAP IN BASEMENT.
18. REMOVE FUNNEL DRAIN AND ALL ASSOCIATED MISC. DRAIN LINES SERVING BOILER B-3.
19. REMOVE EXISTING BOILER FEEDWATER PUMPS AND MOTORS AND REPLACE WITH NEW, LARGER CAPACITY PUMPS. SEE PIPING PLANS.
20. REMOVE EXISTING VFDS THAT FEED THE BOILER FEEDWATER PUMPS AND REPLACE WITH NEW VFDS. REFER TO ELEC. DRAWINGS.
21. REMOVE EXISTING WYE STRAINER ON SUCTION LINE FEEDING BOILER FEEDWATER PUMPS. REPLACE STRAINER WITH FLANGED SPOOL PIECE.

BID SET

No:	Date:	Description:

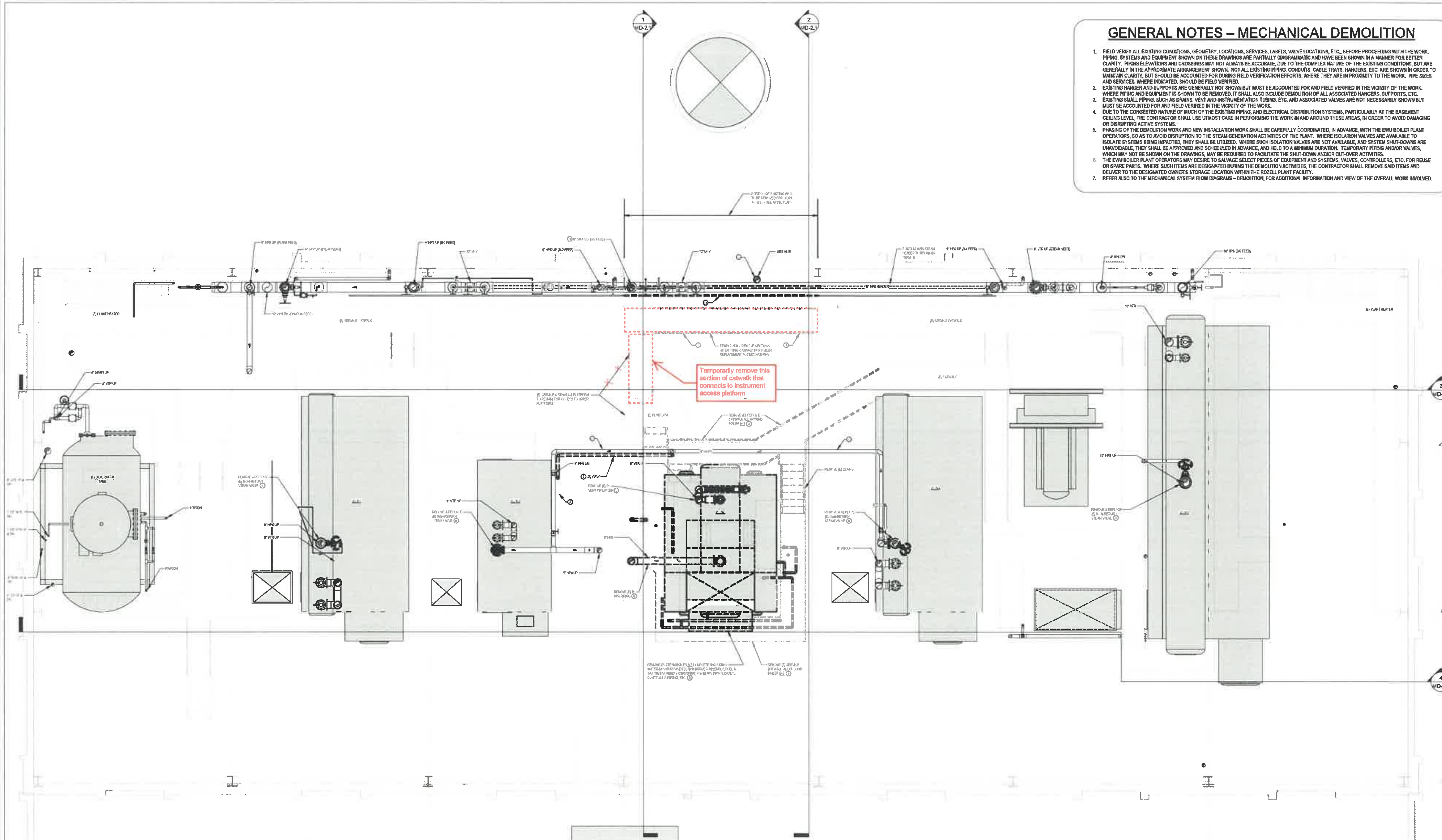
INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

OPERATING LEVEL - MECHANICAL DEMOLITION

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19,59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

MD-1.2



GENERAL NOTES – MECHANICAL DEMOLITION

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3. EXISTING SMALL PIPING, SUCH AS DRAINS, VENT AND INSTRUMENTATION TUBING, ETC. AND ASSOCIATED VALVES ARE NOT NECESSARILY SHOWN BUT MUST BE ACCOUNTED FOR AND FIELD VERIFIED IN THE VICINITY OF THE WORK.
4. DUE TO THE CONGESTED NATURE OF MUCH OF THE EXISTING PIPING, AND ELECTRICAL DISTRIBUTION SYSTEMS, PARTICULARLY AT THE BASEMENT CEILING LEVEL, THE CONTRACTOR SHALL USE UTMOST CARE IN PERFORMING THE WORK IN AND AROUND THESE AREAS, IN ORDER TO AVOID DAMAGING OR DISRUPTING ACTIVE SYSTEMS.
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6. THE EWU BOILER PLANT OPERATORS MAY DESIRE TO SALVAGE SELECT PIECES OF EQUIPMENT AND SYSTEMS, VALVES, CONTROLLERS, ETC. FOR REUSE OR SPARE PARTS. WHERE SUCH ITEMS ARE DESIGNATED DURING THE DEMOLITION ACTIVITIES, THE CONTRACTOR SHALL REMOVE SAID ITEMS AND DELIVER TO THE DESIGNATED OWNER'S STORAGE LOCATION WITHIN THE ROZELL PLANT FACILITY.
7. REFER ALSO TO THE MECHANICAL SYSTEM FLOW DIAGRAMS – DEMOLITION, FOR ADDITIONAL INFORMATION AND VIEW OF THE OVERALL WORK INVOLVED.

1 GALLERY LEVEL - MECHANICAL DEMOLITION
SCALE: 1/4" = 1'-0"

CONFORMED SET
12-31-21

KEY NOTES - DEMOLITION

1. TEMPORARILY REMOVE SECTION OF EXISTING CATWALK AND ASSOCIATED PIPING (HUNG BELOW), CONDUITS, ETC. IN THE PATHWAY OF THE BOILER REMOVAL AND REINSTALLATION ROUTE. RETAIN CATWALK SECTION FOR REINSTALLATION AFTER NEW BOILER HAS BEEN INSTALLED. ALSO, REINSTALL THE CATWALK SECTION TEMPORARILY IN THE TIME PERIOD BETWEEN DEMO OF THE EXISTING BOILER AND INSTALLATION OF THE NEW BOILER, IN ORDER TO MAINTAIN GALLERY LEVEL SERVICE ACCESS.
2. REMOVE PORTION OF 8" VENT PIPING RISER OFF OF BLOW-DOWN TANK IN BASEMENT, AND REMOVE AROUND NEW ACCESS OPENING AS INDICATED.
3. EXISTING FLANGED CAP TIE-IN POINT ON STEAM HEADER FOR B-3 CONNECTION TO BE REMOVED PRIOR TO CONNECTING NEW STEAM LINE.
4. REMOVE ALL EXISTING SERVICE CATWALKS AND STAIRS ASSOCIATED WITH BOILER B-3. REMOVE SUPPORT HANGERS TO UPPER ROOF STRUCTURE.
5. REMOVE (E) 8" HPS PIPING FROM OUTLET OF BOILER B-3 TO TIE-IN POINT AT EXISTING MAIN STEAM HEADER.
6. REMOVE (E) 8" RELIEF VENT PIPE RISER UP THRU ROOF TO TERMINATION POINT. RETAIN ROOF OPENING/FLASHING FOR REUSE WITH NEW BOILER RELIEF VENT PIPING.
7. REMOVE PORTION OF (E) AUXILIARY FEEDWATER PIPING THAT CONNECTS BOILER B-2 TO B-4. SEE MECH. PIPING PLANS FOR REROUTED PIPING.
8. REMOVE EXISTING BOILER NON-RETURN (STOP-CHECK) STEAM VALVE ON OUTLET FROM EACH BOILER AND REPLACE WITH NEW VALVE AS INDICATED ON PIPING PLANS. COORDINATE BOILER SHUT-DOWN & PHASING W/ EWU PLANT OPERATORS.
9. THE REMOVAL OF EXISTING BOILER B-3 IS INTENDED TO BE FACILITATED THRU THE CREATION OF THE NEW WALL OPENING BETWEEN GRIDS D-E ON THE WEST WALL OF THE PLANT, AND UP TO A HEIGHT OF APPROX. 15'-0" AFF, JUST BELOW THE EXISTING MAIN STEAM HEADER (WHICH IS TO REMAIN IN SERVICE). IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE FINAL AMOUNT OF SPACE AVAILABLE FOR REMOVAL OF THE EXISTING BOILER, INCLUDING WORKING CLEARANCES, AND DISASSEMBLE OR CUT-UP PORTIONS OF THE EXISTING BOILER ASSEMBLY AS REQUIRED FOR REMOVAL THRU AVAILABLE SPACE.
10. EXISTING 4" AUXILIARY HPS CROSS-CONNECT BETWEEN B-2 & B-4 TO REMAIN. PROTECT PIPING IN-PLACE AND WORK AROUND PIPING FOR DEMO & NEW WORK.
11. TEMPORARILY REMOVE (E) HPS (WARM-UP) PIPING AT WALL OPENING TO FACILITATE CLEARANCE FOR INSTALLATION WORK. REPLACE & REINSTALL AFTER WORK IS COMPLETE.

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA
GALLERY LEVEL - MECHANICAL DEMOLITION

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19.59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

MD-1.3

GENERAL NOTES – MECHANICAL DEMOLITION

1. FIELD VERIFY ALL EXISTING CONDITIONS, GEOMETRY, LOCATIONS, SERVICES, LABELS, VALVE LOCATIONS, ETC., BEFORE PROCEEDING WITH THE WORK. PIPING, SYSTEMS AND EQUIPMENT SHOWN ON THESE DRAWINGS ARE PARTIALLY DIAGRAMMATIC AND HAVE BEEN SHOWN IN A MANNER FOR BETTER CLARITY. PIPING ELEVATIONS AND CROSSINGS MAY NOT ALWAYS BE ACCURATE, DUE TO THE COMPLEX NATURE OF THE EXISTING CONDITIONS, BUT ARE GENERALLY IN THE APPROXIMATE ARRANGEMENT SHOWN. NOT ALL EXISTING PIPING, CONDUITS, CABLE TRAYS, HANGERS, ETC. ARE SHOWN IN ORDER TO MAINTAIN CLARITY, BUT SHOULD BE ACCOUNTED FOR DURING FIELD VERIFICATION EFFORTS, WHERE THEY ARE IN PROXIMITY TO THE WORK. PIPE SIZES AND SERVICES, WHERE INDICATED, SHOULD BE FIELD VERIFIED.
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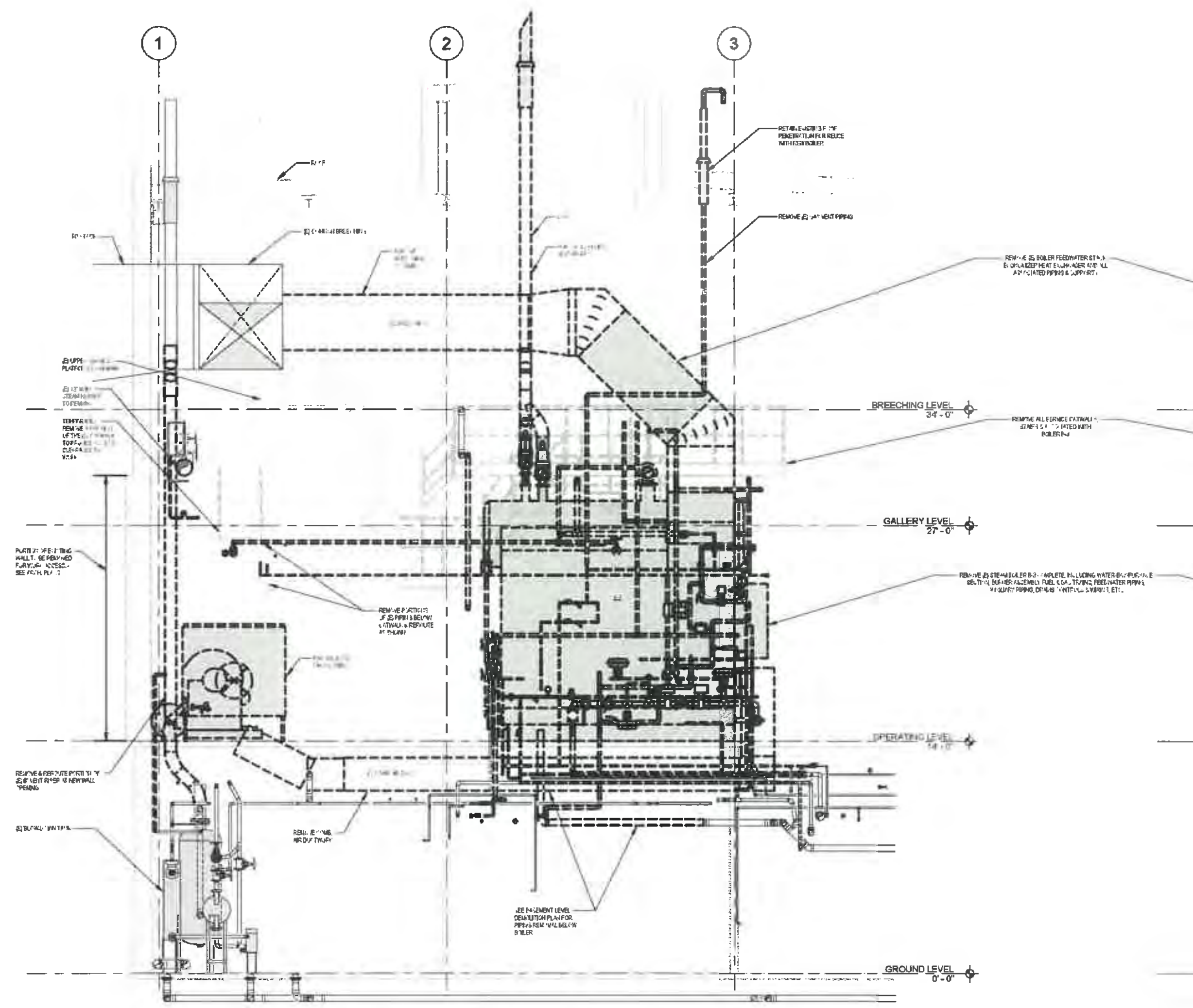
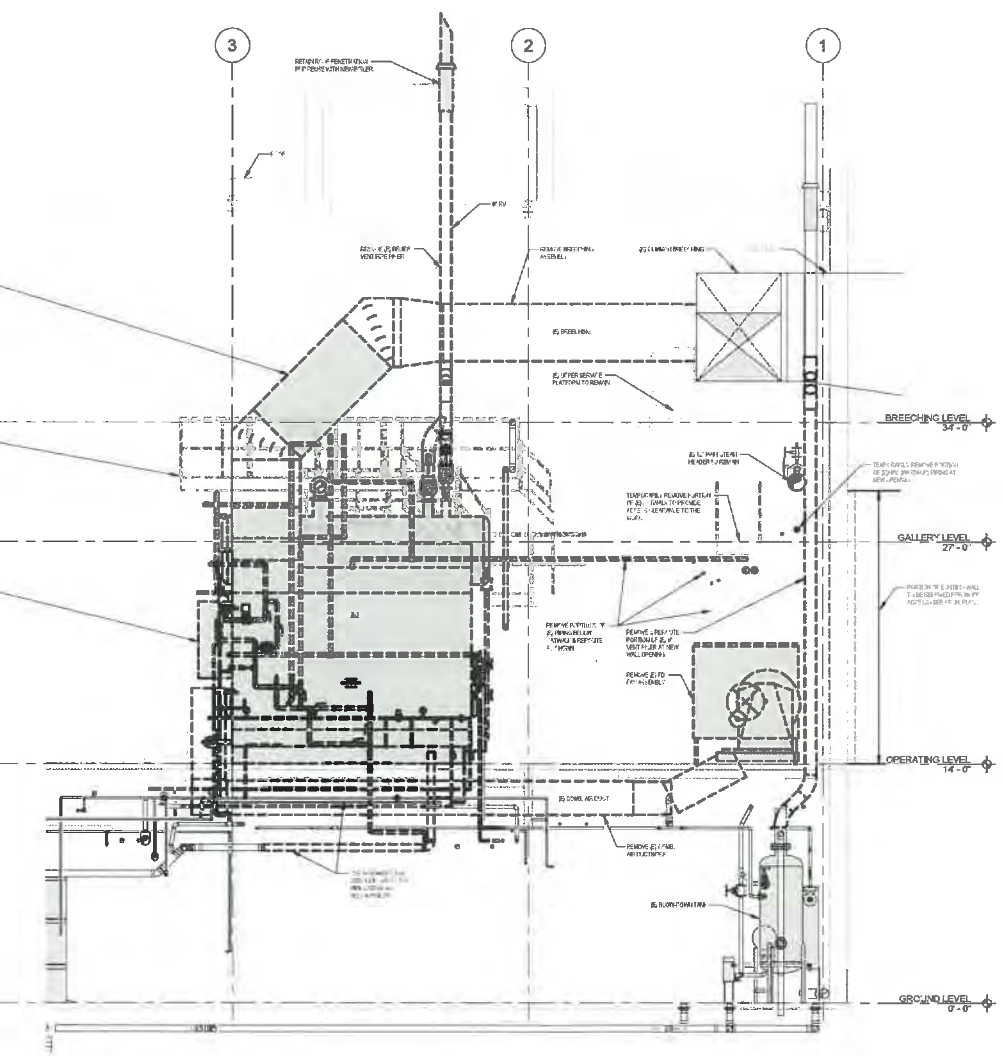
6. THE EWU BOILER PLANT OPERATORS MAY DESIRE TO SALVAGE SELECT PIECES OF EQUIPMENT AND SYSTEMS, VALVES, CONTROLLERS, ETC. FOR REUSE OR SPARE PARTS. WHERE SUCH ITEMS ARE DESIGNATED DURING THE DEMOLITION ACTIVITIES, THE CONTRACTOR SHALL REMOVE SAID ITEMS AND DELIVER TO THE DESIGNATED OWNER'S STORAGE LOCATION WITHIN THE ROZELL PLANT FACILITY.
7. REFER ALSO TO THE MECHANICAL SYSTEM FLOW DIAGRAMS – DEMOLITION, FOR ADDITIONAL INFORMATION AND VIEW OF THE OVERALL WORK INVOLVED.



1 MECHANICAL SECTION DEMOLITION - LH SIDE
SCALE: 1/4" = 1'-0"



2 MECHANICAL SECTION DEMOLITION - RH SIDE
SCALE: 1/4" = 1'-0"

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

SECTIONS - MECHANICAL DEMOLITION

MSI ENGINEERS
www.msi-engineers.com

CONFORMED SET
12-31-21

PROJECT NO:	18.59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

MD-2.1

GENERAL NOTES – MECHANICAL DEMOLITION

1. FIELD VERIFY ALL EXISTING CONDITIONS, GEOMETRY, LOCATIONS, SERVICES, LABELS, VALVE LOCATIONS, ETC., BEFORE PROCEEDING WITH THE WORK. PIPING, SYSTEMS AND EQUIPMENT SHOWN ON THESE DRAWINGS ARE PARTIALLY DIAGRAMMATIC AND HAVE BEEN SHOWN IN A MANNER FOR BETTER CLARITY. PIPING ELEVATIONS AND CROSSINGS MAY NOT ALWAYS BE ACCURATE, DUE TO THE COMPLEX NATURE OF THE EXISTING CONDITIONS, BUT ARE GENERALLY IN THE APPROXIMATE ARRANGEMENT SHOWN. NOT ALL EXISTING PIPING, CONDUITS, CABLE TRAYS, HANGERS, ETC. ARE SHOWN IN ORDER TO MAINTAIN CLARITY, BUT SHOULD BE ACCOUNTED FOR DURING FIELD VERIFICATION EFFORTS, WHERE THEY ARE IN PROXIMITY TO THE WORK. PIPE SIZES AND SERVICES, WHERE INDICATED, SHOULD BE FIELD VERIFIED.
2. EXISTING HANGER AND SUPPORTS ARE GENERALLY NOT SHOWN BUT MUST BE ACCOUNTED FOR AND FIELD VERIFIED IN THE VICINITY OF THE WORK. WHERE PIPING AND EQUIPMENT IS SHOWN TO BE REMOVED, IT SHALL ALSO INCLUDE DEMOLITION OF ALL ASSOCIATED HANGERS, SUPPORTS, ETC.
3. EXISTING SMALL PIPING, SUCH AS DRAINS, VENT AND INSTRUMENTATION TUBING, ETC. AND ASSOCIATED VALVES ARE NOT NECESSARILY SHOWN BUT MUST BE ACCOUNTED FOR AND FIELD VERIFIED IN THE VICINITY OF THE WORK.
4. DUE TO THE CONGESTED NATURE OF MUCH OF THE EXISTING PIPING, AND ELECTRICAL DISTRIBUTION SYSTEMS, PARTICULARILY AT THE BASEMENT CEILING LEVEL, THE CONTRACTOR SHALL USE UTMOST CARE IN PERFORMING THE WORK IN AND AROUND THESE AREAS, IN ORDER TO AVOIDE DAMAGING OR DISRUPTING ACTIVE SYSTEMS.
5. PHASING OF THE DEMOLITION WORK AND NEW INSTALLATION WORK SHALL BE CAREFULLY COORDINATED, IN ADVANCE, WITH THE EWU BOILER PLANT OPERATORS, SO AS TO AVOID DISRUPTION TO THE STEAM GENERATION ACTIVITIES OF THE PLANT. WHERE ISOLATION VALVES ARE AVAILABLE TO ISOLATE SYSTEMS BEING IMPACTED, THEY SHALL BE UTILIZED. WHERE SUCH ISOLATION VALVES ARE NOT AVAILABLE, AND SYSTEM SHUT-DOWNS ARE UNAVOIDABLE, THEY SHALL BE APPROVED AND SCHEDULED IN ADVANCE, AND HELD TO A MINIMUM DURATION. TEMPORARY PIPING AND/OR VALVES, WHICH MAY NOT BE SHOWN ON THE DRAWINGS, MAY BE REQUIRED TO FACILITATE THE SHUT-DOWN AND/OR CUT-OVER ACTIVITIES.
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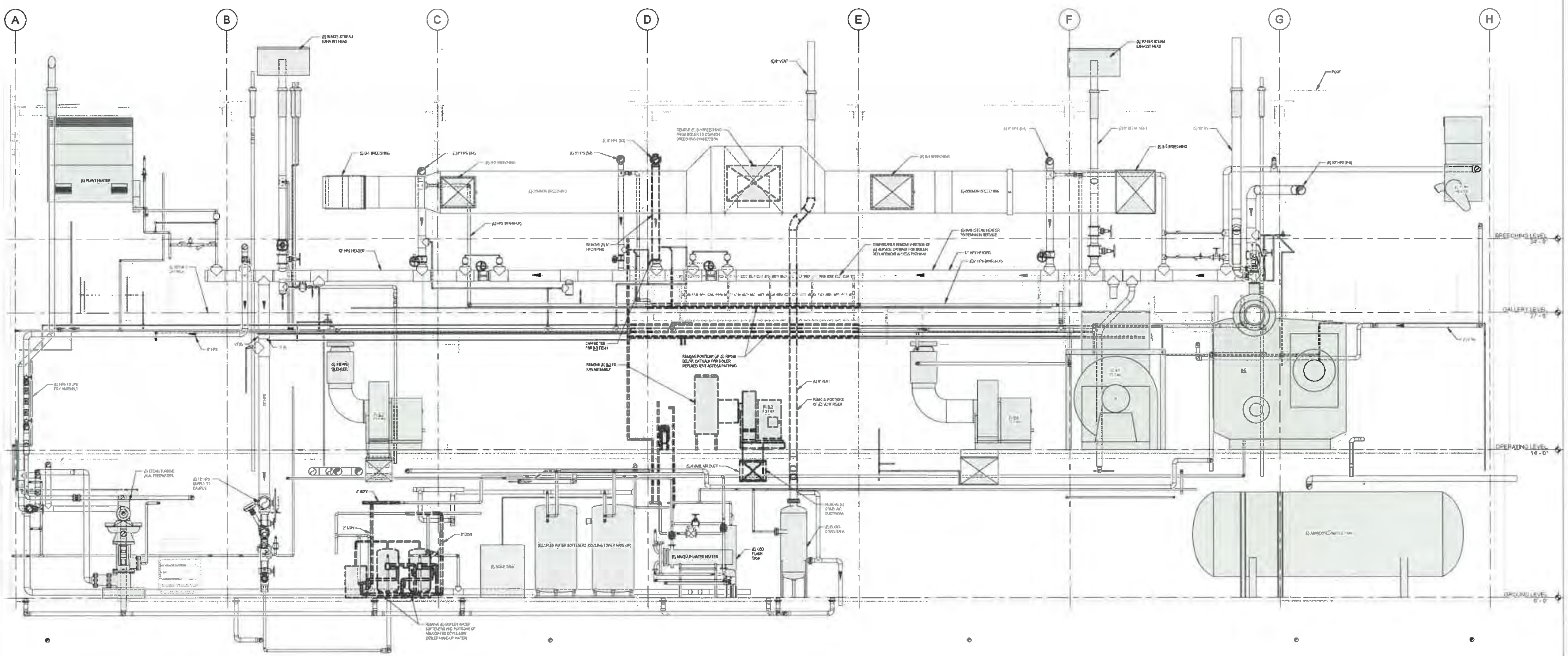

3 **MECHANICAL SECTION DEMOLITION - PLANT WEST WALL**
SCALE: 1/4" = 1'-0"

CONFORMED SET
12-31-21

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

SECTIONS - MECHANICAL DEMOLITION

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19.59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	08/27/21

MD-2.2

GENERAL NOTES – MECHANICAL DEMOLITION

1. FIELD VERIFY ALL EXISTING CONDITIONS, GEOMETRY, LOCATIONS, SERVICES, LABELS, VALVE LOCATIONS, ETC., BEFORE PROCEEDING WITH THE WORK. PIPING, SYSTEMS AND EQUIPMENT SHOWN ON THESE DRAWINGS ARE PARTIALLY DIAGRAMMATIC AND HAVE BEEN SHOWN IN A MANNER FOR BETTER CLARITY. PIPING ELEVATIONS AND CROSSINGS MAY NOT ALWAYS BE ACCURATE, DUE TO THE COMPLEX NATURE OF THE EXISTING CONDITIONS, BUT ARE GENERALLY IN THE APPROXIMATE ARRANGEMENT SHOWN. NOT ALL EXISTING PIPING, CONDUITS, CABLE TRAYS, HANGERS, ETC. ARE SHOWN IN ORDER TO MAINTAIN CLARITY, BUT SHOULD BE ACCOUNTED FOR DURING FIELD VERIFICATION EFFORTS, WHERE THEY ARE IN PROXIMITY TO THE WORK. PIPE SIZES AND SERVICES, WHERE INDICATED, SHOULD BE FIELD VERIFIED.
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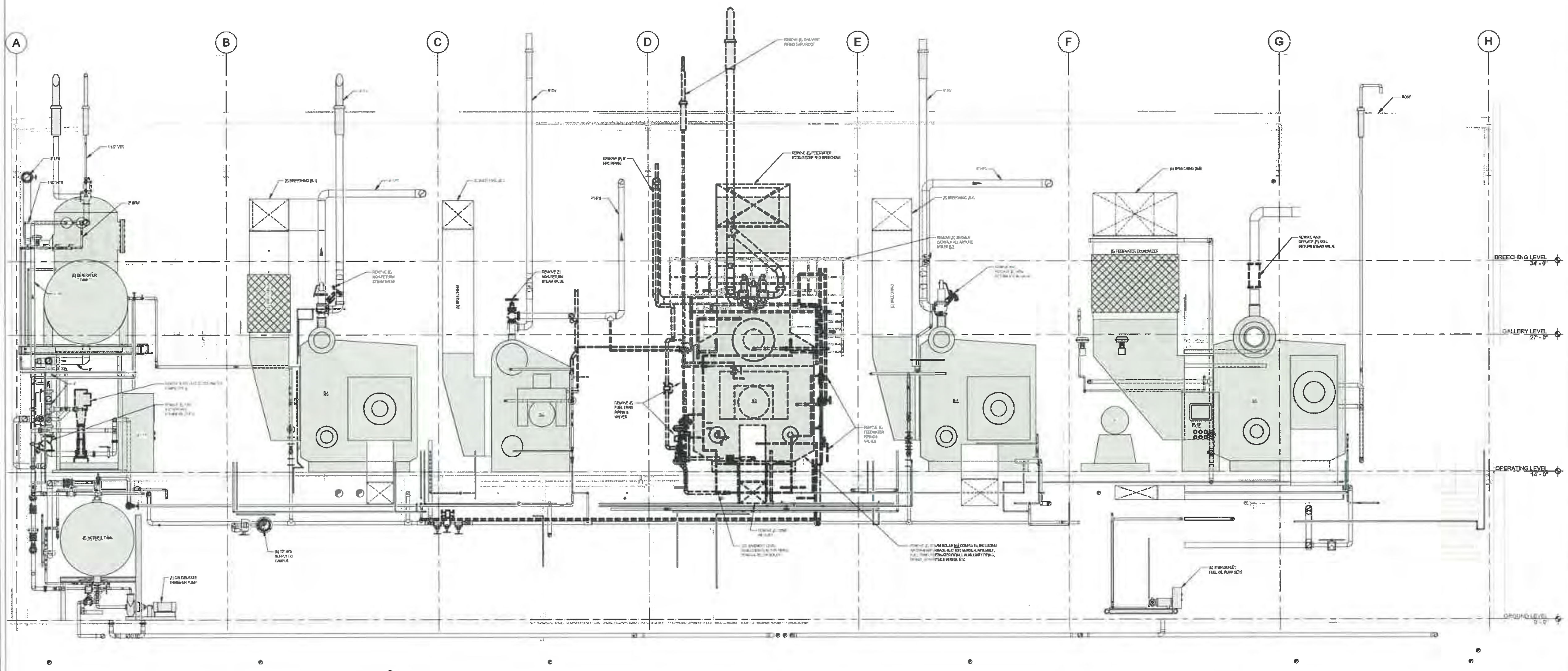

4 **MECHANICAL SECTION DEMOLITION - BOILER FRONT VIEW**
SCALE: 1/4" = 1'-0"

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

SECTIONS - MECHANICAL DEMOLITION

MSI ENGINEERS
www.msi-engineers.com

CONFORMED SET
12-31-21

PROJECT NO:	19.59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	08/27/21

MD-2.3

GENERAL NOTES – MECHANICAL PIPING (NEW WORK)

1. FIELD VERIFY ALL EXISTING CONDITIONS, GEOMETRY, LOCATIONS, SERVICES, LABELS, VALVE LOCATIONS, ETC., BEFORE PROCEEDING WITH THE WORK. PIPING, SYSTEMS AND EQUIPMENT SHOWN ON THESE DRAWINGS ARE PARTIALLY DIAGRAMMATIC AND HAVE BEEN SHOWN IN A MANNER FOR BETTER CLARITY. PIPING ELEVATIONS AND CROSSINGS MAY NOT ALWAYS BE ACCURATE, DUE TO THE COMPLEX NATURE OF THE EXISTING CONDITIONS, BUT ARE GENERALLY IN THE APPROXIMATE ARRANGEMENT SHOWN. NOT ALL EXISTING PIPING, CONDUITS, CABLE TRAYS, HANGERS, ETC. ARE SHOWN IN ORDER TO MAINTAIN CLARITY, BUT SHOULD BE ACCOUNTED FOR DURING FIELD VERIFICATION EFFORTS, WHERE THEY ARE IN PROXIMITY TO THE WORK. PIPE SIZES AND SERVICES, WHERE INDICATED, SHOULD BE FIELD VERIFIED.
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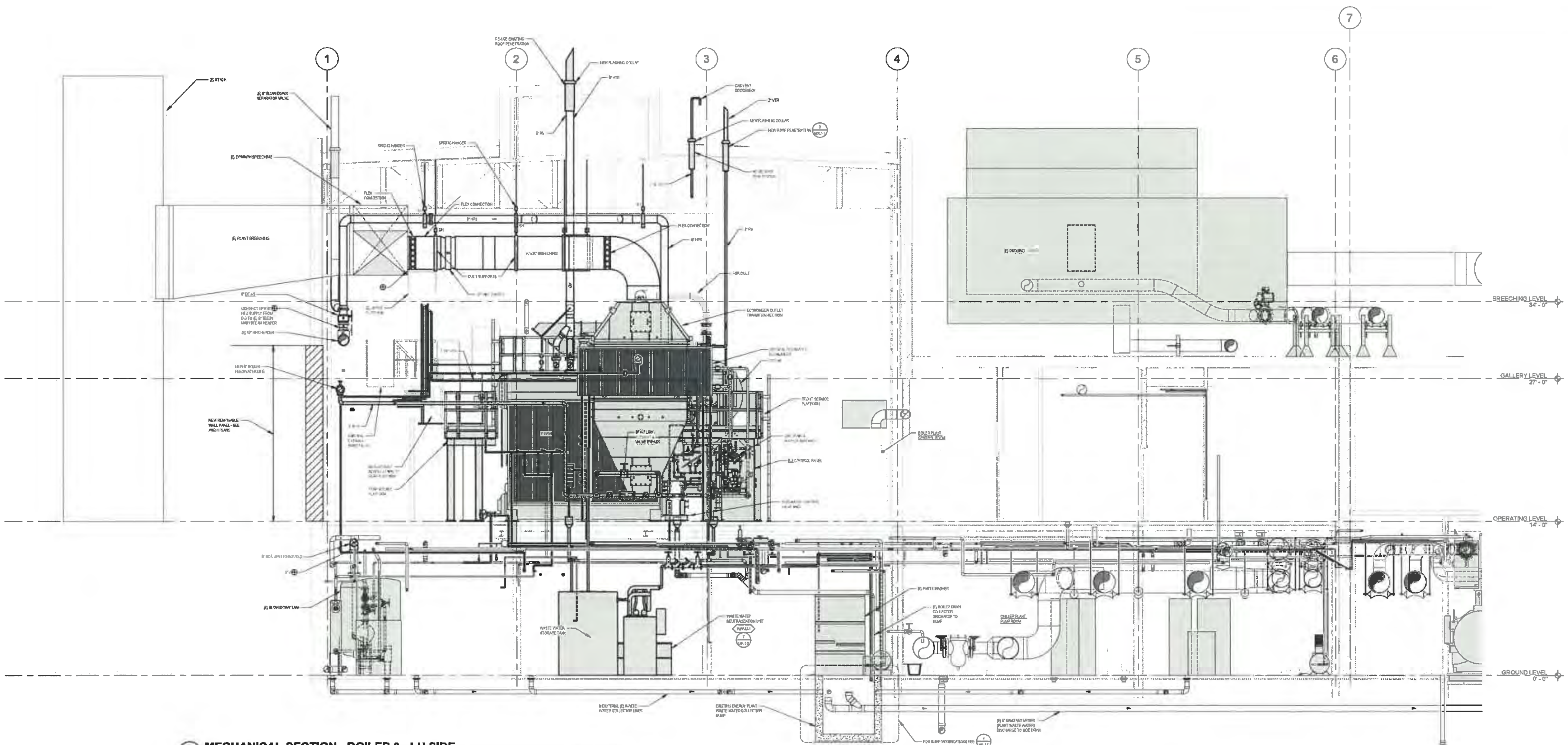

1 **MECHANICAL SECTION - BOILER 3 - LH SIDE**
SCALE: 1/4" = 1'-0"

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA
SECTIONS - MECHANICAL PIPING

MSI ENGINEERS
www.msi-engineers.com

CONFORMED SET
12-31-21

PROJECT NO:	19.59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

MP-2.1

GENERAL NOTES – MECHANICAL PIPING (NEW WORK)

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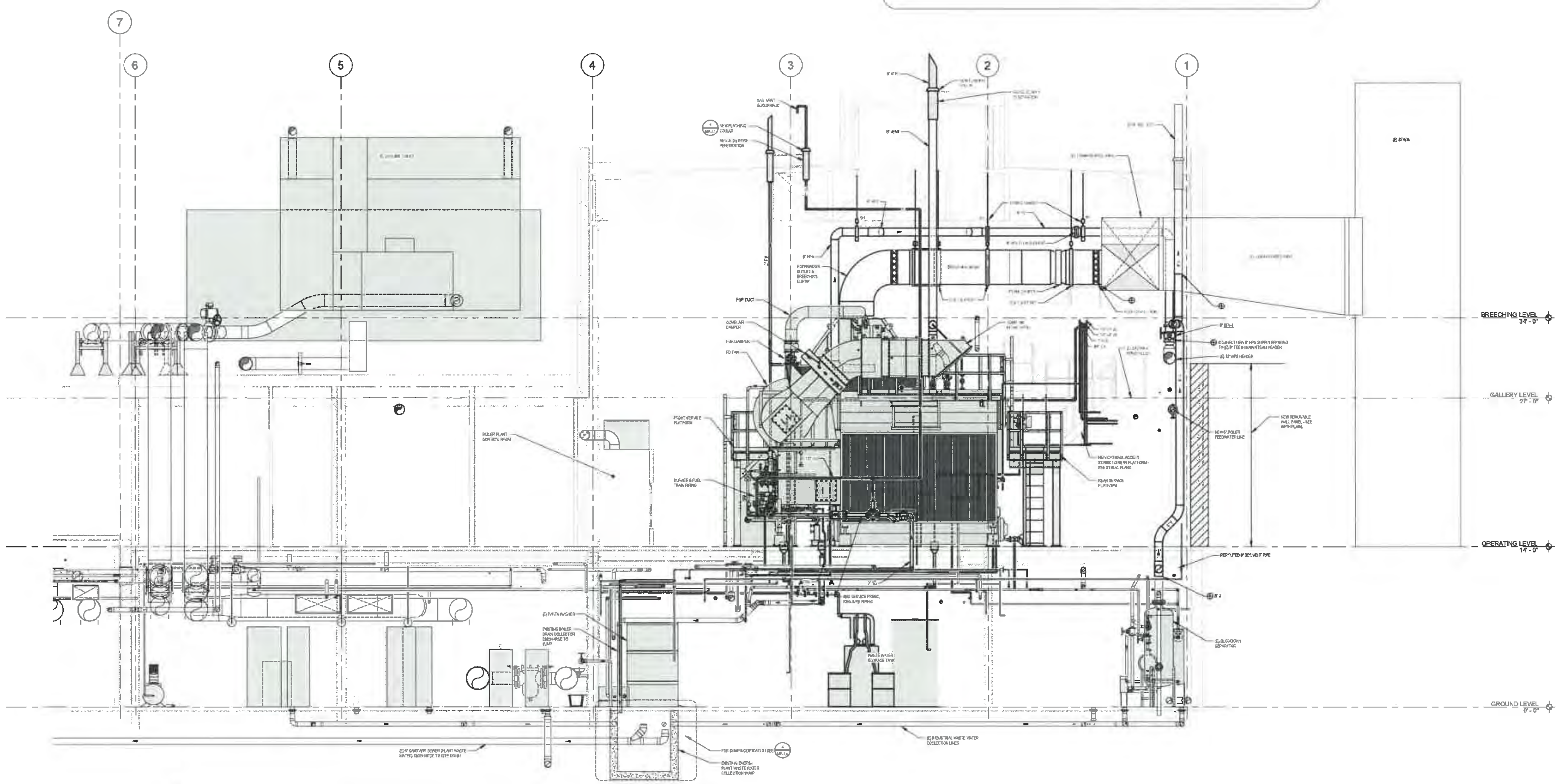

2 MECHANICAL SECTION - BOILER 3 - RH SIDE
SCALE: 1/4" = 1'-0"

CONFORMED SET
12-31-21

BID SET

No: | Date: | Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA
SECTIONS - MECHANICAL PIPING

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19.59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

MP-2.2

GENERAL NOTES – MECHANICAL PIPING (NEW WORK)

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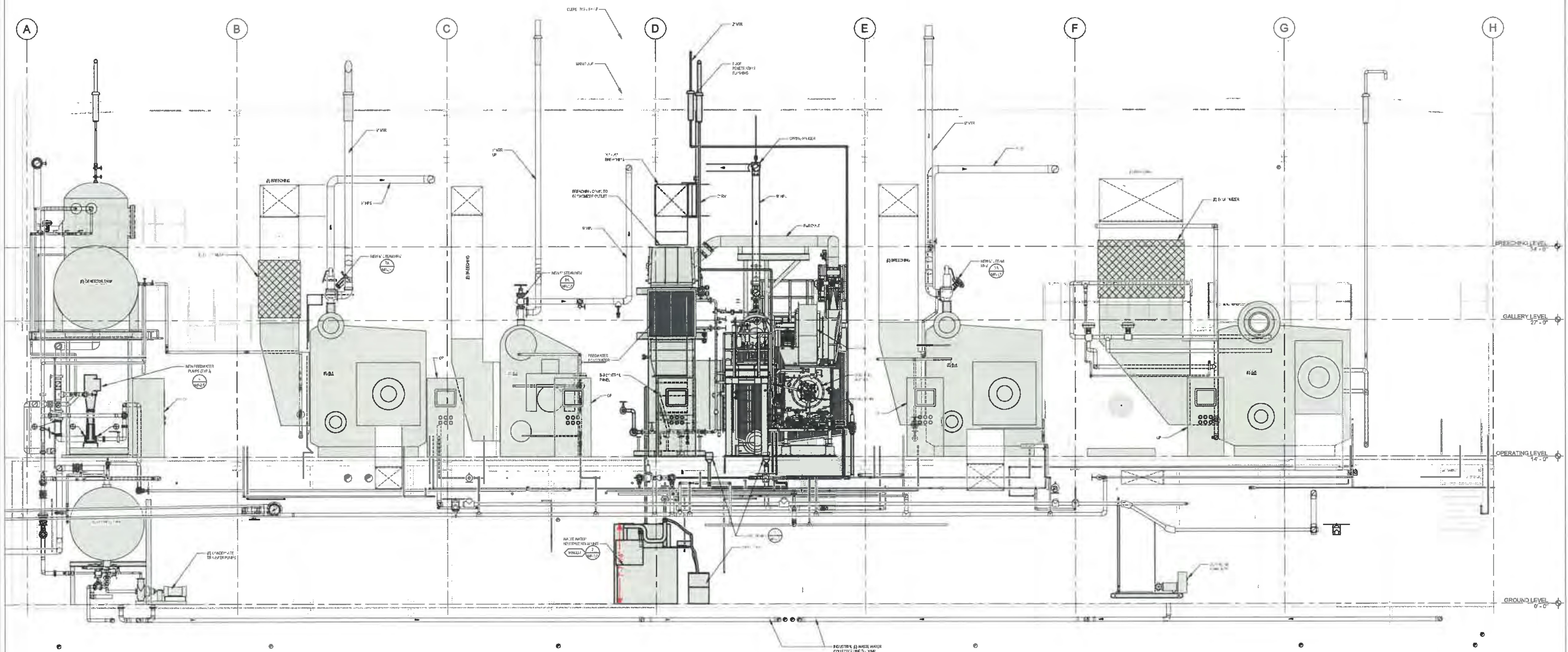


3 **MECHANICAL SECTIONS - BOILERS FRONT VIEW**
SCALE: 1/4" = 1'-0"

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

SECTIONS - MECHANICAL PIPING

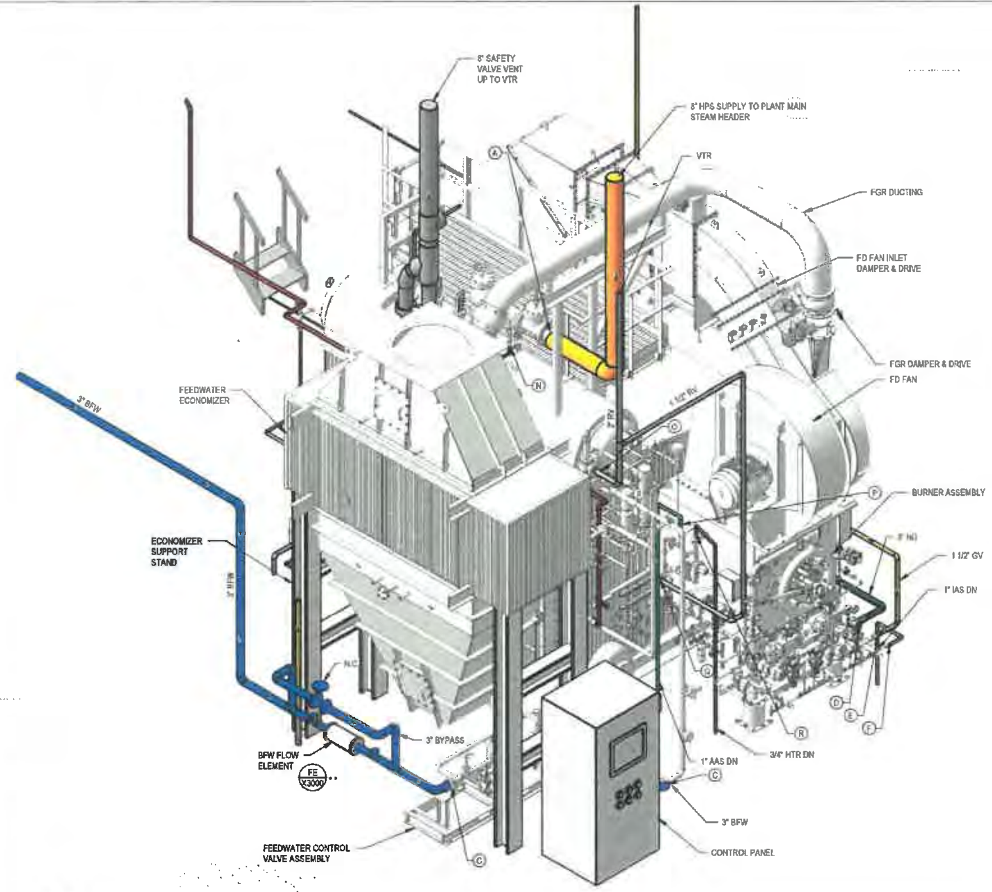
MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19.59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

CONFORMED SET
12-31-21

MP-2.3


CleaverBrooks



1 BOILER PIPING - ISOMETRIC VIEW - 1
SCALE:

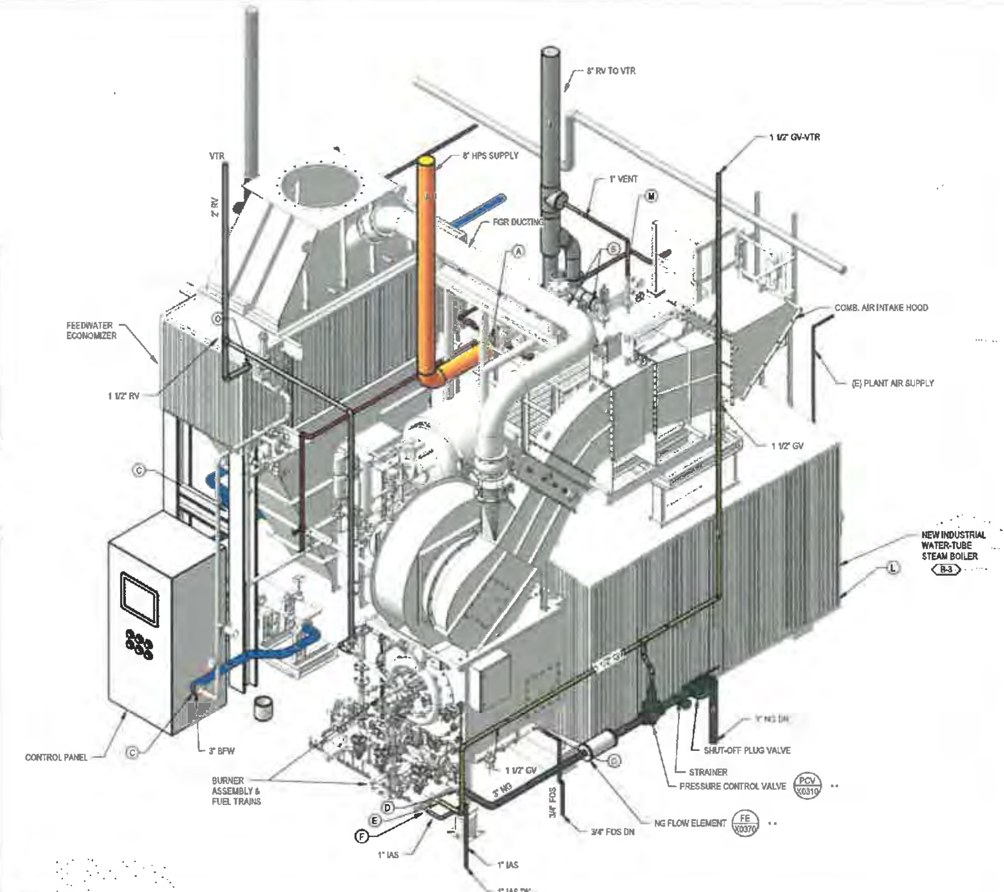
GENERAL NOTES:

1. FRONT & REAR SERVICE/ ACCESS PLATFORMS NOT SHOWN FOR CLARITY, BUT MUST BE PROVIDED.
2. BOILER EXHAUST BREECHING NOT SHOWN FOR CLARITY.
3. BOILER DRAIN PIPING FROM LEVEL CONTROL DEVICES, INSTRUMENTATION, VENTS, DRIP-PAN ELBOWS, ETC. ARE NOT SHOWN FOR CLARITY BUT MUST BE PROVIDED. RUN TO NEAREST FUNNEL DRAIN RECEIVER. REFER ALSO TO P & ID DIAGRAMS.
4. UNLESS INDICATED OTHERWISE, ALL PIPING, VALVES, DEVICES, ETC., LOCATED ON THE BOILER SIDE OF THE CONNECTION POINTS SHALL BE PROVIDED BY THE BOILER MANUFACTURER.
5. INSTRUMENTATION DEVICES (FLOW ELEMENTS), CONTROL VALVES, ETC. INDICATED BY "**" NOTATION ARE PROVIDED BY THE BOILER MANUFACTURER FOR INSTALLATION IN THE FIELD BY THE INSTALLING CONTRACTOR.

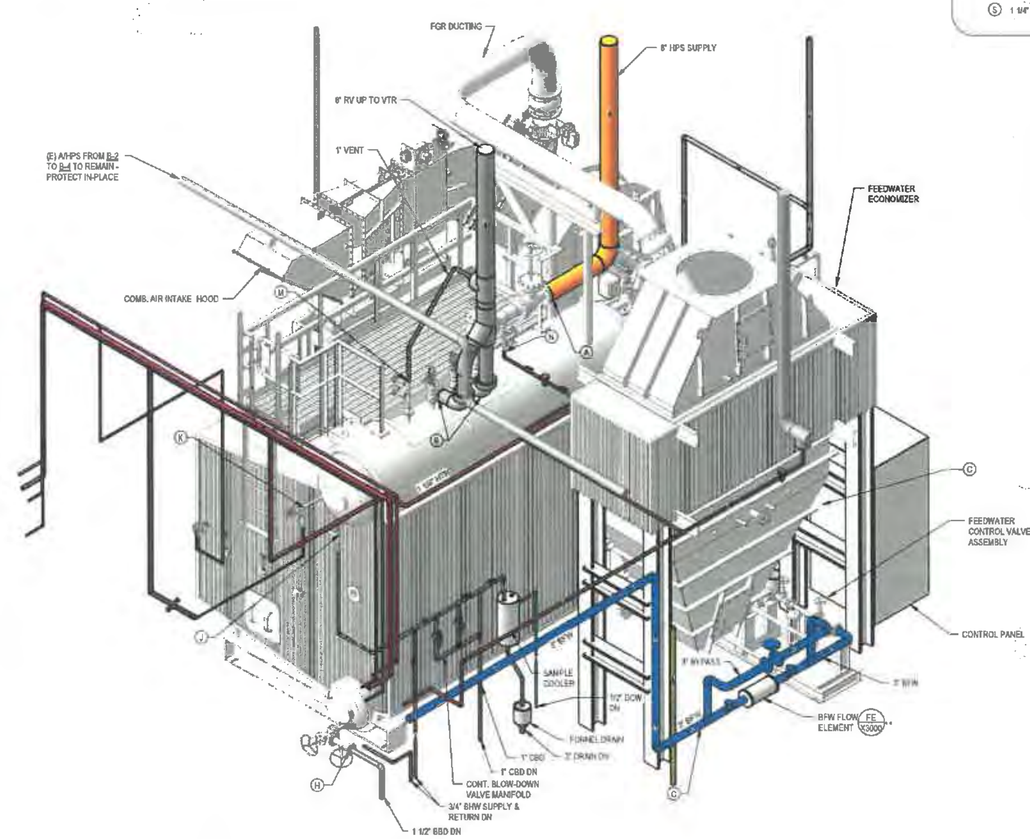
BOILER PIPING CONNECTION KEY

GENERAL: BOILER PIPING CONNECTION POINTS, SIZES AND SERVICES ARE BASED ON CLEAVER-BROOKS PRELIMINARY INSTALLATION DRAWINGS. VERIFY WITH ACTUAL PRODUCTION VERSION SHOP DRAWINGS AND P & ID DIAGRAMS.

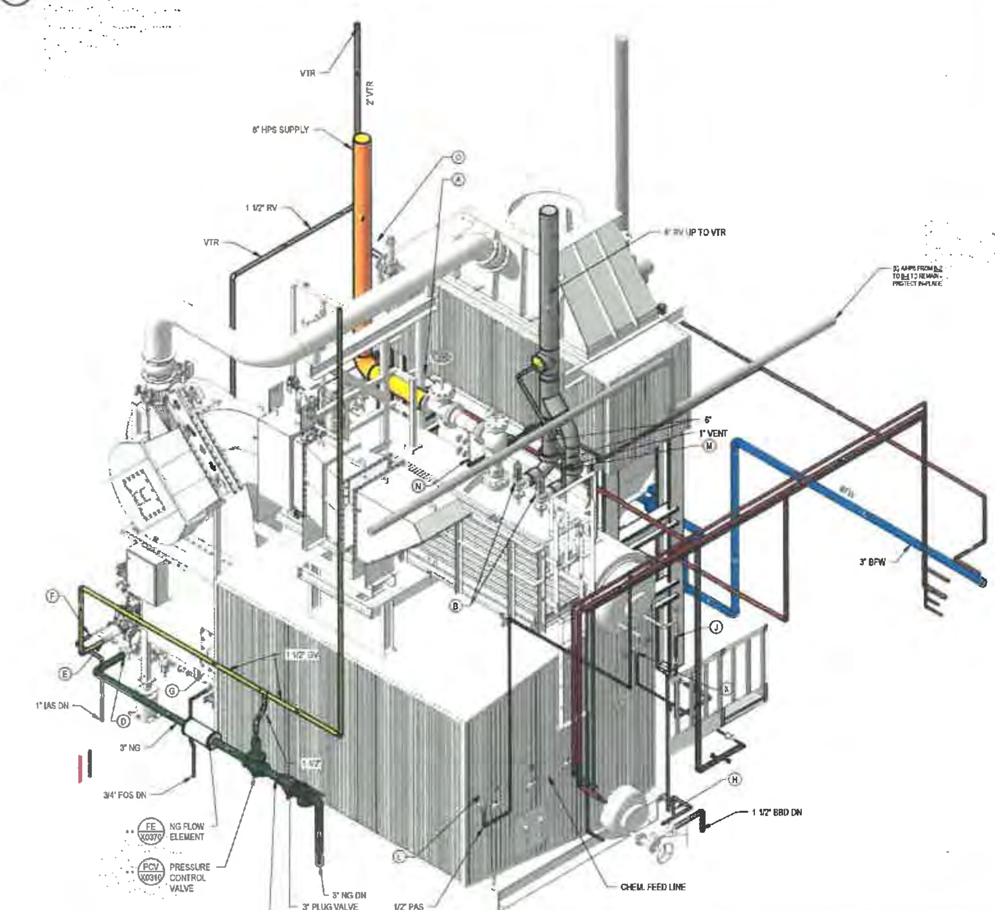
- (A) 8" HIGH PRESSURE STEAM (HPS) BOILER OUTLET CONNECTION
- (B) 4" SAFETY VALVE OUTLETS (2 EACH) WITH 4" x 6" DRIP PAN ELBOWS CONNECTIONS
- (C) 3" BOILER FEEDWATER (BFW) CONNECTION TO FW CONTROL VALVE & BOILER FEED RISER.
- (D) 3" NATURAL GAS (NG) SERVICE CONNECTION TO GAS TRAIN.
- (E) 1 1/2" GAS VENT (GV) CONNECTION TO GAS TRAIN.
- (F) 1" INSTRUMENT AIR SUPPLY (IAS) CONNECTION TO IAS DIST. MANIFOLD.
- (G) 3/4" FUEL OIL SUPPLY (FOS) CONNECTION TO FUEL OIL TRAIN.
- (H) 1 1/2" BOTTOM BLOW-DOWN (BBD) CONNECTION TO LOUVER DRUM.
- (I) NOT USED.
- (J) 1" CONTINUOUS (SURFACE) BLOW-DOWN (CBD) CONNECTION TO UPPER STEAM DRUM.
- (K) 1/2" CHEMICAL FEED (CF) CONNECTION TO UPPER STEAM DRUM.
- (L) 1/2" PLANT AIR SUPPLY (PAS) CONNECTION TO FIRE-BOX VIEW PORTS. *
- (M) 1" BOILER VENT OUTLET CONNECTION WITH 1" VENT TIE-IN TO RELIEF VENT RISER.
- (N) 3/4" HIGH TEMP. (CONDENSATE) RETURN (HTR) CONNECTION TO STEAM OUTLET SPOOL PIECE BETWEEN NON-RETURN VALVE AND ISOLATION VALVE.
- (O) 2" (VERIFY) ECONOMIZER SAFETY VALVE VENT CONNECTION.
- (P) 1" ATOMIZING AIR SUPPLY (AAS) CONNECTION.
- (Q) 1 1/2" (VERIFY) ATOMIZING STEAM SUPPLY SAFETY VALVE VENT CONNECTION.
- (R) 3/4" HIGH TEMP. RETURN (CONDENSATE) DRIP CONNECTION TO ATOM. STEAM HEADER.
- (S) 1 1/4" HTR - FEEDWATER RECIRC. (WARM-UP LINE)



2 BOILER PIPING - ISOMETRIC VIEW - 2
SCALE:



3 BOILER PIPING - ISOMETRIC VIEW - 3
SCALE:



4 BOILER PIPING - ISOMETRIC VIEW - 4
SCALE:

CONFORMED SET
12-31-21

BID SET

No:	Date:	Description:

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

BOILER 3 - ISOMETRIC VIEWS

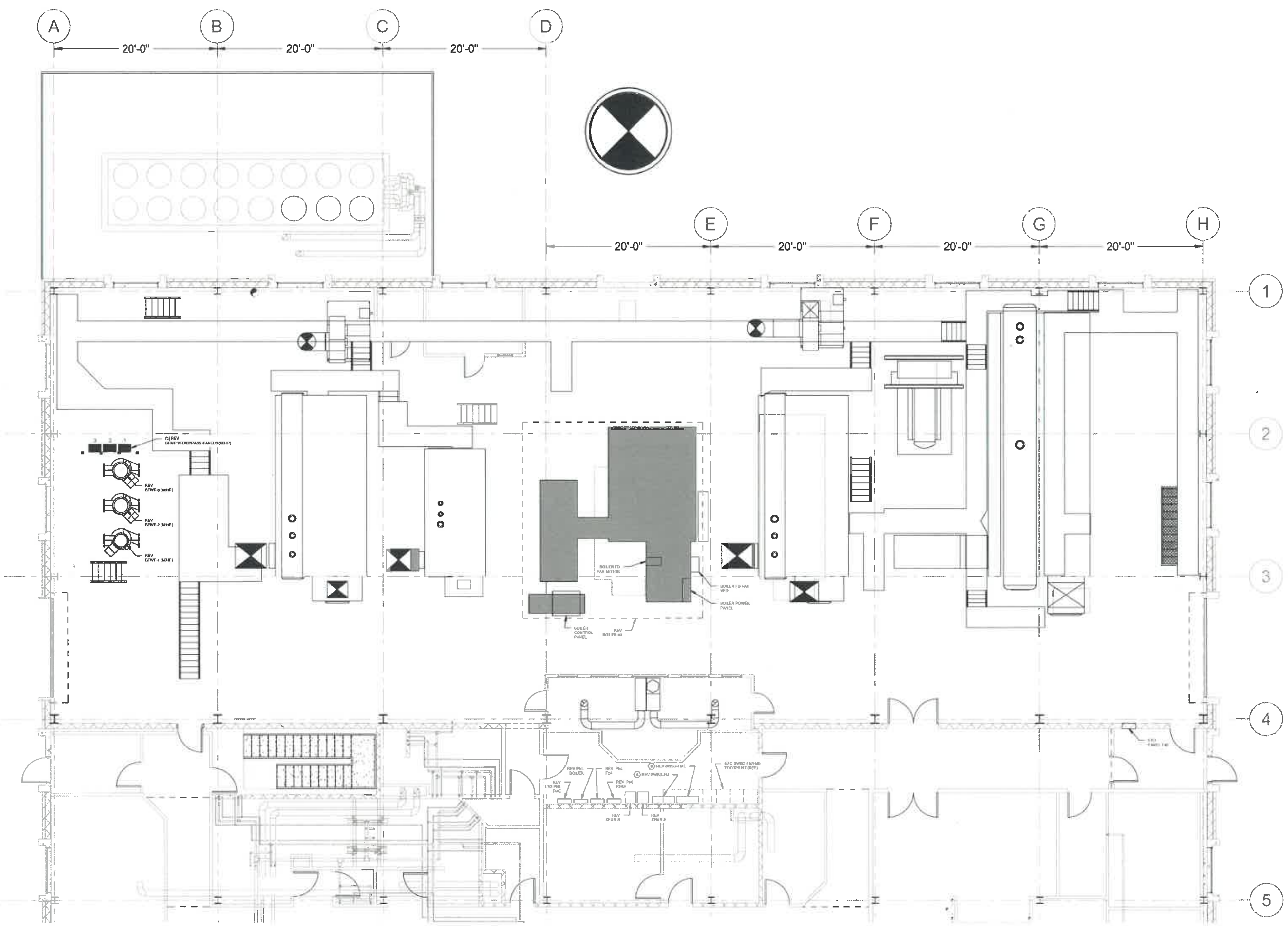
MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19.59
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	03/27/21

MP-3.0

LEGEND:

ITEM NUMBER OF MIGRATION SEQUENCE SHEETS E-3.5 TO E-3.7



OPERATING LEVEL FLOOR PLAN - POWER

3/16" = 1'-0"

CONFORMED SET
12-31-21

ISSUED FOR CONSTRUCTION

CONSTRUCTION SET

No:	Date:	Description:
0	4-12-21	ISSUED FOR CONSTRUCTION

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

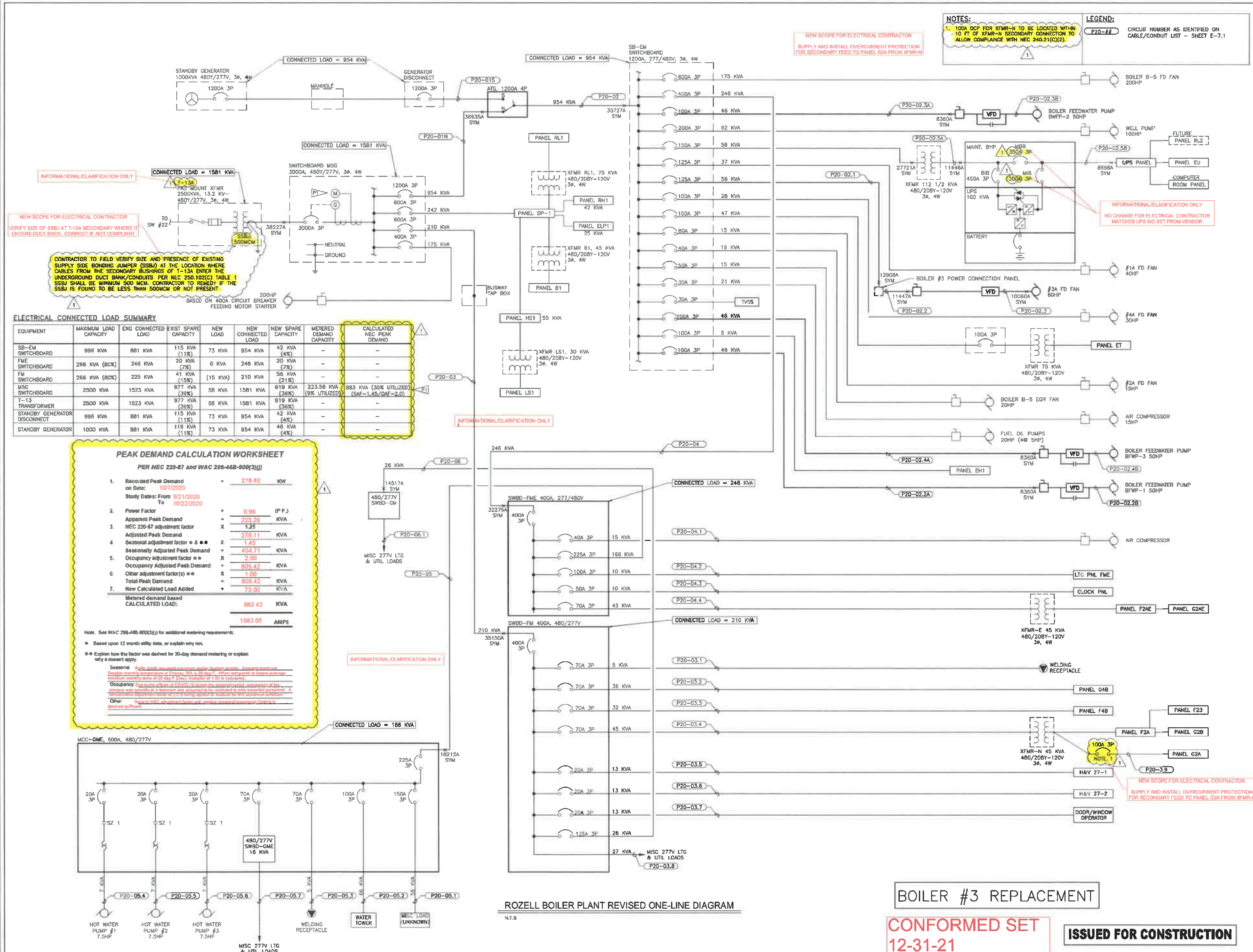
OPERATING LEVEL - ELECTRICAL
POWER

KESTREL ENGINEERING GROUP

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19-59
DRAWN BY:	SDB
CHECKED BY:	JCL
DATE:	3-10-2021

E-3.4



ELECTRICAL CONNECTED LOAD SUMMARY

EQUIPMENT	MAXIMUM LOAD CAPACITY	EXG CONNECTED LOAD	EXIST SPARE CAPACITY	NEW LOAD	NEW CONNECTED LOAD	NEW SPARE CAPACITY	METERED DEMAND CAPACITY	CALCULATED NEC PEAK DEMAND
SB-EM SWITCHBOARD	996 KVA	881 KVA	115 KVA (11%)	73 KVA	954 KVA	42 KVA (4%)	–	–
FME SWITCHBOARD	266 KVA (80%)	246 KVA	20 KVA (7%)	0 KVA	246 KVA	20 KVA (7%)	–	–
FM SWITCHBOARD	266 KVA (80%)	225 KVA	41 KVA (15%)	(15 KVA)	210 KVA	56 KVA (21%)	–	–
MSG SWITCHBOARD	2500 KVA	1523 KVA	977 KVA (39%)	58 KVA	1581 KVA	919 KVA (36%)	223.58 KVA (9% UTILIZED)	883 KVA (35% UTILIZED) (SAF=1.45/OAF=2.0)
T-13 TRANSFORMER	2500 KVA	1523 KVA	977 KVA (39%)	58 KVA	1581 KVA	919 KVA (36%)	–	–
STANDBY GENERATOR DISCONNECT	996 KVA	881 KVA	115 KVA (11%)	73 KVA	954 KVA	42 KVA (4%)	–	–
STANDBY GENERATOR	1000 KVA	881 KVA	119 KVA (11%)	73 KVA	954 KVA	46 KVA (4%)	–	–

PEAK DEMAND CALCULATION WORKSHEET

PER NEC 220-87 and WAC 296-46B-900(3)(j)

1.	Recorded Peak Demand on Date: 10/7/2020; Study Dates: From 9/21/2020 To 10/22/2020	=	218.82	KW
2.	Power Factor	÷	0.98	(P.F.)
	Apparent Peak Demand	=	223.29	KVA
3.	NEC 220-87 adjustment factor	X	1.25	
	Adjusted Peak Demand		279.11	KVA
4.	Seasonal adjustment factor ● & ●●	X	1.45	
	Seasonally Adjusted Peak Demand	=	404.71	KVA
5.	Occupancy adjustment factor ●●	X	2.00	
	Occupancy Adjusted Peak Demand	=	809.42	KVA
6.	Other adjustment factor(s) ●●	X	1.00	
	Total Peak Demand	=	809.42	KVA
7.	New Calculated Load Added	+	73.00	KVA
	Metered demand based CALCULATED LOAD:		882.42	KVA
			1083.05	AMPS

Note. See WAC 296-46B-900(3)(j) for additional metering requirements.

● Based upon 12 month utility data, or explain why not.

●● Explain how the factor was derived for 30-day demand metering or explain why it doesn't apply.

Seasonal: Boiler loads assumed maximum during heating season. Average minimum October monthly temperature in Cheney, WA is 29 deg F. When compared to lowest average minimum monthly temp of 20 deg F (Dec), multiplier of 1.45 is calculated.

Occupancy: Due to the effects of COVID-19 during the metered period, occupancy of the campus was typically at a minimum and assumed to be restricted to only essential personnel. A conservative adjustment factor of 2.0 is being applied to account for this abnormal condition.

Other: General NEC adjustment factor with applied seasonal/occupancy factors is deemed sufficient.

ROZELL BOILER PLANT REVISED ONE-LINE DIAGRAM

N.T.S.

BOILER #3 REPLACEMENT

CONFORMED SET
12-31-21

ISSUED FOR CONSTRUCTION

CONSTRUCTION SET

No:	Date:	Description:
0	4-12-21	ISSUED FOR CONSTRUCTION
1	5-6-21	ISSUED FOR CONSTRUCTION

KESTREL ENGINEERING GROUP

PROJECT NO. 20-026

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA
ELECTRICAL
REVISED BOILER PLANT ONE LINE

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19-59
DRAWN BY:	SDB
CHECKED BY:	JCL
DATE:	3-10-2021

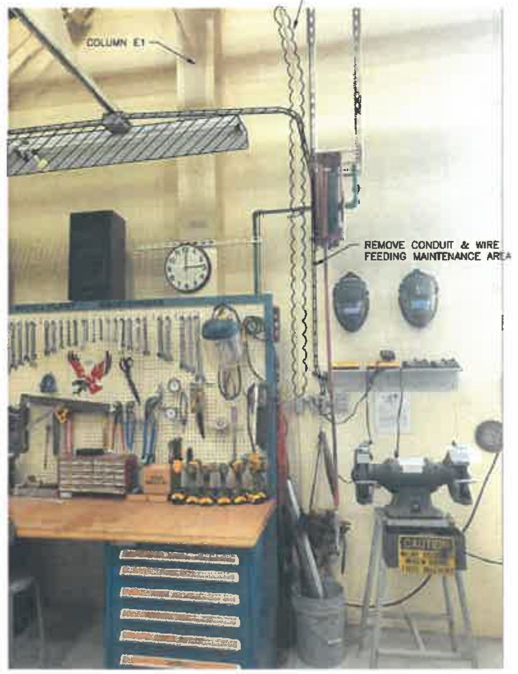
E-6.3

LEGEND:

DEMOLITION WORK

RELOCATED WORK

RELOCATE ELECTRICAL CONDUITS FEEDING CATWALK UP AND OVER WALL REMOVAL AREA. REFERENCE MECHANICAL DRAWINGS FOR EXTENT OF WALL REMOVAL.



DETAIL - OPERATING LEVEL
COLUMN D1 TO E1 - DEMOLTION
N.T.S.

RELOCATE ELECTRICAL CONDUITS ON CATWALK UP AND OVER WALL REMOVAL. REFERENCE MECHANICAL DRAWINGS FOR EXTENT OF WALL REMOVAL.

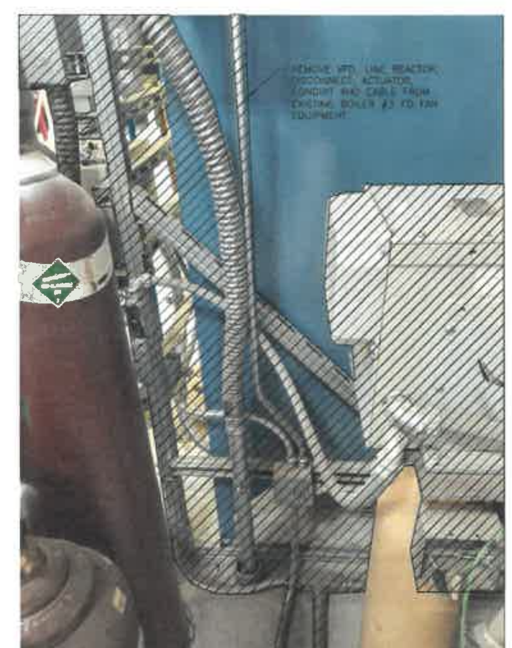
DETAIL - OPERATING LEVEL
COLUMN D1 TO E1 - DEMOLTION
N.T.S.

RELOCATE ELECTRICAL CONDUIT UP AND OVER WALL REMOVAL AREA. MAINTAIN CONTINUITY OF FIRE ALARM CIRCUIT DURING CONSTRUCTION. REFERENCE MECHANICAL DRAWINGS FOR EXTENT OF WALL REMOVAL.

DETAIL - OPERATING LEVEL
COLUMN D1 TO E1 - DEMOLTION
N.T.S.

DETAIL - OPERATING LEVEL
COLUMN D1 TO E1 - DEMOLTION
N.T.S.

DETAIL - OPERATING LEVEL
COLUMN D1 TO E1 - DEMOLTION
N.T.S.



DETAIL - OPERATING LEVEL
COLUMN D1 TO E1 - DEMOLTION
N.T.S.

REMOVE CONTROL/UTILITY CONDUIT DROPS TO #3 BOILER FD FAN. RELOCATE UP AND OVER WALL REMOVAL AREA AS REQUIRED. REFER TO MECHANICAL DRAWINGS FOR EXTENT OF WALL REMOVAL.

LOCATE EXISTING CONTROL POWER FEED FOR BOILER #3. INSTALL JUNCTION BOX OUTSIDE OF WALL REMOVAL AREA AND PROVIDE CONDUIT/CABLE CONTINUATION TO NEW BOILER #3 CONTROL PANEL.

DETAIL - OPERATING LEVEL
COLUMN D1 TO E1 - DEMOLTION
N.T.S.

CONFORMED SET
12-31-21

ISSUED FOR CONSTRUCTION

JANELLE C. LEE
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER

KESTREL ENGINEERING GROUP
www.KestrelEngGroup.com
PROJECT NO: 20-028

CONSTRUCTION SET

No:	Date:	Description:
0	4-12-21	ISSUED FOR CONSTRUCTION

INSTALL NEW BOILER
ROZELL CENTRAL ENERGY PLANT
EASTERN WASHINGTON UNIVERSITY - CHENEY, WA

ELECTRICAL
DEMOLITION/RELOCATION

MSI ENGINEERS
www.msi-engineers.com

PROJECT NO:	19-58
DRAWN BY:	SDB
CHECKED BY:	JCL
DATE:	2-23-2021

E-7.3

APPENDIX D2

EASTERN WASHINGTON UNIVERSITY
MEDIUM VOLTAGE UPGRADE (CP1057)

526 5th St, Cheney, WA 99004

LOCATION PLAN
12" = 1'-0"

-PROJECT DESCRIPTION-

REFER TO DIVISION 01 SECIFICATIONS FOR PROJECT DESCRIPTION.

-GENERAL-

G0.1 COVER SHEET

-CIVIL-

C1 - EROSION AND SEDIMENT CONTROL PLAN
C2 - PLAN AND PROFILE CEDAR STREET
C3 - PLAN AND PROFILE 11TH STREET
C4 - DETAILS - CIVIL
C5 - TRAFFICE CONTROL PLAN

-STRUCTURAL-

S1 - RETAINING WALL PLAN AND DETAILS

-ELECTRICAL-

E0.1 - LEGENDS & ABBREVIATIONS
E1.1 - OVERALL - SITE PLAN - ELECTRICAL
E1.2 - PARITAL SITE PLAN - PROJECT AREA - ELECTRICAL - EXISTING
E1.3 - PARTIAL SITE PLAN - PROJECT AREA - ELECTRICAL - NEW
E4.1 - ENLARGED PLANS - ELECTRICAL
E5.1 - DETAILS - ELECTRICAL
E5.2 - DETAILS - ELECTRICAL
E5.3 - DETAILS - ELECTRICAL
E5.4 - DETAILS - ELECTRICAL
E5.5 - DETAILS - ELECTRICAL
E8.1 - PARTIAL ONE LINE DIAGRAM - ELECTRICAL
E8.2 - PARTIAL ONE LINE DIAGRAM - ELECTRICAL
E8.3 - PARTIAL ONE LINE DIAGRAM - ELECTRICAL

MW Engineers

EWU MEDIUM VOLTAGE UPGRADE

DATE

REVISIONS

COVER SHEET

DWN BY: Author
CHK BY: Checker
SCALE: AS NOTED
DATE: 10/15/2021

G0.1

BID SET

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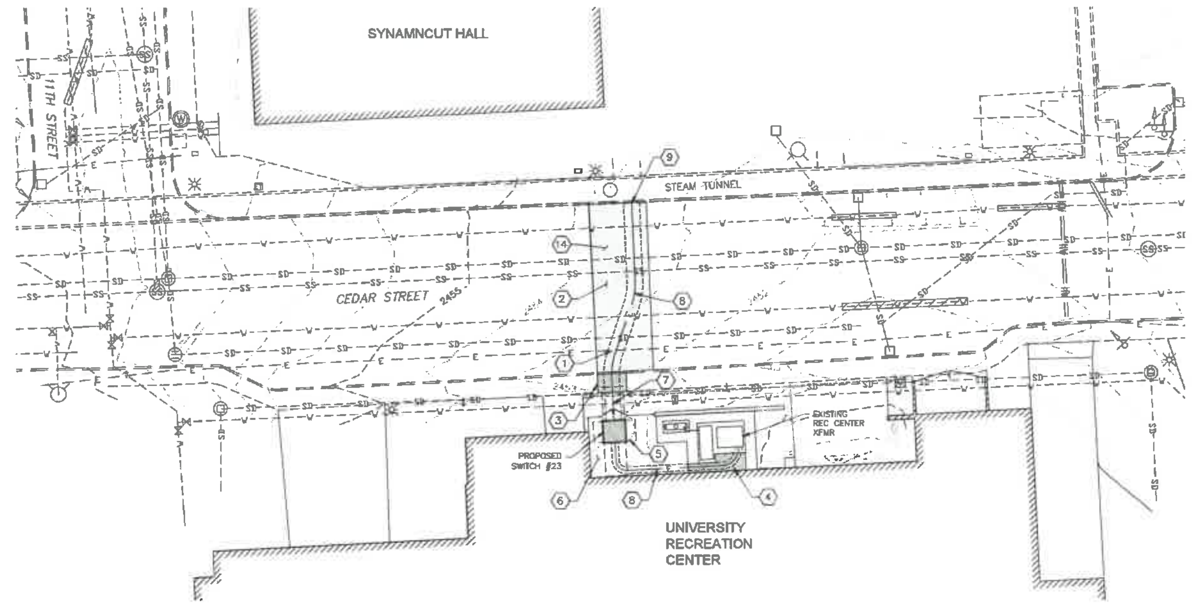
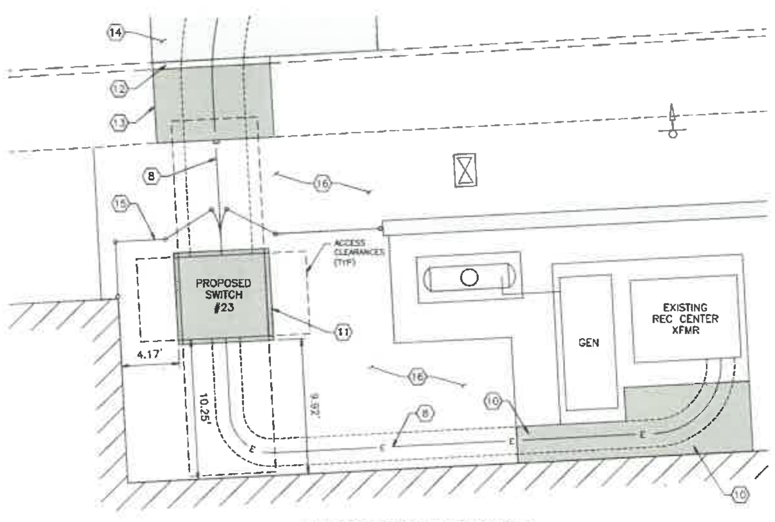


GENERAL NOTE

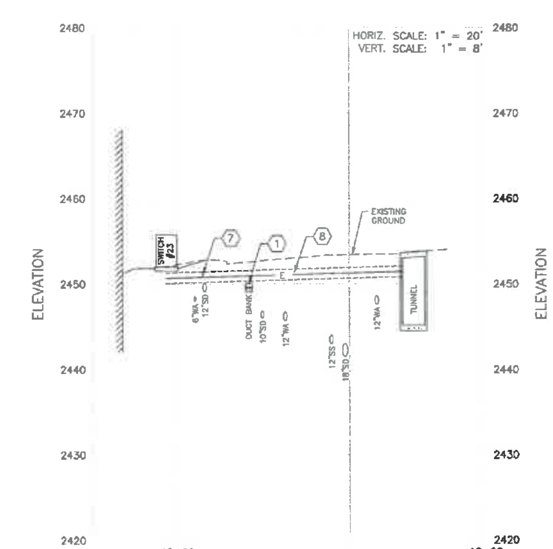
CONTRACTOR SHALL OBTAIN A RIGHT-OF-WAY PERMIT FROM THE CITY OF CHENEY PUBLIC WORKS DEPARTMENT PRIOR TO ANY WORK WITHIN THE CITY RIGHT-OF-WAY.

CONSTRUCTION NOTES

1. POTHOLE EXISTING POWER DUCTBANK TO DETERMINE DEPTH. NOTIFY ENGINEER IF DEPTH TO TOP OF DUCT BANK IS LESS THAN 30 INCHES.
2. REMOVE PAVEMENT TO LIMITS SHOWN. PAVEMENT DAMAGE OUTSIDE OF LIMITS SHOWN SHALL BE REPLACED AT CONTRACTOR'S EXPENSE.
3. SAWCUT AND REMOVE EXISTING SIDEWALK AT FULL PANEL JOINTS TO ALLOW FOR ELECTRICAL DUCT BANK CONSTRUCTION.
4. SAWCUT AND REMOVE EXISTING CONCRETE PAD TO ALLOW FOR ELECTRICAL DUCT BANK CONSTRUCTION.
5. REMOVE EXISTING TREE, SHRUBS AND LANDSCAPING.
6. REMOVE DRIP IRRIGATION LINES WITHIN LIMITS OF SWITCH YARD. CAP AND/OR RECONNECT LINES TO MAINTAIN OPERATION OUTSIDE OF LIMITS OF SWITCH YARD PER SPECIFICATION 328400.
7. LOWER EXISTING IRRIGATION MAIN UNDER PROPOSED DUCT BANK.
8. PROPOSED POWER DUCTBANK. ARRANGE CONDUITS IN SINGLE LEVEL TO LIMIT HEIGHT OF DUCTBANK. SEE SHEET E1.3 FOR NUMBER OF CONDUITS REQUIRED AT EACH LOCATION AND DETAIL 2 ON SHEET E5.1 FOR DUCTBANK CONSTRUCTION REQUIREMENTS. SEE DETAIL 1 ON SHEET C4 FOR TRENCH BACKFILL REQUIREMENTS.
9. SEE ELECTRICAL PLANS FOR CONTINUATION OF CONDUITS IN STEAM TUNNEL.
10. 6" CONCRETE SLAB ON 6" CSTC PER DETAIL 4 ON SHEET C4.
11. 8" CONCRETE EQUIPMENT PAD ON 6" CSTC PER DETAIL 4 ON SHEET C4.
12. CURB TYPE 'A' ON 4" OF CSBC. SEE CITY OF CHENEY STANDARD PLAN A-2 FOR CONSTRUCTION DETAILS.
13. 6" CONCRETE SIDEWALK PER DETAIL 3 ON SHEET C4. MATCH EXISTING SIDEWALK ELEVATIONS.
14. 4" OF 1/2" HMA PG 64-28 (2" LIFTS MAX), ON 6" CSTC PER DETAIL 2 ON SHEET C4. REPLACE PAVEMENT MARKINGS AS REQUIRED.
15. 6 FOOT HIGH CHAIN LINK FENCE ENCLOSURE. PROVIDE 8 FOOT WIDE GATE CENTERED ON SWITCH COMPARTMENT ACCESS DOORS.
16. 3" OF 5/8" BASALT CHIPS WITHIN LIMITS OF SWITCH YARD AND BETWEEN SWITCH YARD AND SIDEWALK.



SWITCH YARD DETAIL
1 INCH = 5 FEET
1



UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

N

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 inch = 20 ft.

TD&H Engineering

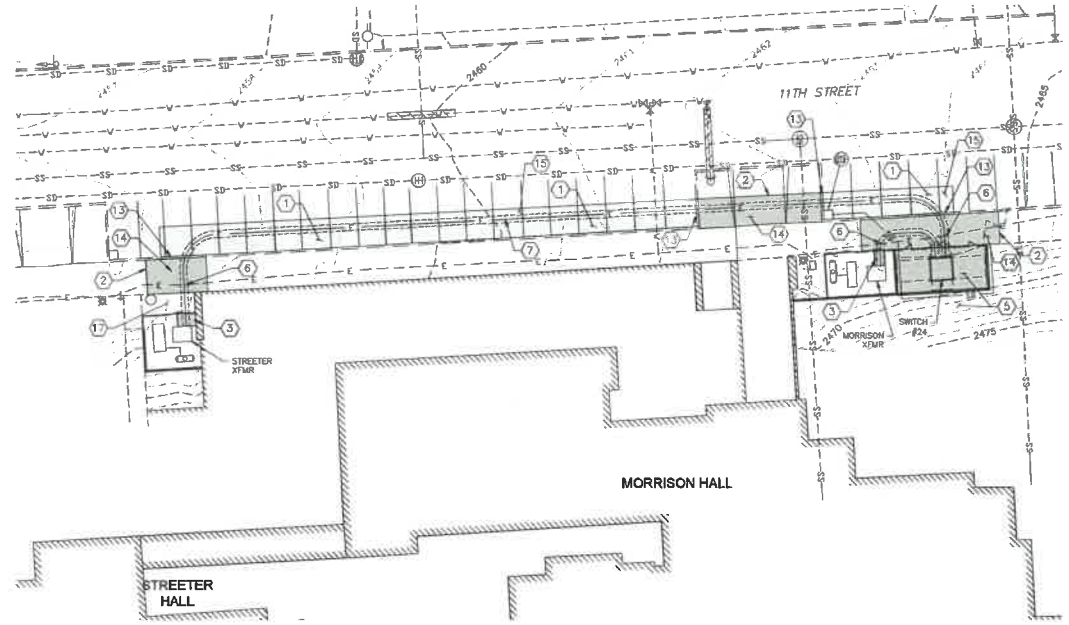
EWU MEDIUM VOLTAGE UPGRADE

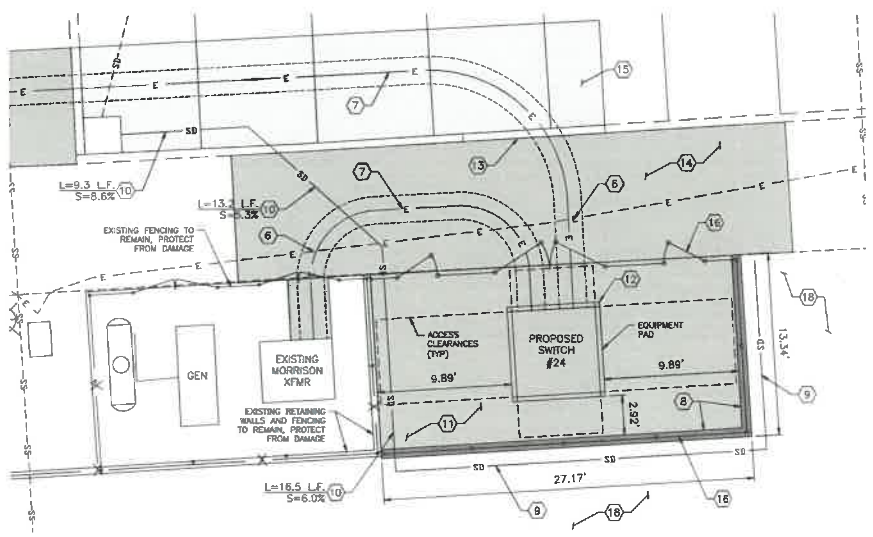
REVISION | DATE | REV

PLAN AND PROFILE
CEDAR STREET

DRAWN BY:	DNW
DESIGNED BY:	DNW
QUALITY CHECK:	DNW
DATE:	10/15/21
JOB NO.	521-222
EWU NO.	CP1067

C2

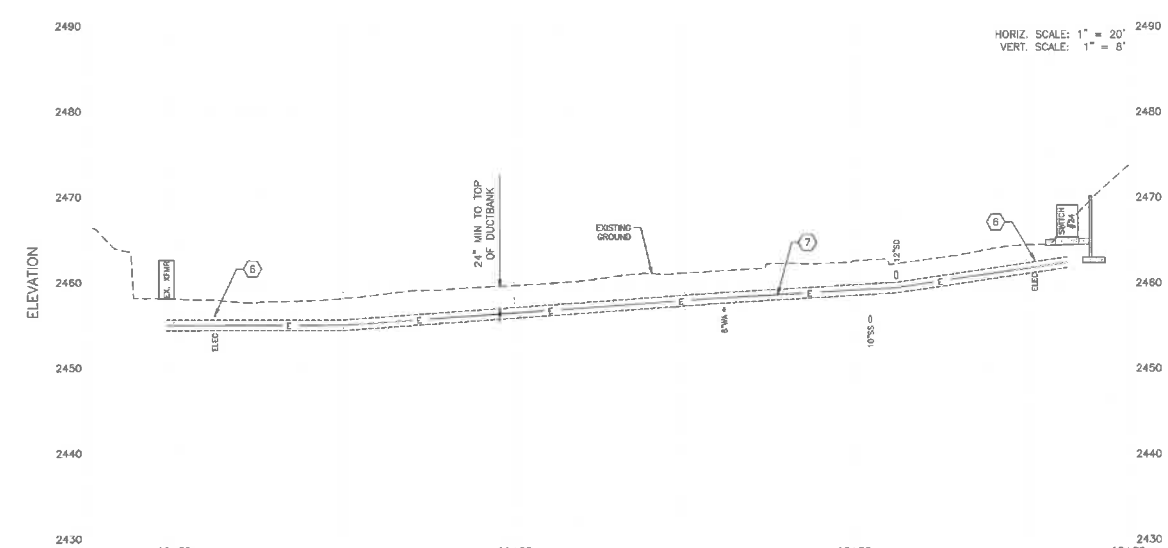




SWITCH YARD DETAIL

1 INCH = 5 FEET

1



GENERAL NOTE

CONTRACTOR SHALL OBTAIN A RIGHT-OF-WAY PERMIT FROM THE CITY OF CHENEY PUBLIC WORKS DEPARTMENT PRIOR TO ANY WORK WITHIN THE CITY RIGHT-OF-WAY.

CONSTRUCTION NOTES

1. REMOVE PAVEMENT TO LIMITS SHOWN. PAVEMENT DAMAGE OUTSIDE OF LIMITS SHOWN SHALL BE REPLACED AT CONTRACTOR'S EXPENSE.
2. SAWCUT AND REMOVE EXISTING SIDEWALK AT FULL PANEL JOINTS TO ALLOW FOR ELECTRICAL DUCTBANK CONSTRUCTION.
3. SAWCUT AND REMOVE EXISTING CONCRETE PAD TO ALLOW FOR DUCTBANK CONSTRUCTION.
5. REMOVE EXISTING SOD AND TOPSOIL. REMOVE IRRIGATION LINES WITHIN LIMITS OF SWITCH YARD. RELOCATE SPRINKLER HEADS AND CAP AND/OR RECONNECT LINES TO MAINTAIN OPERATION OUTSIDE OF LIMITS OF SWITCH YARD PER SPECIFICATION 328400.
6. RELOCATE LIGHTING CONDUIT AS REQUIRED FOR DUCTBANK CONSTRUCTION.
7. PROPOSED POWER DUCTBANK. ARRANGE CONDUITS IN SINGLE LEVEL TO LIMIT HEIGHT OF DUCTBANK. SEE SHEET E1.3 FOR NUMBER OF CONDUITS REQUIRED AT EACH LOCATION AND DETAIL 2 ON SHEET E5.1 FOR DUCTBANK CONSTRUCTION REQUIREMENTS. SEE DETAIL 1 ON SHEET C5 FOR TRENCH BACKFILL REQUIREMENTS.
8. CONCRETE RETAINING WALL. REFER TO STRUCTURAL SHEET S1.
9. 4" PVC PERFORATED PIPE WALL DRAIN. LENGTH = 41 LF, SLOPE = 0.00 FT/FT.
10. 4" DIA PVC STORM PIPE. LENGTH AND SLOPE PER PLAN.
11. 6" CONCRETE SLAB ON 6" CSTC PER DETAIL 4 ON SHEET C4.
12. 8" CONCRETE EQUIPMENT PAD ON 6" CSTC PER DETAIL 4 ON SHEET C4.
13. CURB TYPE 'A' ON 4" OF CSBC. SEE CITY OF CHENEY STANDARD PLAN A-2 FOR CONSTRUCTION DETAILS.
14. 6" CONCRETE SIDEWALK PER DETAIL 3 ON SHEET C4. MATCH EXISTING SIDEWALK ELEVATIONS.
15. 4" OF 1/2" HMA PG 64-28 (2" LIFTS MAX), ON 6" CSTC PER DETAIL 2 ON SHEET C4. REPLACE PAVEMENT MARKINGS AS REQUIRED.
16. 6 FOOT HIGH CHAIN LINK FENCE ENCLOSURE. PROVIDE 8 FOOT WIDE GATE CENTERED ON SWITCH COMPARTMENT ACCESS DOORS AND 3 FOOT WIDE GATES AT LOCATIONS SHOWN.
17. 3" OF 5/8" BASALT CHIPS BETWEEN TRANSFORMER YARD AND SIDEWALK.
18. INSTALL SOD IN ALL DISTURBED AREAS PER SPECIFICATION 329219.

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 inch = 20 ft.

TD&H Engineering

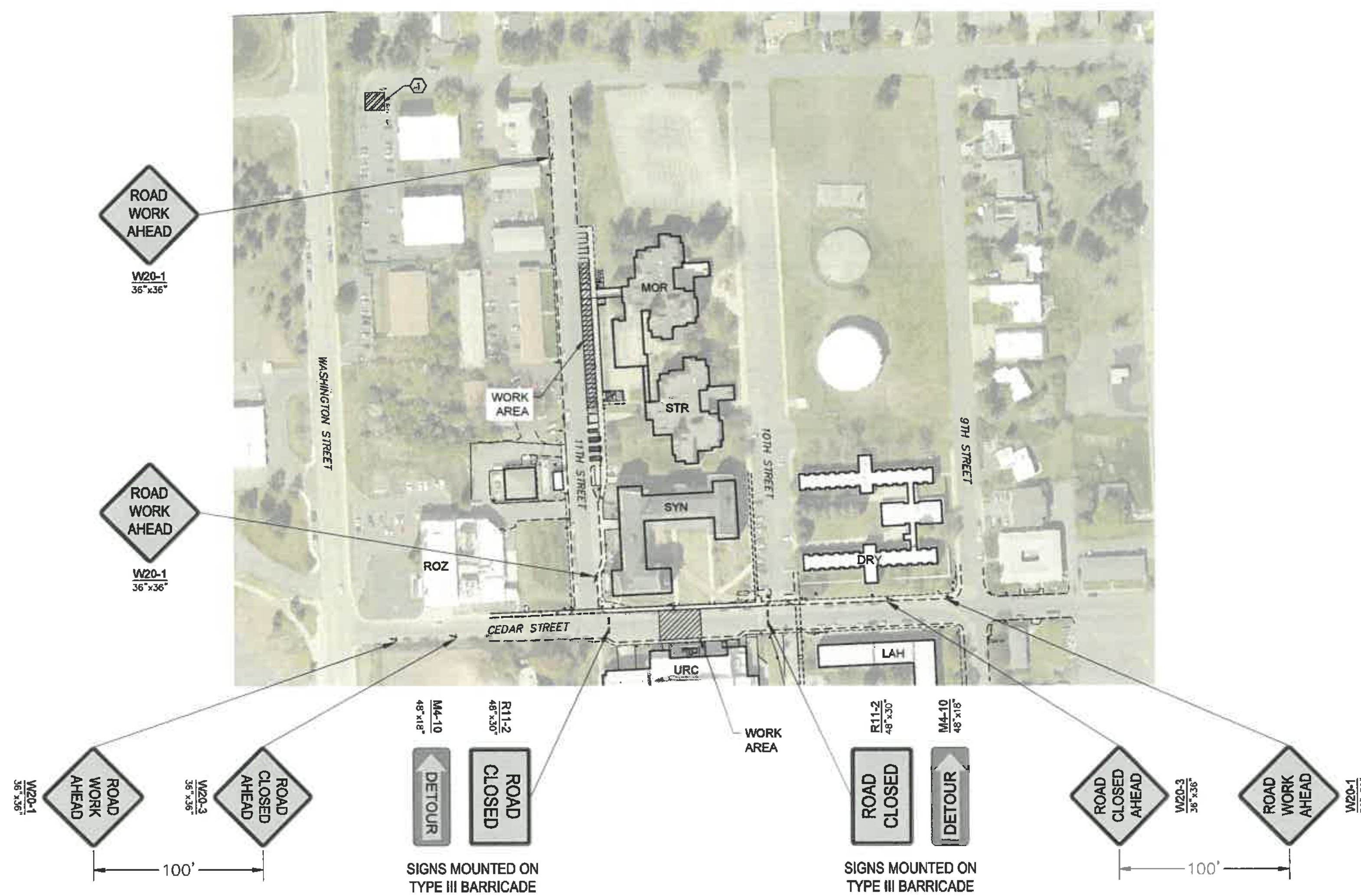
EWU MEDIUM VOLTAGE UPGRADE

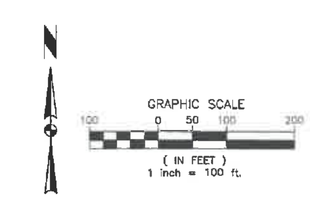
REV	DATE	REVISION

PLAN AND PROFILE
11TH STREET

DRAWN BY:	DNW
DESIGNED BY:	DNW
QUALITY CHECK:	DNW
DATE:	10/15/21
JOB NO.	S21-222
EWU NO.	CP1067

C3





TD&H Engineering

EWU MEDIUM VOLTAGE UPGRADE

REVISION | DATE | REV

TRAFFIC CONTROL PLAN

DRAWN BY:	DNW
DESIGNED BY:	DNW
QUALITY CHECK:	DNW
DATE:	10/15/21
JOB NO.	521-222
EWU NO.	CP1057

C5

GENERAL NOTES

CODES & STANDARDS

1. INTERNATIONAL BUILDING CODE: 2015 IBC
2. AMERICAN SOCIETY OF CIVIL ENGINEERS: ASCE 7-10
3. AMERICAN CONCRETE INSTITUTE: ACI 318-14
4. ASTM STANDARDS FOR THE MATERIALS SPECIFIED.

MISCELLANEOUS

1. THE CONTRACTOR AND SUB-TRADES SHALL FURNISH ALL REQUIRED MATERIAL, LABOR, EQUIPMENT AND PERFORM ALL WORK AS NECESSARY, AS INDICATED ON THE PROJECT DOCUMENTS, OR AS REASONABLE INFERRED TO EXECUTE THE SCOPE OF WORK FOR A PROPERLY FINISHED, COMPLETE JOB.

2. THE CONTRACTOR IS RESPONSIBLE FOR SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK THAT CONFORMS TO THE REGULATIONS OF THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) STANDARDS FOR THE CONSTRUCTION INDUSTRY.

3. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OF CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNOLOGIES, SEQUENCES AND PROCEDURES.

4. WHERE REFERENCE IS MADE TO VARIOUS TEST STANDARDS FOR MATERIALS, SUCH STANDARDS SHALL BE THE LATEST EDITION AND/OR ADDENDUM.

5. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL STRUCTURAL NOTES AND TYPICAL DETAILS. WHERE NO SPECIFIC DETAILS ARE SHOWN, CONSTRUCTION SHALL CONFORM TO SIMILAR WORK ON THE PROJECT.

6. WHERE ANY DISCREPANCIES OCCUR BETWEEN PLANS, DETAILS, GENERAL STRUCTURAL NOTES AND SPECIFICATIONS, THE GREATER REQUIREMENTS SHALL GOVERN.

7. ALL OMISSIONS OR CONFLICTS BETWEEN THE VARIOUS ELEMENTS OF THE WORKING DRAWINGS AND/OR SPECIFICATIONS SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE STRUCTURAL ENGINEER BEFORE PROCEEDING WITH RELATED WORK.

8. VISITS TO THE JOBSITE BY THE ENGINEER TO OBSERVE CONSTRUCTION DO NOT IN ANY WAY MEAN THAT THEY ARE THE GUARANTORS OF THE CONTRACTORS WORK, SUPERVISION, NOR SAFETY AT THE JOBSITE.

9. REVIEW OF SHOP DRAWINGS BY THE ENGINEER IS FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT AND GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS. REVIEW OF SUCH SHOP DRAWINGS BY THE ENGINEER SHALL NOT RELIEVE THE CONTRACTOR FROM RESPONSIBILITY FOR CORRECTNESS OF DIMENSIONS, FABRICATION DETAILS, SPACE REQUIREMENTS, ERRORS IN THE SHOP DRAWINGS, OR FOR DEVIATIONS FROM THE CONTRACT DRAWINGS OR SPECIFICATIONS UNLESS THE CONTRACTOR HAS SPECIFICALLY CALLED ATTENTION TO SUCH DEVIATIONS IN WRITING BY A LETTER ACCOMPANYING THE SHOP DRAWINGS AND THE ENGINEER APPROVES SUCH CHANGE OR DEVIATION IN WRITING.

FOUNDATION AND SOIL PREPARATION

1. DESIGN VALUES
   ASSUMED STATIC LOAD BEARING PRESSURE = 1,500 PSF
   ACTIVE EARTH PRESSURE = 35 PCF
   PASSIVE EARTH PRESSURE = 200 PCF
   FRICTION = .30 FOR STRUCTURAL FILL
   FROST DEPTH = 2'-0" BELOW FINISH GRADE

2. REMOVE ALL TOPSOIL, ORGANIC MATERIAL, VEGETATION, ASPHALT, CONCRETE, AND RELATED CONSTRUCTION DEBRIS FROM THE PROPOSED SITE PRIOR TO FORMING FOUNDATIONS. BEAR FOUNDATIONS ON STRUCTURAL FILL MEETING THE REQUIREMENTS OF THE GEOTECHNICAL ENGINEER.

3. CONFORM TO IBC CHAPTER 18 "FOUNDATIONS AND RETAINING WALLS."

CONCRETE

1. CONCRETE WORK SHALL CONFORM TO ALL REQUIREMENTS OF ACI 301 "STANDARD SPECIFICATIONS FOR STRUCTURAL CONCRETE", AND ACI 318 "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE".

2. CONCRETE PROPERTIES:

USE	28 DAY STRENGTH	MAX W/C	AIR	MAX SLUMP	MAX AGGREGATE
FTGS & WALLS	4,500 PSI	.45	4½-7½%	4"	1½"

3. CONCRETE DROP HEIGHT SHOULD BE LIMITED TO 4'-0" DURING ALL CONCRETE PLACEMENT. CONCRETE SHOULD BE ABLE TO FALL FREELY, WITHOUT OBSTRUCTION FROM REBAR, ETC.

4. COLD WEATHER AND HOT WEATHER CONCRETING SHALL FOLLOW THE RECOMMENDATIONS OF ACI 306 AND ACI 305.

5. MECHANICALLY VIBRATE ALL CONCRETE WHEN PLACED, EXCEPT THAT SLABS ON GRADE NEED BE VIBRATED ONLY AROUND UNDER-FLOOR DUCTS, SLAB EDGES, REINFORCING, KEYS, ETC.

6. ADDITION OF WATER TO THE BATCH FOR MATERIAL WITH INSUFFICIENT SLUMP WILL NOT BE PERMITTED, UNLESS THE SUPPLIER HAS SPECIFICALLY WITHHELD WATER FROM THE BATCH AT THE PLANT. IN SUCH CASE THE MIX DESIGN AND TRUCK TICKET MUST CLEARLY STATE THE MAXIMUM AMOUNT OF WATER THAT CAN BE ADDED TO THE BATCH ON SITE. IN NO CASE SHALL THE DESIGN WATER TO CEMENTITIOUS MATERIAL RATIO BE EXCEEDED.

CONCRETE REINFORCING

1. REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF ACI 301 "STANDARD SPECIFICATIONS FOR STRUCTURAL CONCRETE", AND ACI 318 "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE".

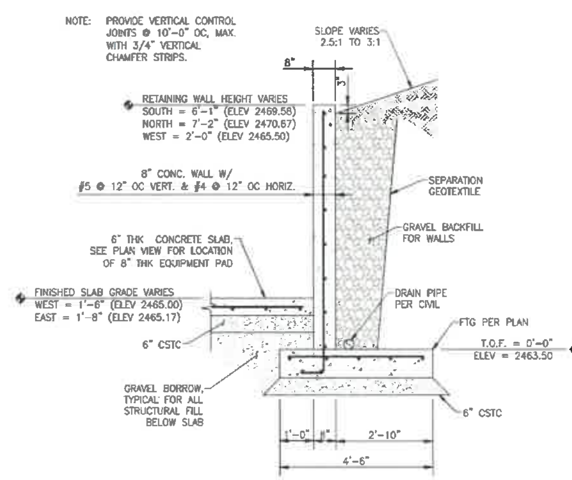
2. ALL REINFORCING STEEL SHALL BE ASTM A615 GRADE 60.

3. REINFORCING SHALL BE CONTINUOUS AROUND ALL CORNERS AND THROUGH CONSTRUCTION JOINTS UNLESS SHOWN OTHERWISE. SPACING SHOWN IS THE MAXIMUM CENTER TO CENTER DISTANCE. WHEN TOTAL NUMBER OF REINFORCING BARS IS SHOWN ON DESIGN DRAWINGS AND SPACING IS NOT SPECIFIED, BARS SHALL BE EQUALLY SPACED.

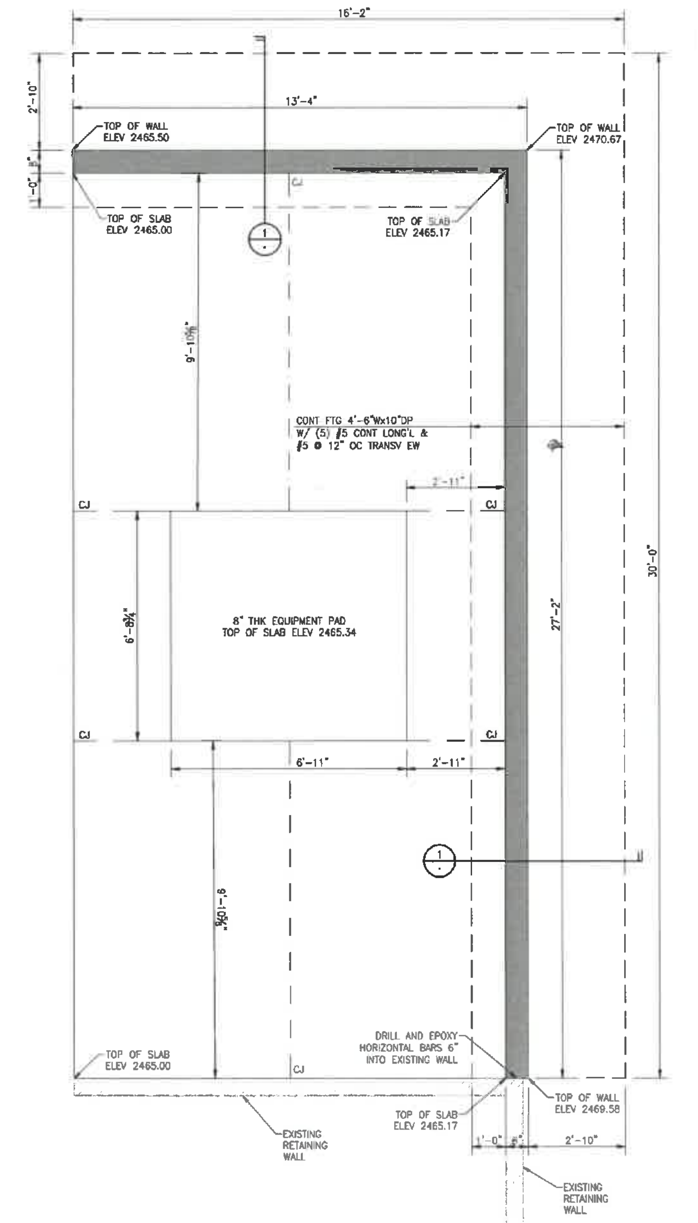
4. UNLESS NOTED OTHERWISE, MAIN REINFORCEMENT CONCRETE COVER SHALL BE 1½" WITH THE FOLLOWING EXCEPTIONS:
   UNFORMED SURFACES EXPOSED TO EARTH - 3"
   FORMED SURFACE EXPOSED TO EARTH - 2"

5. ALL HOOKS ON ALL BARS SHALL BE STANDARD 90 DEGREE HOOKS UNLESS SHOWN OTHERWISE.

6. TYPICAL LAP SPLICES SHALL BE CLASS 'B' TENSION LAP SPLICES PER THE ACI. STAGGER ADJACENT SPLICES A MINIMUM OF ONE LAP LENGTH.



RETAINING WALL SECTION (1)
1/2"=1'-0"



RETAINING WALL PLAN
1/2"=1'-0"

10/15/21

TD&H Engineering

EWU MEDIUM VOLTAGE UPGRADE

REV	DATE	REVISION

RETAINING WALL PLAN AND DETAILS

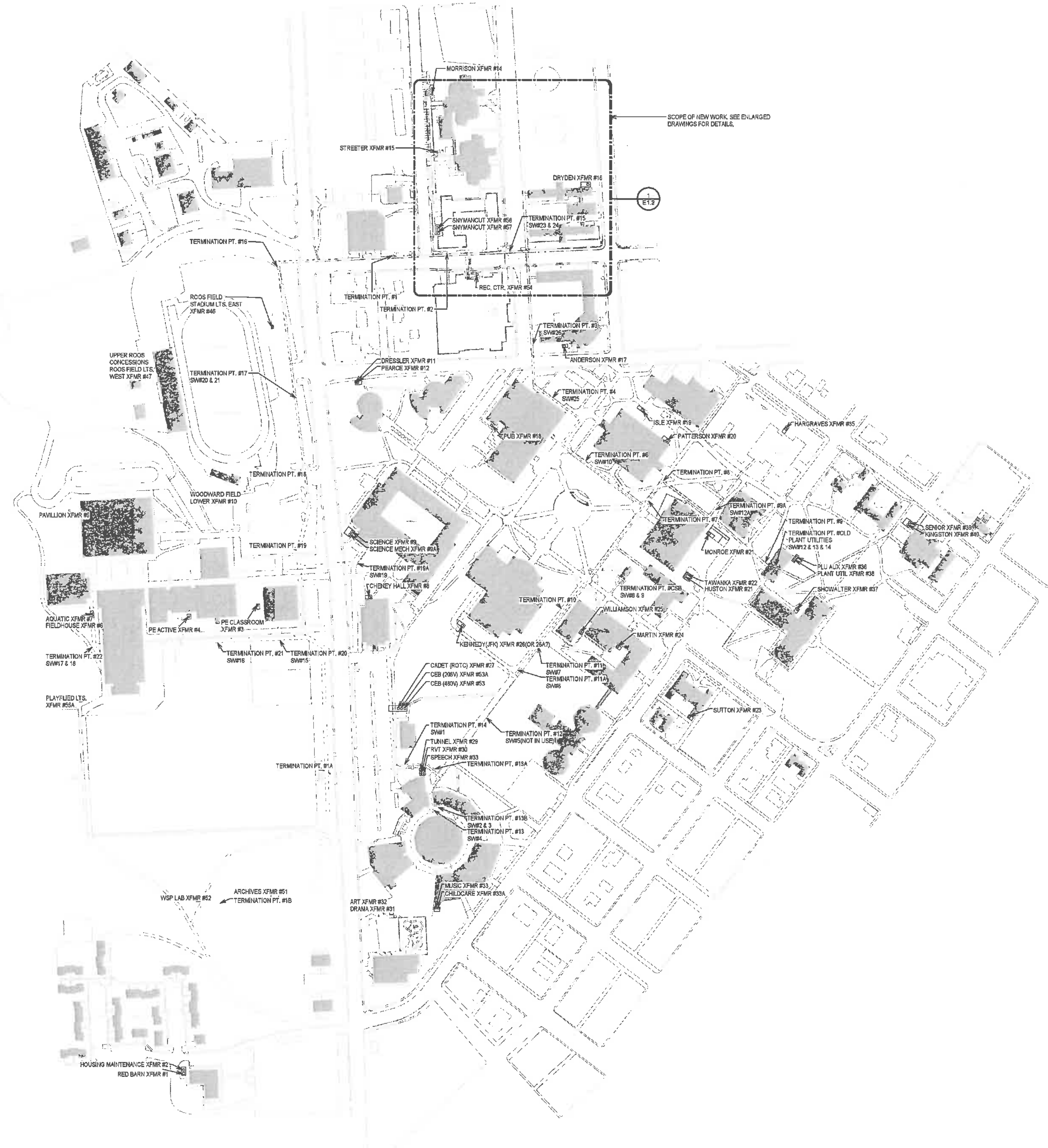
DRAWN BY:	DNW
DESIGNED BY:	TSB
QUALITY CHECK:	TSB
DATE:	10/15/21
JOB NO.	521-222
EWU NO.	CP1067

S1

JOEL RAGAN ENEVOLD
STATE OF WASHINGTON
55377
PROFESSIONAL ENGINEER

MW Engineers

EWU MEDIUM VOLTAGE UPGRADE



N

OVERALL - SITE PLAN - ELECTRICAL

1" = 160'-0"

#	REVISIONS	DATE

OVERALL - SITE PLAN - ELECTRICAL

DWN BY:	Author
CHK BY:	Checker
SCALE:	AS NOTED
DATE:	10/15/2021

E1.1

BID SET

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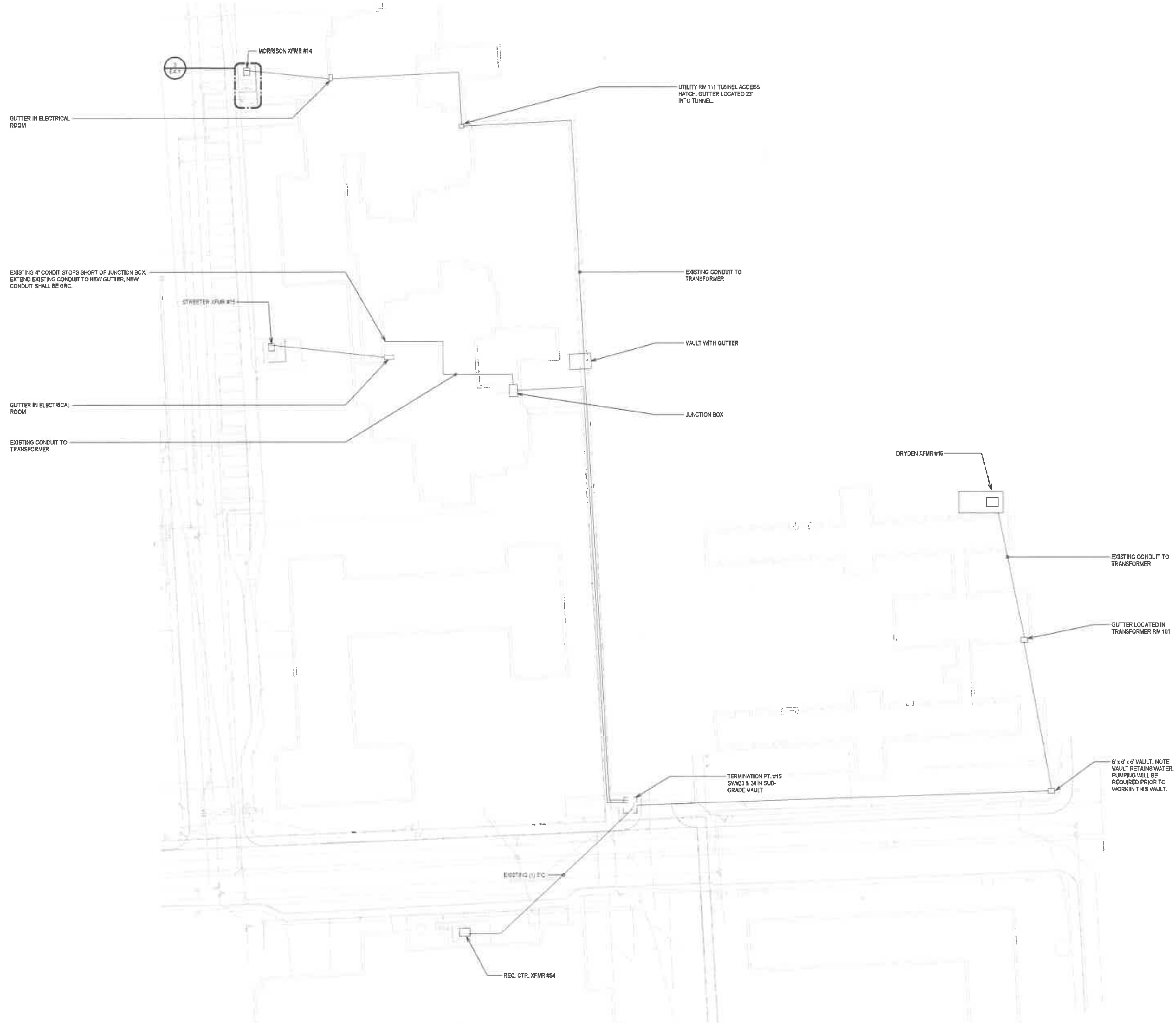


PARTIAL SITE PLAN - PROJECT AREA - ELECTRICAL - EXISTING

1/32" = 1'-0"

MW Engineers

EWU MEDIUM VOLTAGE UPGRADE

DATE	REVISIONS

PARTIAL SITE PLAN - PROJECT AREA - ELECTRICAL - EXISTING

DWN BY: Author
CHK BY: Checker
SCALE: AS NOTED
DATE: 10/15/2021

E1.2

BID SET

GENERAL NOTES:

1. SCOPE OF WORK INCLUDES TRENCHING IN ROADWAY AND SIDEWALKS AS WELL AS WORK ADJACENT TO ROADWAYS AND PEDESTRIAN PATHWAYS. A RIGHT OF WAY PERMIT AND TRAFFIC PLAN WILL BE REQUIRED. SEE CIVIL DRAWINGS FOR DETAILS.
2. WHERE HARDSCAPING OR LANDSCAPING ARE IMPACTED BY PROJECT SCOPE, PATCHBACK PER CIVIL DRAWINGS.
3. CALL FOR LOCATES BEFORE TRENCHING.
4. THIS PROJECT MAKES USE OF EXISTING SPARE CONDUITS TO MIMIMIZE NEW TRENCHING AND CONDUIT SCOPE. UNDER SEPERATE CONTRACT, A MULE-TAPE PULL STRING HAS BEEN INSTALLED IN THE FOLLOWING (E) SPARE CONDUITS AND THE FOOTAGES ARE AS INDICATED.
   A. TER #15 TO DRYDEN XFMR #16 - 590 FEET
   B. TER #15 TO STREETER XFMR #15 - 640 FEET
   C. TER #15 TO MORRISON XFMR #14 - 800 FEET

PARTIAL SITE PLAN - PROJECT AREA - ELECTRICAL - NEW

1/32" = 1'-0"

MW Engineers

EWU MEDIUM VOLTAGE UPGRADE

#	REVISIONS	DATE

PARTIAL SITE PLAN - PROJECT AREA - ELECTRICAL - NEW

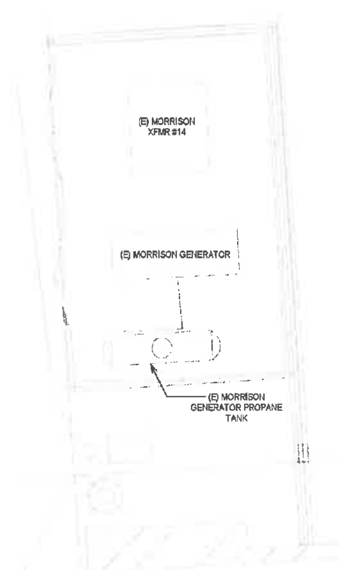
DWN BY:	Author
CHK BY:	Checker
SCALE:	AS NOTED
DATE:	10/15/2021

E1.3

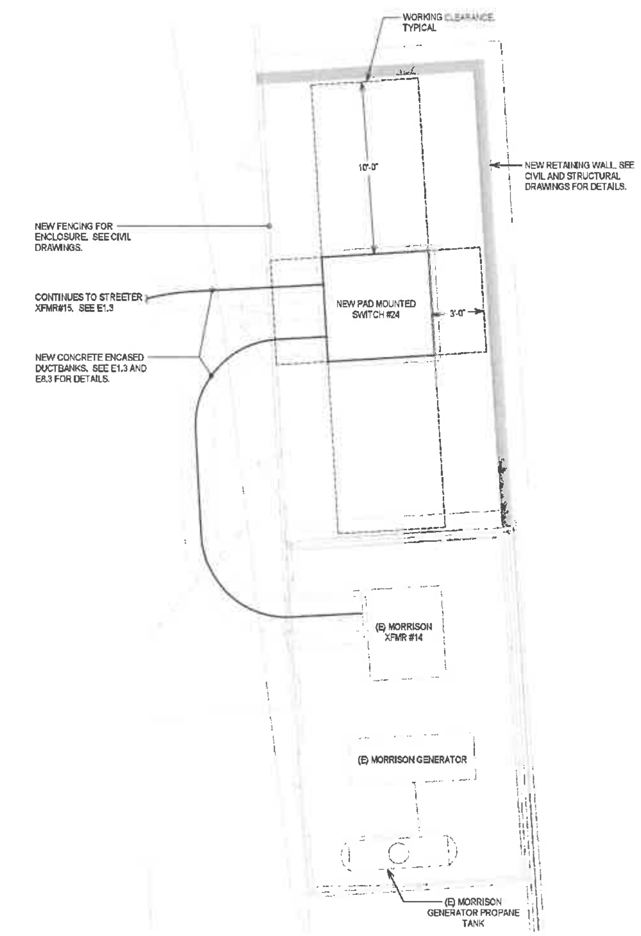
BID SET

1 **MORRISON XFMR #14 INTERIOR - EXISTING**
N.T.S.

2 **MORRISON XFMR #14 LOOKING SOUTH - EXISTING**
N.T.S.



3 **ENLARGED EXISTING MORRISON XFMR #14**
1/4" = 1'-0"



4 **ENLARGED NEW MORRISON XFMR #14**
1/4" = 1'-0"

EWU MEDIUM VOLTAGE UPGRADE

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#	REVISIONS	DATE

ENLARGED PLANS - ELECTRICAL

DWN BY:	Author
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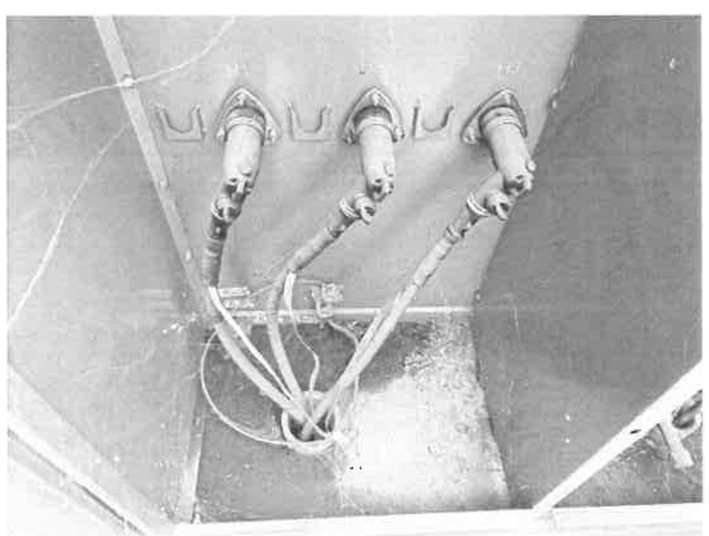
SCALE:	AS NOTED
DATE:	10/15/2021

E4.1

BID SET

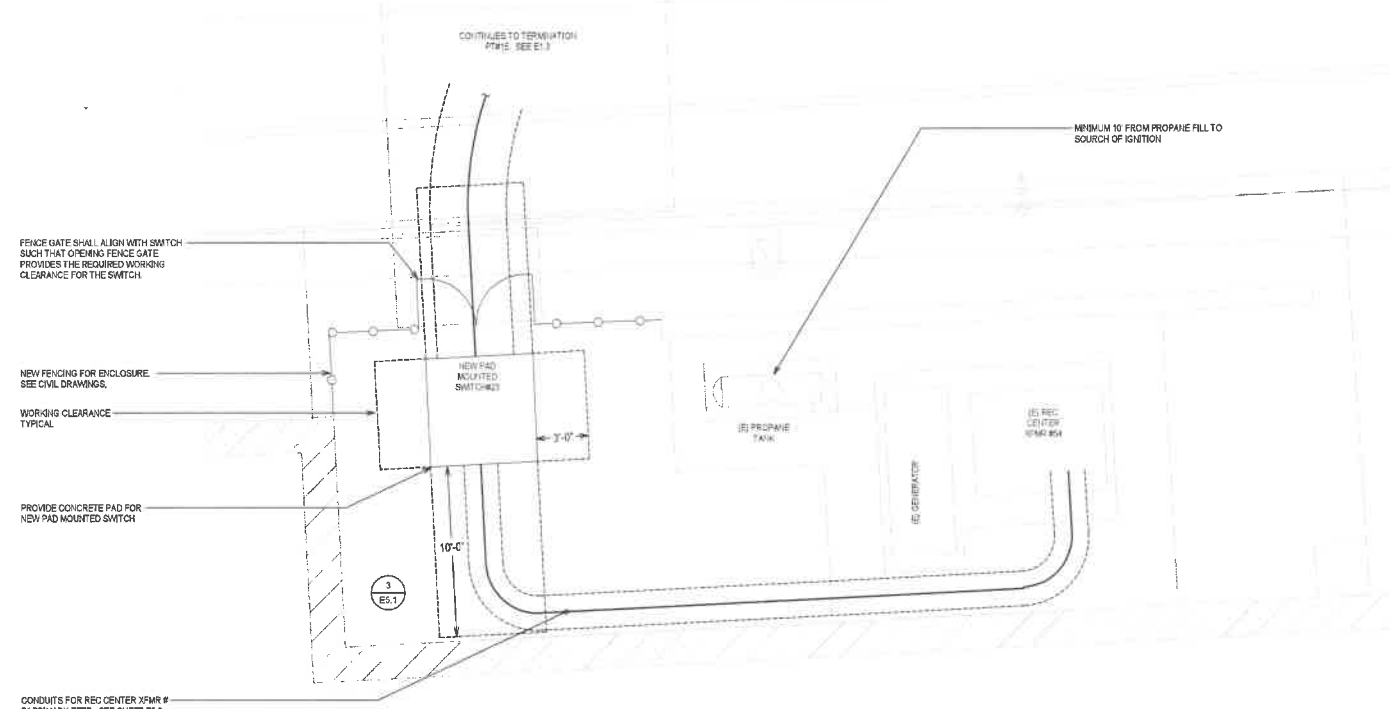
1 REC CENTER XFMR #54 LOOKING WEST - EXISTING
N.T.S.

2 REC CENTER XFMR #54 INTERIOR - EXISTING
N.T.S.



3 REC CENTER XFMR#54 INTERIOR - EXISTING
N.T.S.

4 REC CENTER XFMR #54 ENCLOSURE - ENLARGED SCALE PLAN - EXISTING
1/4" = 1'-0"



5 REC CENTER XFMR #54 ENCLOSURE - ENLARGED SCALE PLAN - NEW
1/4" = 1'-0"

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ENLARGED PLANS - ELECTRICAL

DWN BY:	Author
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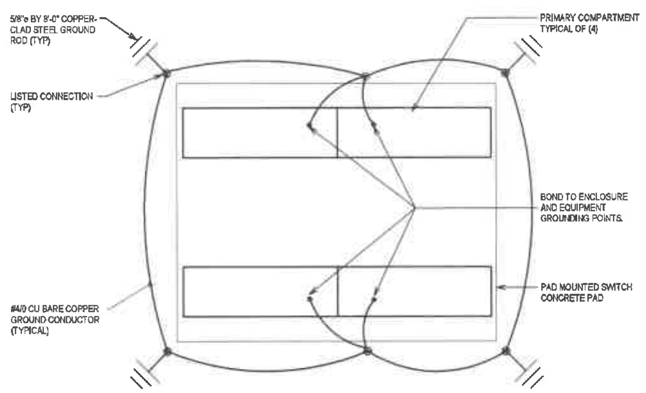
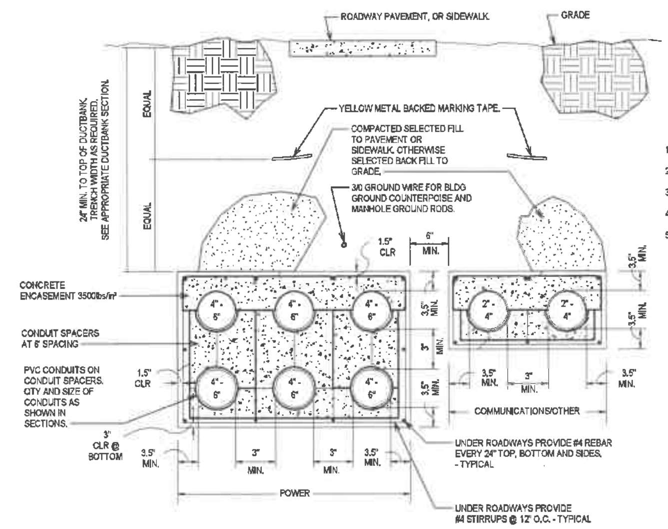
SCALE:	AS NOTED
DATE:	10/15/2021

E4.2

BID SET



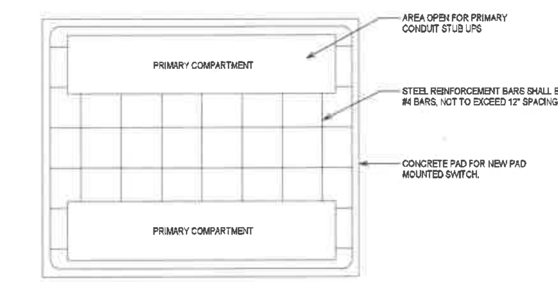
1 **PAD MOUNTED EQUIPMENT GROUNDING**
N.T.S.



GENERAL NOTES:

1. REFERENCE SPECIFICATION SECTION 26 05 43 FOR CONDUIT AND DUCT INSTALLATION AT ENTERANCE INTO BUILDINGS.
2. DIMENSIONS APPLY TO ALL DUCTBANKS UNLESS SPECIFICALLY NOTED OTHERWISE.
3. ALL DUCTBANKS CONTAINING MEDIUM VOLTAGE CIRCUITS SHALL BE ENCASED IN CONCRETE.
4. HORIZONTAL AND VERTICAL SPACING FROM CENTER OF CONDUITS SHALL NOT BE LESS THAN 7.5" PER NEC 310.104.
5. SEE CIVIL DRAWINGS FOR ADDITIONAL REQUIREMENTS.

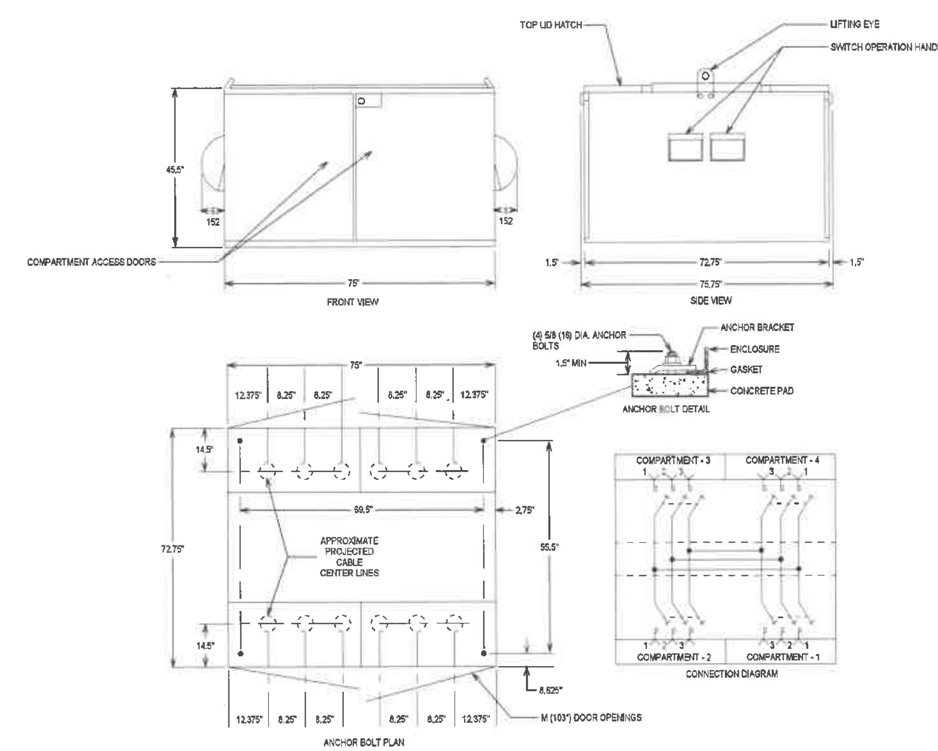
2 **TYPICAL MEDIUM VOLTAGE (600-25,000V) DUCTBANK SECTION**
N.T.S.



GENERAL NOTES:

1. NEW PAD MOUNTED SWITCH PAD SHALL BE SIZED FOR THE SWITCH SIZE INDICATED ON THE ONE-LINE DIAGRAM, SHEET E6.03.
2. PAD MOUNTED SWITCH SIZE, DIMENSIONS, AND OPENINGS SHALL MEET CURRENT MANUFACTURER'S STANDARDS.
3. SEE SPECIFICATIONS 26 05 43 AND 26 12 19.
4. SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS.

3 **NEW PAD MOUNTED SWITCH PAD DETAIL**
N.T.S.



GENERAL NOTES:

1. NEW PAD MOUNTED SWITCHES TO BE S&C PME-10 OR EQUAL. SEE SPECIFICATION SECTION 26 13 16.

5 **PAD MOUNTED SWITCH DETAILS**
N.T.S.

EWU MEDIUM VOLTAGE UPGRADE

DETAILS - ELECTRICAL

DWN BY:	Author
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SCALE:	AS NOTED
DATE:	10/15/2021

E5.1

BID SET

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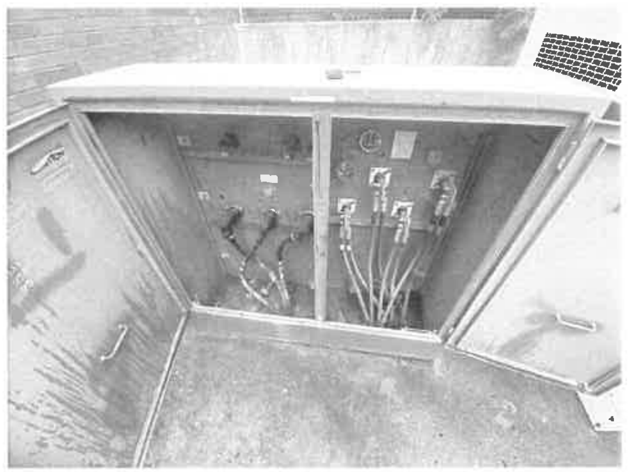
1 **DRYDEN XFMR #16 INTERIOR - EXISTING**
N.T.S.

2 **DRYDEN XFMR#16 INTERIOR - EXISTING**
N.T.S.

3 **STREETER XFMR #15 LOOKING EAST - EXISTING**
N.T.S.

4 **STREETER XFMR#15 LOOKING NORTH - EXISTING**
N.T.S.



5 **STREETER XFMR #15 INTERIOR - EXISTING**
N.T.S.

6 **STREETER XFMR #15 - INTERIOR - EXISTING**
N.T.S.

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EWU MEDIUM VOLTAGE UPGRADE

DATE	REVISIONS

DETAILS - ELECTRICAL

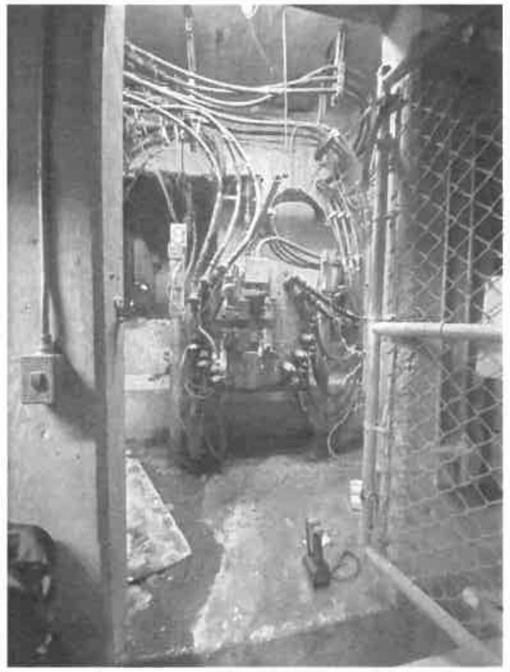
DWN BY:	Author
CHK BY:	Checker
SCALE:	AS NOTED
DATE:	10/15/2021

E5.2

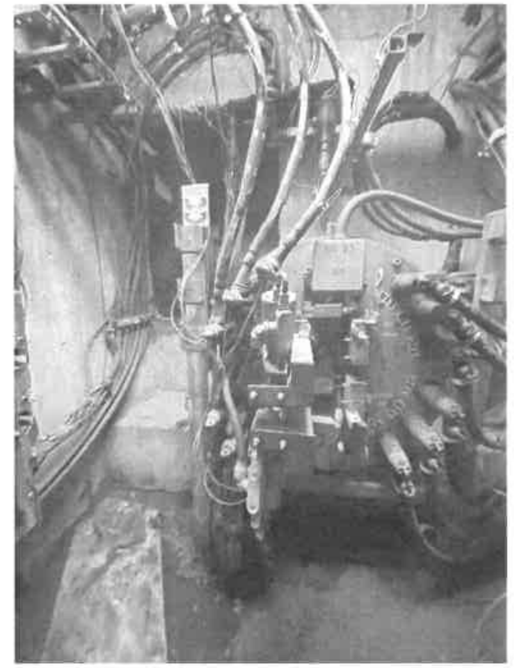
BID SET

GENERAL NOTES:

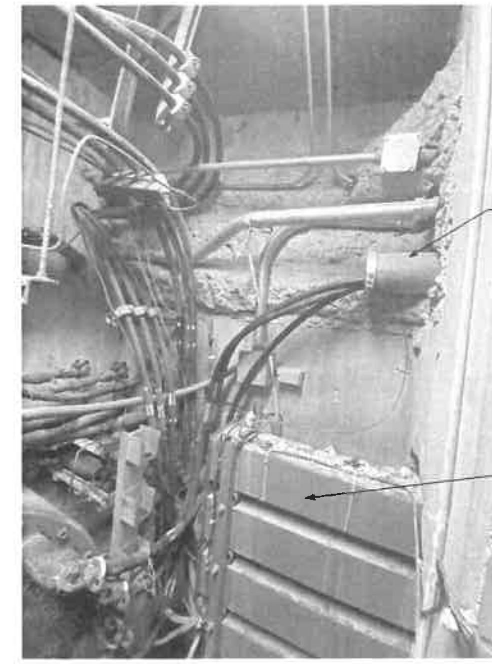
1. EXISTING VACUUM SWITCHES CONTAIN SULFUR HEXAFLUORIDE (SF6) AS AN INSULATING GAS. COORDINATE WITH EWU'S ENVIRONMENTAL HEALTH AND SAFETY DEPARTMENT AND PROPERLY DISPOSE OF THE EXISTING VACUUM SWITCHES.
2. DEMOLISH ALL EQUIPMENT IN THE VAULT WHICH IS DISCONNECTED OR INACTIVE SUCH THAT ONLY ACTIVE EQUIPMENT REMAINS AT THE COMPLETION OF THE PROJECT.
3. REPLACE INSULATORS, BUSHING STRAPS AND SUPPORT STRUCTURE FOR FEEDERS NEW OR MODIFIED UNDER PROJECT SCOPE.
4. NEW SUPPORT STRUCTURE (UNISTRUT OR SIMILAR) SHALL BE FIBERGLASS OR STAINLESS STEEL TO PREVENT CORROSION.



1 VACUUM SWITCH #23 AT TER#15 IN TUNNEL - EXISTING
N.T.S.

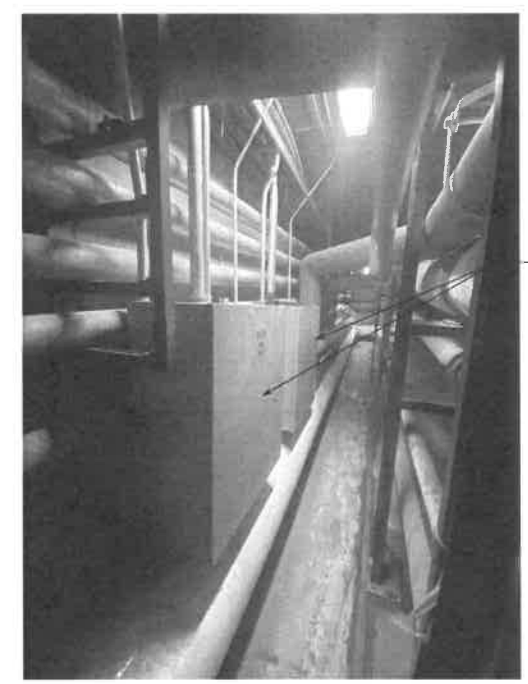


2 VACUUM SWITCH#23 AT TER#15 IN TUNNEL - EXISTING
N.T.S.



3 VACUUM SWITCH#23 AT TER #15 IN TUNNEL - EXISTING
N.T.S.

4 VACUUM SWITCH #23 AT TER# 15 IN TUNNEL - EXISTING
N.T.S.



5 VACUUM SWITCH # 23 AT TER#15 IN TUNNEL - EXISTING
N.T.S.

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EWU MEDIUM VOLTAGE UPGRADE

DATE	REVISIONS

DETAILS - ELECTRICAL

DWN BY: Author
CHK BY: Checker
SCALE: AS NOTED
DATE: 10/15/2021

E5.3

BID SET

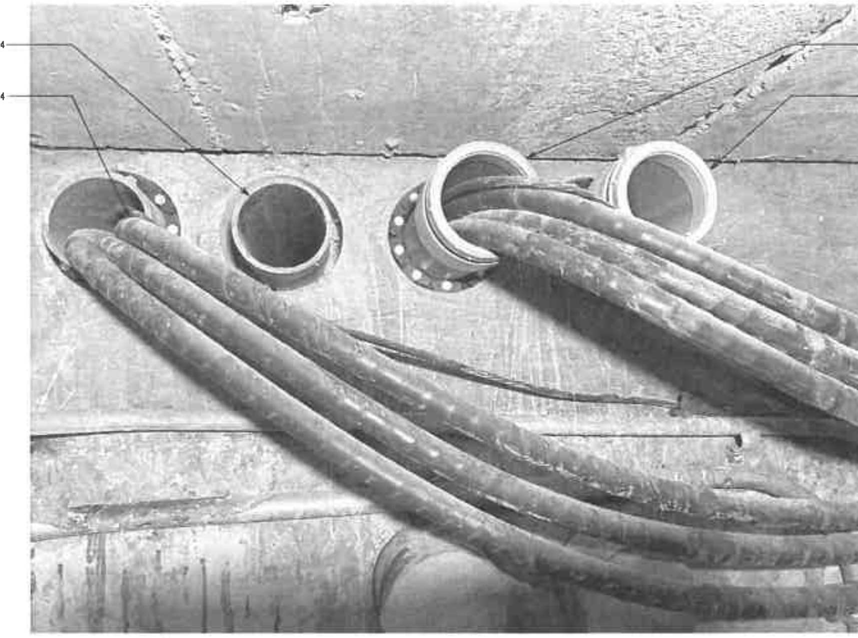
10/14/2021 10:18:03 AM PROJECT NUMBER (E5.3) C:\Users\Ryans\Documents\Revit Central Files\2020\2020.002.02-EWU Medium Voltage Upgrade-MEP Central_ryanS8T6SY.rvt

MORRISON XFMR#14 SPARE CONDUIT

MORRISON XFMR#14 FEEDERS

STREETER XFMR #15 FEEDERS

STREETER XFMR#15 SPARE CONDUITS



1 VACUUM SWITCH#24 AT TER#15 IN TUNNEL - EXISTING
N.T.S.

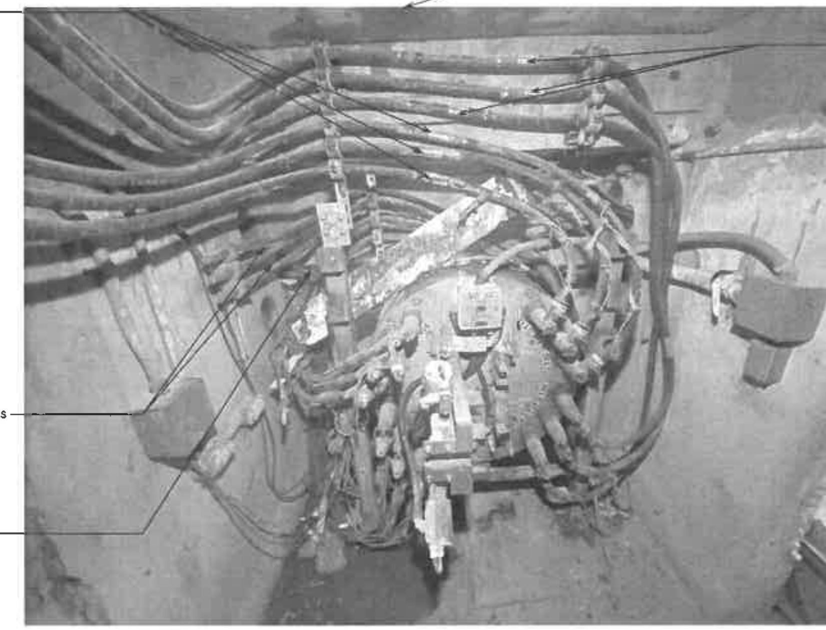
MORRISON XFMR#14 FEEDERS

REPLACE EXISTING LIGHT WITH NEW 1' x 4' LED GASKETED FIXTURE. CONNECT NEW LIGHT TO EXISTING CIRCUIT. FIXTURE SHALL BE EQUAL TO AN LITHONIA MODEL# FEM-L48-8000LM-LPPCL-MD-MVOLT-GZ10-35K-80CRI

STREETER XFMR #15 FEEDERS

(E) ABANDONED FEEDERS TO BE DEMOLISHED

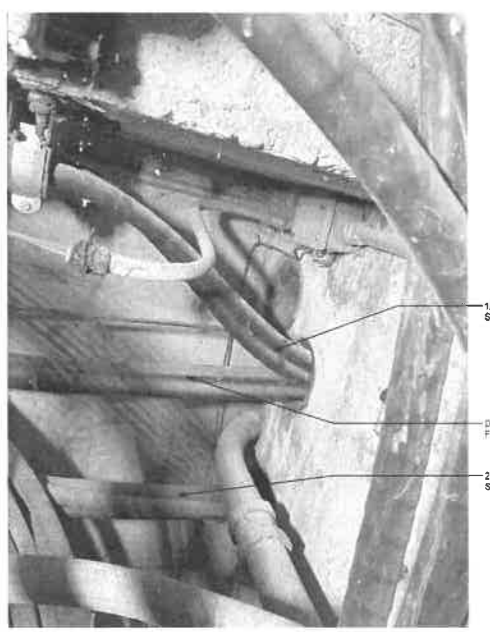
DRYDEN XFMR #16 FEEDERS



2 VACUUM SWITCH #24 AT TER#15 IN TUNNEL - EXISTING
N.T.S.

GENERAL NOTES:

1. EXISTING VACUUM SWITCHES CONTAIN SULFUR HEXAFLUORIDE (SF6) AS AN INSULATING GAS. COORDINATE WITH EWU'S ENVIRONMENTAL HEALTH AND SAFETY DEPARTMENT AND PROPERLY DISPOSE OF THE EXISTING VACUUM SWITCHES.
2. DEMOLISH ALL EQUIPMENT IN THE VAULT WHICH IS DISCONNECTED OR INACTIVE SUCH THAT ONLY ACTIVE EQUIPMENT REMAINS AT THE COMPLETION OF THE PROJECT.
3. REPLACE INSULATORS, BUSHING STRAPS AND SUPPORT STRUCTURE FOR FEEDERS NEW OR MODIFIED UNDER PROJECT SCOPE.
4. NEW SUPPORT STRUCTURE (UNISTRUT OR SIMILAR) SHALL BE FIBERGLASS OR STAINLESS STEEL TO PREVENT CORROSION.



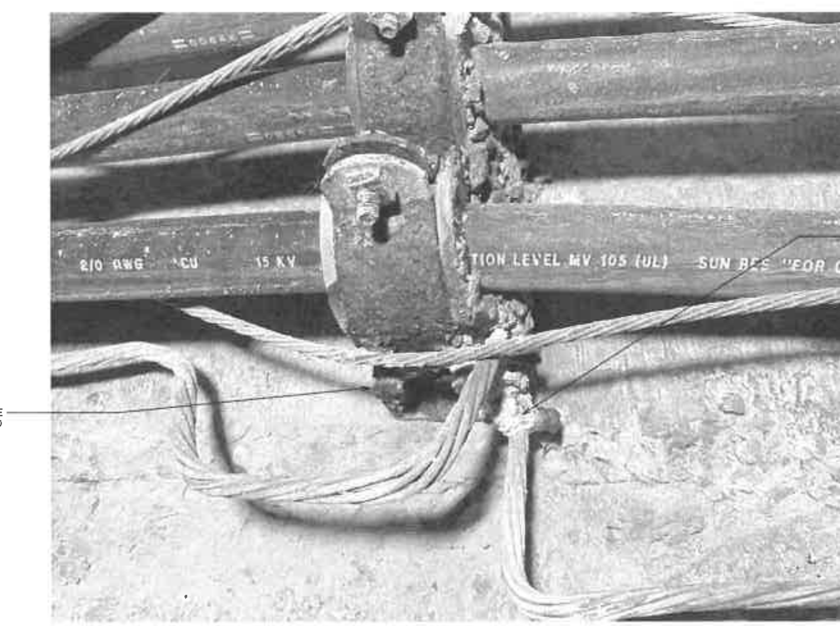
1A FEEDERS TO SWITCH #24

DRYDEN XFMR #16 FEEDERS

2A FEEDERS TO SWTICH #24

3 VACUUM SWITCH#24 AT TER# 15 IN TUNNEL - EXISTING
N.T.S.

NEW SUPPORT STRUCTURE SHALL BE FIBERGLASS OR STAINLESS STEEL TO PREVENT CORROSION.



RETERMINATE ALL CORRODED GROUND WIRES NEW OR MODIFIED UNDER PROJECT SCOPE

4 VACUUM SWITCH #24 AT TER# 15 IN TUNNEL - EXISTING
N.T.S.

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EWU MEDIUM VOLTAGE UPGRADE

#	REVISIONS	DATE

DETAILS - ELECTRICAL

DWN BY: Author
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SCALE: AS NOTED
DATE: 10/15/2021

E5.4

BID SET

Appendix E – Significant Health, Safety and Code Issues

Appendix E

Significant Health, Safety, and Code Issues:

Sub-Sections:

1. **Central Steam Production**
   a. Issue Addressed: **Heating Public Facilities – Life safety**
      i. Applicable Code: **Local Jurisdiction Model Code IPMC 2015 Section 602.4 Occupiable work spaces:** "Indoor occupiable work spaces shall be supplied with heat during the period **[DATE]** to **[DATE]** to maintain a minimum temperature of 65°F (18°C) during the period the spaces are occupied", meaning the university has a requirement to maintain temperate building environments for daily university operations.
   b. Issue Addressed: **N + 1 Redundancy – Life safety**
      i. Applicable Code: **Local Jurisdiction Model Code IBC 2018 Section 1203.1 Equipment and Systems:** "Interior spaces intended for human occupancy shall be provided with space heating systems capable of maintaining and indoor temperature of not less than 68 F at a point 3 feet above the floor on a design heating day". The project will improve consistency with this code through boiler replacement back to N+1 plant redundancy.
      ii. Applicable Code: **Local Jurisdiction Model Code IMC 2018 Section 309.1 Equipment and Systems:** "Interior spaces intended for human occupancy shall be provided with space heating systems capable of maintaining an indoor temperature of not less than 68 F at a point 3 feet above the floor on a design heating day. The installation of portable space heaters shall not be used to achieve compliance with this code". The project is needed to bring Central Steam Production into compliance with known winter heat loads and allow for maintenance or repair to occur without interruption.
      iii. Applicable Code: **Local Jurisdiction Model Code 2018 IPMC Section 603.1 Mechanical appliances:** "Mechanical equipment shall be capable of performing the intended function", meaning, the age of the boilers intended for replacement currently cannot be maintained and/or repaired to meet this code requirement.
      iv. Applicable Code: **Local Jurisdiction Model Code 2018 IPMC Section 603.1 Mechanical appliances:** "Mechanical equipment shall be capable of performing the intended function", meaning, the lack of redundancy limits the capability to generate medium pressure steam for building space and domestic hot water heating (boiler maintenance, boiler repairs etc.).
   c. Issue Addressed: **Energy Efficiency (Code)**
      i. Applicable Codes: **2015 Washington State Energy Code, Commercial Provisions, Section C403.2.3(5) "Minimum Efficiency Requirements Gas Fired Boilers- Steam- > 2,500,000 BTU/Hr ":** The project will provide new boiler(s) meeting these energy efficiency codes as part of design and construction.

d. Issue Addressed: **Seismic Restraints – Life safety**
    i. Applicable Codes: **Local jurisdiction model code IBC 2018 Section 1613.1 Earthquake Loads:** "Every structure, and portion thereof, including non-structural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Section 1613 or ASCE 7", meaning the existing boilers and auxiliary equipment within the plant are not constructed to this requirement, however the project will improve consistency to this code by requiring all subject equipment installed under the project align with this code.

2. Chilled Water Production

a. Issue Addressed: **N + 1 Redundancy – Life safety**
    i. Applicable Codes: **Local Jurisdiction Model Code 2018 IPMC Section 603.**1 **Mechanical appliances:** "Mechanical equipment shall be capable of performing the intended function", meaning, the lack of redundancy limits the capability to generate chilled water for building air conditioning during all periods (chiller maintenance, chiller repairs etc).

b. Issue Addressed: **Energy Efficiency (Code):**
    i. Applicable Codes: **2015 Washington State Energy Code, Commercial Provisions, Section C403.2.3 HVAC Equipment Performance Requirements:** "Equipment shall meet the minimums requirements of Tables C403.2.3(1) through C403.2.3(9) when tested and rated in accordance with the applicable test procedure.

c. Issue Addressed: **Seismic Restraints – Life safety**
    i. Applicable Codes: **Local jurisdiction model code IBC 2018 Section 1613.1 Earthquake Loads:** "Every structure, and portion thereof, including non-structural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Section 1613 or ASCE 7", meaning the existing chillers and auxiliary equipment within the plant were not constructed to this requirement will be brought up to this code.

3. Medium Voltage Electrical Distribution

a. Issue Addressed: **Electrical Safety of EWU Electrical Shop Workers – Life safety**
    i. The current usage/installation of SF6 (sulfur-hexafluoride) circuit breakers in the EWU utility tunnel system presents (3) operational safety issues addressed in the following codes:
        1. **2017 National Electrical Safety Code (NESC) C2-2017 Section 443:** "Work on Energized Lines and Equipment" Sub-Section J "Gas-Insulated equipment", "By-products resulting from arcing in

Sulfur-Hexafluoride (SF6) gas insulated systems are generally toxic and irritant".

2. **USEPA Office of Air and Radiation – Catalog of Guidelines and Standards for the Handling and Management of Sulfur Hexafluoride (SF_6):** "Catalog list more than 65 references addressing topics related to the safe handling, management, and removal of Sulfur Hexafluoride infused components in the electrical, magnesium processing, and semiconductor industries". The project will improve consistency to the code by safe removal of this greenhouse gas.
3. **2017 National Electrical Safety Code (NESC) C2-2017 Section 12:** "Installation and Maintenance of Equipment", Sub-Section 125 "Working Space about Electric Equipment", Part B "Working Space Over 600 Volts".
4. **OSHA Confined Work Space Definition:** "Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, **underground utility vaults, tunnels**, pipelines, and open top spaces more than 4 feet in depth such as pits, tubs, vaults, and vessels.

Appendix F – Evidence of Increased Repairs

APPENDIX F

Evidence of increased repairs/service interruption

Central Steam Plant

BOILER REPAIR AND MAINTENANCE SINCE 2018

YEAR	O&M	REPAIR	WORK FOR OTHERS	IMPROVEMENT	GRAND TOTAL
2018	20,433.83				20,433.83
2019	37,740.41		293.36	4,066.18	42,099.95
2020	49,047.93		2,624.63	12,770.92	64,443.48
2021	12,140.67	2,396.36	3,618.64	212,951.29	231,106.96
2022	4,376.60		1,233.75	25,615.94	31,226.29
GRAND TOTAL	**123,739.44**	**2,396.36**	**7,770.38**	**255,404.33**	**389,310.51**

Boiler Maintenance and Repair

2018 - 2022

Work Order	Description	Status	Type	Category	Date Created
18-153954	ROZ, MOVE #1 & #2 POSCA VALVES BACK FOR EASIER ACCESS ON #1 BOILER.	CLOSED	O&M	DSW	4/13/2018
18-154021	ROZ, REPLACE SURFACE BLOW ISOLATION BALL VALVE ON THE SIDE OF #4 BOILER	CLOSED	O&M	DSW	4/17/2018
18-154100	ROZ, REPAIR EXHAUST FAN IN BOILER ROOM	CLOSED	O&M	DSW	4/19/2018
18-154185	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	4/20/2018
18-154295	ROZ, REPLACE LEAKING 1/2" 90 ELBOW, ALSO REPLACE 1/2" UNION, BOTH SCHED. 80, ON #5 BOILER NON R	CLOSED	O&M	DSW	4/24/2018
18-154452	CLOSE UP BOILER ANNUAL	CANCEL	O&M	PM	4/27/2018
18-154466	LUBRICATE & CLEAN BOILER FEEDWATER PUMP & HOTWELL MOTORS.	CLOSED	O&M	DSW	4/27/2018
18-154996	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	5/11/2018
18-155497	ROZ, REPLACE GLASS IN BOILER ROOM WINDOWS DUE TO VANDALISM	CLOSED	O&M	DSW	5/24/2018
18-155691	VALVE OFF, LOTO, DRAIN & CLEAN WATERSIDE/FIRESIDE #5 BOILER.	CLOSED	O&M	DSW	5/31/2018
18-155786	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	6/1/2018
18-155834	ROZ, REMOVE SAFETY VALVES #5 BOILER, SEND OUT FOR CERTIFICATION.	CLOSED	O&M	DSW	6/4/2018
18-156001	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	6/8/2018
18-156713	ROZ, LOTO, OPEN, DRAIN & CLEAN #1 BOILER. REPAIR REFRACTORY/CLEAN FIREBOX,BLOWOUT & VACUUM	CLOSED	O&M	DSW	6/26/2018
18-156714	ROZ - REMOVE SAFETY VALVES #1 BOILER, SEND OUT FOR CERTIFICATION.	CLOSED	O&M	DSW	6/26/2018
18-156897	BOILER CHEMICAL TREAMENT SYSTEM ANNUAL	CANCEL	O&M	PM	6/29/2018
19-157738	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	7/13/2018
19-158792	BOILERS SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	8/10/2018
19-158841	BOILER SAFETY VALVES MONTHLY	CANCEL	O&M	PM	8/10/2018
19-159102	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	8/17/2018
19-159261	ROZ - CLOSE UP #1 BOILER.	CLOSED	O&M	DSW	8/22/2018
19-159626	CLOSE UP BOILER ANNUAL	CANCEL	O&M	PM	8/31/2018
19-159879	CLOSE #5 BOILER, FILL & WET STORE.	CLOSED	O&M	DSW	9/11/2018
19-160060	BOILER SAFETY VALVES MONTHLY	CANCEL	O&M	PM	9/14/2018
19-160311	ROZ - REPLACE POLY TUBING ON BOILER CHEMICAL SYSTEM.	CLOSED	O&M	DSW	9/21/2018
19-160375	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	9/21/2018
19-160517	ROZ, ASSIST WITH TUNING ON #5 BOILER	CLOSED	O&M	DSW	9/26/2018
19-160674	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	9/28/2018
19-160833	ROZ, TEST FIRE OIL #1 & #4 BOILERS.	CLOSED	O&M	DSW	10/3/2018
19-160928	GC1-4 - GENERAL CAMPUS ZONE 4 - WASHINGTON COURT #5 - CHECK & SERVICE THE BOILER ON HEATING !	CLOSED	O&M	DSW	10/5/2018
19-161070	ROZ, TROUBLESHOOT ELECTRICAL ISSUE ON #2 BOILER	CLOSED	O&M	DSW	10/9/2018
19-161230	BOILER SAFETY VALVES MONTHLY	CANCEL	O&M	PM	10/12/2018
19-161490	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	10/19/2018
19-161705	REPLACE BOILER HOT CIRC. PUMP. WITH NEW PUMP. DISCONNECT WIRING.	CLOSED	O&M	DSW	10/26/2018
19-162178	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	11/9/2018
19-162601	ROZ - OPEN #2 BOILER FOR INTERNAL INSPECTION. REPAIR REFRACTORY IN FIREBOX. CLOSE BOILER AFTER II	CLOSED	O&M	DSW	11/26/2018
19-163394	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	12/14/2018
19-163544	ROZ, REPLACE STAIRS THAT WERE TAKEN DOWN FOR #5 BOILER FAN REPAIR.	CLOSED	O&M	DSW	12/20/2018
19-163669	ROZ, REPLACE SEAL ON #1 BOILER FEEDWATER PUMP.	CLOSED	O&M	DSW	12/26/2018
19-163974	DRAIN NEEDS SNAKED, BACK SINK IN ROZELL BOILER RM.	CLOSED	O&M	DSW	1/4/2019
19-164291	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	1/11/2019
19-164468	ROZ, REPLACE STAIRS NEXT TO #4 BOILER.	CLOSED	O&M	DSW	1/17/2019
19-164949	TROUBLESHOOT O2 PROBE ON #1 BOILER.	CLOSED	O&M	DSW	2/1/2019
19-165067	ROZ - REPLACE GASKET ON #2 BOILER NON-RETURN VALVE BONNET.	CLOSED	O&M	DSW	2/5/2019
19-165210	BOILERS SEMI ANNUAL- HOUSING, DBH	CLOSED	O&M	PM	2/8/2019
19-165439	BOILER SAFETY VALVES MONTHLY	CANCEL	O&M	PM	2/15/2019
19-165455	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	2/15/2019
19-165894	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	3/1/2019
19-166322	BOILER SAFETY VALVES MONTHLY	CANCEL	O&M	PM	3/15/2019
19-166563	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	3/22/2019
19-166788	CLOSE UP BOILER ANNUAL	CANCEL	O&M	PM	3/29/2019
19-166789	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	3/29/2019
19-166862	SUR, RESET ALARM ON BOILERS	CLOSED	O&M	DSW	4/1/2019
19-166881	ROZ, REPLACE ROSEMOUNT O2 BOX IN #1 BOILER PANEL.	CLOSED	O&M	DSW	4/2/2019
19-166896	DBH, CHECK BOILERS, POSSIBLE ALARM	CLOSED	O&M	DSW	4/2/2019
19-166967	ROZ - REMOVE & RE-WELD COVER FOR #1 BOILER FAN.	CLOSED	O&M	DSW	4/4/2019
19-167201	SUR, CHECK BOILERS AT SURBECK DUE TO COLD IN BUILDING.	CLOSED	O&M	DSW	4/11/2019
19-167281	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	4/12/2019
19-167409	REPLACE BOILER HOT-CIRC. MOTOR, SEAL & PRESSURE RELIEF VALVE ON HEAT EXCHANGER.	CLOSED	O&M	DSW	4/17/2019
19-167532	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	4/19/2019
19-167747	ROZ - DRAIN & OPEN/CLEAN #5 BOILER.	CLOSED	O&M	DSW	4/26/2019
19-167748	ROZ - FLUSH LINES & POTS FOR #5 BOILER STEAM FLOW METER.	CLOSED	O&M	DSW	4/26/2019
19-167785	CLOSE UP BOILER ANNUAL	CANCEL	O&M	PM	4/26/2019
19-168255	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	5/10/2019
19-168325	REMOVE BOILER CIRC. HEAT EXCHANGER TUBE BUNDLE TO CHECK FOR LEAKS.	CLOSED	O&M	DSW	5/13/2019
19-168666	REPLACE BAD OIL GAUGE ON #2 BOILER & BAD F/W GAUGE ON #4 BOILER.	CLOSED	O&M	DSW	5/22/2019
19-168696	ROZ - REPLACE STEAM WARM UP VALVES ON #1 & #4 BOILER CASHCO ATOMIZING STEAM VALVES WITH 1/:	CLOSED	O&M	DSW	5/22/2019
19-168871	1 LED FIXTURE IS OUT & 1 HAS PARTIAL LED STRIP OUT IN THE ROZELL BOILER ROOM.	CLOSED	O&M	DSW	5/29/2019
19-169012	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	5/31/2019
19-169174	ROZ - FINISH REFRACTORY WORK IN #5 BOILER FIREBOX.	CLOSED	O&M	DSW	6/6/2019
19-169358	ROZ, REPLACE LEAKING BALL VALVE ON #2 BOILER SURFACE BLOW LINE	CLOSED	O&M	DSW	6/12/2019
19-169359	ROZ, REMOVE #4 BOILER FAN MOTOR TO SEND OUT FOR NEW BEARINGS & WINDING CHECK.	CLOSED	O&M	DSW	6/12/2019
19-169396	ROZ, INSULATE SHORT SECTION OF PIPING ON #2 BOILER SURFACE BLOW LINE IN ROZELL.	CLOSED	O&M	DSW	6/13/2019
19-169488	BOILER SAFETY VALVES MONTHLY	CANCEL	O&M	PM	6/14/2019
19-169954	BOILER CHEMICAL TREAMENT SYSTEM ANNUAL	CANCEL	O&M	PM	6/28/2019
20-170415	ROZ, RE-PACK #4 BOILER NON RETURN VALVE & MAIN SOOT BLOWER STEAM VALVE.	CLOSED	O&M	DSW	7/2/2019
20-170789	BOILER SAFETY VALVES MONTHLY	CANCEL	O&M	PM	7/12/2019
20-170882	ROZ, LED LIGHT FIXTURE ABOVE #5 BOILER IN ROZELL IS OUT & NEEDS CHECKED.	CLOSED	O&M	DSW	7/17/2019
20-171097	ROZ - REPLACE COVER PLATE ON OUTLET AT NW CORNER OF #4 BOILER	CLOSED	O&M	DSW	7/23/2019
20-171098	ROZ - MAKE NEW COUPLING COVER FOR #4 BOILER FD FAN.	CLOSED	O&M	DSW	7/23/2019
20-171116	ROZ, CLOSE #4 BOILER, FILL & PLACE ON HOT CIRC.	CLOSED	O&M	DSW	7/24/2019

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20-171517	ROZ, CLOSE #5 BOILER & FILL.	CLOSED	O&M	DSW	8/5/2019
20-171668	BOILERS SEMI ANNUAL- HOUSING - DBH	CLOSED	O&M	PM	8/9/2019
20-171868	ROZ - LOTO, DRAIN & OPEN #1 BOILER FOR INSPECTION.	CLOSED	O&M	DSW	8/15/2019
20-171949	BOILER SAFETY VALVES MONTHLY	CANCEL	O&M	PM	8/16/2019
20-171966	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	8/16/2019
20-172425	CLOSE UP BOILER ANNUAL	CLOSED	O&M	PM	9/3/2019
20-172840	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	9/13/2019
20-172876	ROZ - CLOSE #1 BOILER, FILL & PLACE ON HOT-CIRC.	CLOSED	O&M	DSW	9/16/2019
20-172895	IWA 1003 - CP1032 - BOILER PLANT CONTROLS UPGRADE - INTERNAL WORK AGREEMENT	CLOSED	IMPROVEMENT	MAINT SVCS SUPP	9/16/2019
20-173105	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	9/20/2019
20-173254	DBH - FIRE UP THE BOILERS AT BREWSTER HALL FRIDAY 9/27/19	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	9/25/2019
20-173409	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	9/27/2019
20-173977	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	10/11/2019
20-174274	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	10/18/2019
20-174310	ROZ, REPLACE SEALS ON #1 & #2 BOILER FEED WATER PUMPS.	CLOSED	O&M	DSW	10/18/2019
20-174331	IWA 1009 - CP1056 - ROZELL CENTRAL ENERGY PLANT - INSTALL NEW BOILER - INTERNAL WORK AGREEMEN	OPEN	IMPROVEMENT	MAINT SVCS SUPP	10/18/2019
20-174718	ROZ, REPLACE GASKET ON BOILER MAKE UP HEAT EXCHANGER END PLATE.	CLOSED	O&M	DSW	10/31/2019
20-174740	BOILER FORCED DRAFT FAN MOTORS 1, 2, 4 & 5	CLOSED	O&M	PM	11/1/2019
20-174741	BOILER FEED WATER PUMPS 1, 2, & 3 - BI-ANNUAL	CLOSED	O&M	PM	11/1/2019
20-174929	ROZ, TAKE LOCAL 44 APPRENTICES ON TOUR OF TUNNELS AND BOILER PLANT	CLOSED	O&M	DSW	11/6/2019
20-175110	ROZ, ADD BALL VALVE & FITTINGS TO THE TOP OF EACH DRUM LEVEL POT AT BOILERS FOR LINE FLUSHING.	CLOSED	O&M	DSW	11/15/2019
20-175174	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	11/15/2019
20-175937	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	12/16/2019
20-176439	ROZ, OPEN #2 BOILER	CLOSED	O&M	DSW	1/8/2020
20-176483	ROZ, REBUILD OIL REGULATOR ON #1 BOILER	CLOSED	O&M	DSW	1/9/2020
20-176651	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	1/10/2020
20-176801	ROZ, REPLACE BULBS IN ROZELL BATHROOM, BOILER ROOM	CLOSED	O&M	DSW	1/15/2020
20-177430	ROZ, PACK ALL BOILER MANUAL GAS VALVES WITH GREASE PACKING.	CLOSED	O&M	DSW	2/4/2020
20-177731	BOILERS SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	2/14/2020
20-177777	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	2/14/2020
20-177793	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	2/14/2020
20-178204	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	2/28/2020
20-178602	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	3/13/2020
20-178882	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	3/27/2020
20-179105	CLOSE UP BOILER ANNUAL	CLOSED	O&M	PM	4/3/2020
20-179106	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	4/3/2020
20-179255	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	4/10/2020
20-179296	ROZ, THERE'S A HOLE IN THE CONCRETE FLOOR THAT NEED TO BE FILLED/COVERED (ROUGHLY 1' X 6"). THE	CLOSED	O&M	DSW	4/14/2020
20-179403	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	4/17/2020
20-179691	CLOSE UP BOILER ANNUAL	CLOSED	O&M	PM	5/1/2020
20-179973	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	5/15/2020
20-180102	DBH, REPLACE PRV VALVE ON BOILER 1	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	5/21/2020
20-180224	ROZ, FLUSH STEAM FLOW TRANSMITTER LINES FOR #1 & #5 BOILERS IN ROZELL.	OPEN	O&M	DSW	5/26/2020
20-180558	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	6/5/2020
20-180872	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	6/19/2020
21-181473	BOILER CHEMICAL TREAMENT SYSTEM ANNUAL	CLOSED	O&M	PM	7/2/2020
21-181495	ROZ, REPAIR CRACK TUBE INSIDE #5 BOILER, COLE INDUSTRIAL WILL BE DOING THE WORK	CLOSED	O&M	DSW	7/2/2020
21-181574	ROZ, REPLACE ALL TUBING ON BOILER CHEMICAL FEED SYSTEM.	CLOSED	O&M	DSW	7/6/2020
21-181766	ROZ, REPAIR REFRACTORY #1 BOILER BURNER CONE.	CLOSED	O&M	DSW	7/8/2020
21-181967	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	7/17/2020
21-182421	ROZ, LIGHT FIXTURE NOT WORKING BEHIND #5 BOILER IN ROZELL	CLOSED	O&M	DSW	8/6/2020
21-182518	ROZ, REQUESTING SCAFFOLDING SET UP. STEAM LEAK ON #1 BOILER HEADER WARM UP LINE(UPPER CATW.	CLOSED	O&M	DSW	8/10/2020
21-182603	BOILERS SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	8/14/2020
21-182651	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	8/14/2020
21-182813	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	8/21/2020
21-182881	ROZ, I NEED A 30 DAY PEAK DEMAND METER READ ON THE ROZ BOILER PLANT MAIN MSG 480/277V SWITC	CLOSED	O&M	DSW	8/25/2020
21-182936	ROZ, TROUBLESHOOT BOILER CIRC PUMP MOTOR. ROZELL BASEMENT	CLOSED	O&M	DSW	8/27/2020
21-183064	ROZ, CLOSE #1 BOILER & FILL.	CLOSED	O&M	DSW	9/1/2020
21-183166	CLOSE UP BOILER ANNUAL	CLOSED	O&M	PM	9/4/2020
21-183234	ROZ, BACK SINK DRAIN NEEDS SNAKED, CAUSING OTHER DRAINS TO BACK UP. ROZELL BOILER ROOM.	CLOSED	O&M	DSW	9/10/2020
21-183457	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	9/18/2020
21-183724	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	9/29/2020
21-183861	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	10/2/2020
21-183914	DBH, SHUT DOWN AND DRAIN CHILLER FOR SEASON AND START UP BOILERS FOR HEAT.	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	10/6/2020
21-184073	SSB, TURN ON BOILER AND SHUT OFF AC AT MATLOCKS.	CLOSED	O&M	DSW	10/13/2020
21-184082	DBH, BOILER 2 NOT FIRING.	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	10/13/2020
21-184167	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	10/15/2020
21-184338	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	10/23/2020
21-184402	DBH, RESET BOILER #2 AT DBH DUE TO FAILURE.	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	10/26/2020
21-184848	SUR, CHECK OUT GLYCOL LEAK ON BOILERS.	CLOSED	O&M	DSW	11/17/2020
21-184951	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	11/20/2020
21-185212	ROZ, BELTS NEED REPLACED ON NORTH AIR HANDLER IN ROZELL BOILER RM.	CLOSED	O&M	DSW	12/4/2020
21-185280	ROZ, CLEAN BOILER & MASTER PANEL CABINET FILTERS.	OPEN	O&M	DSW	12/10/2020
21-185281	ROZ, REPLACE MOTOR COOLING FANS ON ALL BOILER FEED WATER PUMPS.	CLOSED	O&M	DSW	12/10/2020
21-185593	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	12/24/2020
21-185760	SUR - CHECK BOILER AND GLYCOL DUE TO BUTLERS OFFICE BLOWING COLD.	CLOSED	O&M	DSW	1/4/2021
21-186048	DBH, CHECK OPERATION OF BOILER #2 AT DBR HALL DUE TO SHOWING FAILED.	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	1/19/2021
21-186143	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	1/22/2021
21-186605	BOILERS SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	2/12/2021
21-186790	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	2/19/2021
21-186968	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	2/26/2021

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21-187137	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	3/5/2021
21-187294	ROZ, REPLACE SEAL ON #3 BOILER FEED WATER PUMP. FOR SHOP 200	CLOSED	O&M	DSW	3/15/2021
21-187562	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	3/26/2021
21-187582	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	3/26/2021
21-187746	CLOSE UP BOILER ANNUAL	CLOSED	O&M	PM	4/2/2021
21-187747	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	4/2/2021
21-187929	BOILER/CHILLER CONTRACTOR REPAIR WORK, FY21	CLOSED	REPAIR	MINOR REPAIR	4/13/2021
21-188087	ROZ, REPAIR REFRACTORY #5 BOILER FIREBOX. FOR SHOP 200	CLOSED	O&M	DSW	4/20/2021
21-188180	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	4/23/2021
21-188200	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	4/23/2021
21-188396	CLOSE UP BOILER ANNUAL	CLOSED	O&M	PM	4/30/2021
21-188778	CEB, RM319B HOT EMS BOILER OPREATORS	CLOSED	O&M	DSW	5/18/2021
21-188815	ROZ, LED LIGHT FIXTURE IS OUT AND NOT WORKING, SOUTH END OF ROZELL BOILER ROOM. FOR SHOP 060	CLOSED	O&M	DSW	5/19/2021
21-188918	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	5/21/2021
21-189131	ROZ, REMOVE FLAGGED ITEMS ON #3 BOILER FOR SALVAGE.	CLOSED	O&M	DSW	6/1/2021
21-189251	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	6/4/2021
21-189682	DBH, BOILER REPLACE VALVE, CHILLED WATER BLEEDING THRU TO DRAIN...3RD FL GETTING WATER LEAKEDANNING/ESTIM/		WORK FOR OTHERS	DSW, NON-RPIE	6/24/2021
21-189770	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	6/25/2021
22-190238	BOILER CHEMICAL TREAMENT SYSTEM ANNUAL	CLOSED	O&M	PM	7/2/2021
22-190723	ROZ, REPLACE #1 POSCA CHEMICAL PUMP FOR BOILERS. FOR SHOP 200	CLOSED	O&M	DSW	7/12/2021
22-190724	ROZ, REPLACE ALL POLY TUBING ON BOILER CHEMICAL FEED SYSTEM. `FOR SHOP 200	CLOSED	O&M	DSW	7/12/2021
22-190787	ROZ, OPEN #1 BOILER FOR INSPECTION. FOR SHOP 200	CLOSED	O&M	DSW	7/15/2021
22-190990	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	7/23/2021
22-191540	BOILERS SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	8/13/2021
22-191636	ROZ, CLOSE #1 BOILER & FILL. FOR SHOP 200	CLOSED	O&M	DSW	8/16/2021
22-191702	SUR - CHECK BOILERS AT SURBECK DUE TO ALARM.	CLOSED	O&M	DSW	8/18/2021
22-191810	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	8/20/2021
22-191987	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	8/27/2021
22-192199	CLOSE UP BOILER ANNUAL	CLOSED	O&M	PM	9/3/2021
22-192636	ROZ - MOUNT PNUEMATIC HOSE REEL ON STRUCTURAL POST AT #1 BOILER.	OPEN	O&M	DSW	9/22/2021
22-192795	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	9/24/2021
22-192873	ROZ - TEST FIRE #1 & #4 BOILER ON #2 FUEL OIL.	OPEN	O&M	DSW	9/28/2021
22-193037	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	10/1/2021
22-193038	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	10/1/2021
22-193268	DBH - REPLACE HOT SURFACE IGNITER ON BOILER 1 AT DBR	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	10/11/2021
22-193624	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	10/22/2021
22-193918	BOILER FORCED DRAFT FAN MOTORS 1, 2, 4 & 5	CLOSED	O&M	PM	11/5/2021
22-193919	BOILER FEED WATER PUMPS 1, 2, & 3 - BI-ANNUAL	OPEN	O&M	PM	11/5/2021
22-193985	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	11/5/2021
22-194255	ROZ, PURCHASE AND INSTALL OF AIR DRYER FOR BOILER PLANT	CLOSED	REPAIR	REPLACEMENT	11/17/2021
22-194477	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	11/24/2021
22-194530	SUR - CHECK BOILER #1 DUE TO ALARM	CLOSED	O&M	DSW	11/24/2021
22-195019	SCI, ROOM 298, CEILING LEAK, BOILER OPERATOR WENT OVER AND PLACED BUCKETS UNDER LEAK	CLOSED	O&M	DSW	12/20/2021
22-195040	ROZ, WHITE BOOM LIFT ON BOILER DECK NEXT TO #1 BOILER HAS A BLOWN SEAL ON HYDRAULIC, CAN IT BE	CLOSED	O&M	DSW	12/21/2021
22-195352	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	12/30/2021
22-195725	ROZ, LIGHT SWITCH IN ROZELL BOILER ROOM BATHROOM IS NOT WORKING, NEEDS REPLACED.	OPEN	O&M	DSW	1/18/2022
22-196128	ROZ, TUNE & UPDATE NATURAL GAS CURVE ON #2 BOILER. FOR SHOP 200	CLOSED	O&M	DSW	2/2/2022
22-196231	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	2/4/2022
22-196539	BOILERS SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	2/18/2022
22-196597	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	2/18/2022
22-197004	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	3/4/2022
22-197005	OPEN BOILER FOR INSPECTION ANNUAL	CLOSED	O&M	PM	3/4/2022
22-197460	DBH - REPLACE LEAKING PRV ON HEATING WATER BOILER AT DBR.	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	3/22/2022
22-197490	REPLACE SURFACE BLOW BALL VALVE ON THE SIDE OF #4 BOILER. FOR SHOP 200	OPEN	O&M	DSW	3/23/2022
22-197616	BOILERS SEMI ANNUAL	CLOSED	O&M	PM	3/25/2022
22-197662	ROZ - LOTO, DRAIN, OPEN & WASH #2 BOILER FOR INSPECTION.	CLOSED	O&M	DSW	3/28/2022
22-197827	BOILER SAFETY VALVES MONTHLY	CLOSED	O&M	PM	4/1/2022
22-197828	CLOSE UP BOILER ANNUAL	CLOSED	O&M	PM	4/1/2022
22-197829	OPEN BOILER FOR INSPECTION ANNUAL	OPEN	O&M	PM	4/1/2022
22-197948	ROZ - GAUGE GLASS BLEW OUT ON #4 BOILER, REPLACE GLASS AND GASKETS.	CLOSED	O&M	DSW	4/6/2022
22-198436	BOILERS SEMI ANNUAL	OPEN	O&M	PM	4/22/2022
22-198493	ROZ - REPAIR REFRACTORY AT #5 BOILER BURNER WALL.	OPEN	O&M	DSW	4/25/2022
22-198626	BOILER SAFETY VALVES MONTHLY	OPEN	O&M	PM	4/29/2022
22-198627	CLOSE UP BOILER ANNUAL	CLOSED	O&M	PM	4/29/2022
22-198716	ROZ - REPAIR OR REPLACE LIGHT FIXTURE BEHIND #5 BOILER AT ROZELL.	CLOSED	O&M	DSW	5/4/2022
22-198835	REPLACE SEAL AND O-RING ON #3 BOILER FEED WATER PUMP. FOR SHOP 200	CLOSED	O&M	DSW	5/9/2022
22-199383	ROZ - SHUTDOWN #4 BOILER AND UNPLUG POSCA CHEMICAL FITTING AT STEAM DRUM.	CLOSED	O&M	DSW	5/27/2022
22-199435	ROZ, PURCHASE FISHER CERTIFIED RE MANUFACTURED NPS 1 1/2 ES 667 SIZE 34I DVC6200 FACTORY MTGS	OPEN	O&M	DSW	6/1/2022
22-199468	ROZ, BOILER PLANT PIERCE AC MINI CHAIN HOIST - ANNUAL MAINTENANCE WITH OTHER HOISTS AND LIFTS	OPEN	O&M	PM	6/2/2022
22-199559	BOILER SAFETY VALVES MONTHLY	OPEN	O&M	PM	6/3/2022
22-199560	OPEN BOILER FOR INSPECTION ANNUAL	OPEN	O&M	PM	6/3/2022
22-200006	ROZ, BOILER PLANT, REPAIRS FROM ANNUAL LIFT INSPECTIONS, PIERCE 1TON MONORAIL CRANE #11 - SEE I	OPEN	O&M	DSW	6/21/2022
22-200025	ROZ - REPAIR REFRACTORY ON BURNER WALL #1 BOILER.	OPEN	O&M	DSW	6/22/2022
22-200397	BOILER CHEMICAL TREAMENT SYSTEM ANNUAL	OPEN	O&M	PM	6/30/2022
22-200398	BOILER SAFETY VALVES MONTHLY	OPEN	O&M	PM	6/30/2022

Chilled Water Plant

CHILLER REPAIR AND MAINTENANCE SINCE 2018

YEAR	O&M	REPAIR	WORK FOR OTHERS	IMPROVEMENT	GRAND TOTAL
2018	29,079.88	2,628.38	372.23	1,490.34	33,570.83
2019	47,239.42	5,499.79			52,739.21
2020	46,182.31		4,426.54	34.52	50,643.37
2021	48,927.32	-	10,404.39		59,331.71
2022	22,094.34		8,451.47		30,545.81
GRAND TOTAL	**193,523.27**	**8,128.17**	**23,654.63**	**1,524.86**	**226,830.93**

Chiller Maintenance and Repair

2018 - 2022

Work Order	Description	Status	Type	Category	Date Created
18-154937	ROZ; WIRELESS ACCESS POINT IN THE BASEMENT OF ROZELL. THIS WILL ENABLE THE PLANT OPERATORS TC	CLOSED	IMPROVEMENT	MINOR CONST	5/10/2018
18-154949	POWER OUTAGE TO ACCOMMODATE THE ROZELL CHILLER/ELECTRICAL UPGRADE PROJECT. THIS OUTAGE W	CLOSED	O&M	DSW	5/10/2018
18-154950	POWER OUTAGE TO ACCOMMODATE THE ROZELL CHILLER/ELECTRICAL UPGRADE PROJECT. THIS OUTAGE W	CLOSED	O&M	DSW	5/10/2018
18-154951	POWER OUTAGE TO ACCOMMODATE THE ROZELL CHILLER/ ELECTRICAL UPGRADE PROJECT. THIS OUTAGE V	CLOSED	O&M	DSW	5/10/2018
18-155223	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	5/18/2018
18-155554	CHILLER OIL COOLER STRAINER ANNUAL	CANCEL	O&M	PM	5/25/2018
18-155832	DBH, RESET CHILLER WORK ORDER 18-155842 WAS SENT TO EMS	CLOSED	O&M	DSW	6/4/2018
18-155842	DBH, HELP HVAC TROUBLESHOOT CHILLER SYSTEM WORK ORDER 18-155832 HAS ALREADY BEEN SENT TO H	CLOSED	O&M	DSW	6/4/2018
18-156099	ROZ, INSTALL WALL MOUNTED COMPUTER DESK FOR CHILLER OPERATIONS.	CLOSED	O&M	DSW	6/12/2018
18-156175	ROZ, ADJUST AND REPAIR EXISTING LIGHTING IN THE CHILLER DECK, PUMP ROOM, AND NEAR 1&2 WATER !	CLOSED	O&M	DSW	6/13/2018
18-156282	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	6/15/2018
18-156627	SUR - CUT BACK ROSE BUSH NEAR THE CHILLER AT SURBECK	CLOSED	O&M	DSW	6/22/2018
18-156896	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	6/29/2018
19-157247	ARC - CHILLER ALERT ALARM - ATTN, BILL	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	7/2/2018
19-157475	SCI - POWER OUTAGE TO ACCOMMODATE THE ROZELL CHILLER/ELECTRICAL UPGRADE PROJECT. THIS OUTA	CLOSED	O&M	DSW	7/5/2018
19-157476	ARC - CHILLER ALERT. NO AUDIBLE ALARM. CWST IS IN RANGE. TOM CHASSES WAS CALLED OUT ON THE LC	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	7/5/2018
19-157783	ROZ, REPLACE EXISTING LIGHTS WITH NEW LED LIGHTING IN CHILLER PLANT	CLOSED	REPAIR	REPLACEMENT	7/13/2018
19-157788	DBH, CHILLER NOT RUNNING PLEASE CHECK	CLOSED	O&M	DSW	7/13/2018
19-157795	SUR - CHILLER IS NOT WORKING	CLOSED	O&M	DSW	7/16/2018
19-157837	SUR - CHILLER IS NOT WORKING	CLOSED	O&M	DSW	7/16/2018
19-157989	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	7/20/2018
19-158028	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	7/20/2018
19-158235	DBH, CHECK CHILLER, LOOKS LIKE IT MIGHT BE TURNED OFF	CLOSED	O&M	DSW	7/26/2018
19-158304	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	7/27/2018
19-158398	DBH, CHECK AND RESET CHILLERS	CLOSED	O&M	DSW	7/31/2018
19-158400	SUR, CHILLER NOT WORKING	CLOSED	O&M	DSW	7/31/2018
19-158549	URC CIMCO CHILLER- WEEKLY	CANCEL	O&M	PM	8/3/2018
19-158550	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/3/2018
19-158590	DBH, RESTART CHILLER	CLOSED	O&M	DSW	8/3/2018
19-158791	CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	8/10/2018
19-158815	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/10/2018
19-158897	DBH - REPLACE CONDENSER FAN MOTOR ON CHILLER	CLOSED	O&M	DSW	8/13/2018
19-159072	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/17/2018
19-159351	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/24/2018
19-159589	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/31/2018
19-159625	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	8/31/2018
19-159732	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/7/2018
19-160035	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/14/2018
19-160253	ROZ, OPEN CHILLER CONDENSER'S & PUNCH TUBES.	CLOSED	O&M	DSW	9/19/2018
19-160338	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/21/2018
19-160374	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	9/21/2018
19-160575	URC, PURCHASE AND INSTALL TEMPORARY AMMONIA GAS SENORS FOR GAS DETECTION IN CHILLER AREA	CLOSED	O&M	DSW	9/27/2018
19-160642	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/28/2018
19-160673	ROZELL CHILLER SHUTDOWN	CANCEL	O&M	PM	9/28/2018
19-160712	URC, THE BLAST CHILLER IN THE ROOST BACK KITCHEN IS GIVING SOME SORT OF ERROR CODE AND IS NOT \	CLOSED	O&M	DSW	9/28/2018
19-160953	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/5/2018
19-161132	ARC - UPGRADE CHILLER PANEL TO BACK NET IP-DELTA	CLOSED	O&M	DSW	10/10/2018
19-161204	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/12/2018
19-161326	MAR - CHILLER PUMP REPAIR ON AIR HANDLER #4	CLOSED	O&M	DSW	10/15/2018
19-161327	HUS- CHILLER PUMP REPAIR	CLOSED	O&M	DSW	10/15/2018
19-161339	CHILLER PLANT AIR HANDLER SOUNDS LIKE BELT CAME OFF AND NEEDS CHECKED.	CLOSED	O&M	DSW	10/15/2018
19-161445	ROZ, ON CHILLER DECK, PICK UP WOOD POST AND RELOCATE TO BLDG MAINT POLE BARN	CLOSED	O&M	DSW	10/18/2018
19-161463	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/19/2018
19-161489	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	10/19/2018
19-161696	URC, REPLACE SIDE STREAM FILTERS ON CIMCO CHILLER	CLOSED	O&M	DSW	10/25/2018
19-161718	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/26/2018
19-161893	ROZ, CHECK EXESSIVE HEAT IN PRINTER ROOM ON CHILLER DECK	CLOSED	O&M	DSW	11/1/2018
19-161931	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/2/2018
19-162059	ROZ - INSTALL VENT VALVES ON ALL CHILLER CONDENSER BARRELS.	CLOSED	O&M	DSW	11/6/2018
19-162154	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/9/2018
19-162230	ROZ, ON 11-07-18, GET ALL CONTROLS FOR CHILLER PLANT DRY COOLER POWERED UP AND READY FOR SYS	CLOSED	O&M	DSW	11/13/2018
19-162374	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING - DRE	CLOSED	O&M	PM	11/16/2018
19-162392	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/16/2018
19-162650	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/26/2018
19-162860	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/30/2018
19-163095	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/7/2018
19-163367	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/14/2018
19-163574	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/20/2018
19-163602	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	12/20/2018
19-163785	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/2/2019
19-163921	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/4/2019
19-164266	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/11/2019
19-164467	ROZ, SURPLUS PICK UP FROM ROZELL CHILLER DECK. (LOADING DOCK).	CLOSED	O&M	DSW	1/17/2019
19-164517	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	1/18/2019
19-164531	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/18/2019
19-164556	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	1/18/2019
19-164761	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/28/2019
19-164823	ROZ, REBUILD OR REPLACE STEAM TRAP ON CHILLER PLANT AIR HANDLER CONDENSATE LINE.	CLOSED	O&M	DSW	1/29/2019
19-164824	ROZ, CLOSE #3, #4 & #5 CHILLER CONDENSERS.	CLOSED	O&M	DSW	1/29/2019
19-164977	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	2/1/2019
19-165056	ROZ, REPLACE REMAINDER OF OLD FLUORESCENT FIXTURES IN ROZELL BASEMENT TO MATCH NEW LED ON	CLOSED	O&M	DSW	2/4/2019

Chiller Maintenance and Repair

2018 - 2022

Work Order	Description	Status	Type	Category	Date Created
18-154937	ROZ; WIRELESS ACCESS POINT IN THE BASEMENT OF ROZELL. THIS WILL ENABLE THE PLANT OPERATORS TO	CLOSED	IMPROVEMENT	MINOR CONST	5/10/2018
18-154949	POWER OUTAGE TO ACCOMMODATE THE ROZELL CHILLER/ELECTRICAL UPGRADE PROJECT. THIS OUTAGE W	CLOSED	O&M	DSW	5/10/2018
18-154950	POWER OUTAGE TO ACCOMMODATE THE ROZELL CHILLER/ELECTRICAL UPGRADE PROJECT. THIS OUTAGE W	CLOSED	O&M	DSW	5/10/2018
18-154951	POWER OUTAGE TO ACCOMMODATE THE ROZELL CHILLER/ ELECTRICAL UPGRADE PROJECT. THIS OUTAGE V	CLOSED	O&M	DSW	5/10/2018
18-155223	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	5/18/2018
18-155554	CHILLER OIL COOLER STRAINER ANNUAL	CANCEL	O&M	PM	5/25/2018
18-155832	DBH, RESET CHILLER WORK ORDER 18-155842 WAS SENT TO EMS	CLOSED	O&M	DSW	6/4/2018
18-155842	DBH, HELP HVAC TROUBLESHOOT CHILLER SYSTEM WORK ORDER 18-155832 HAS ALREADY BEEN SENT TO H	CLOSED	O&M	DSW	6/4/2018
18-156099	ROZ, INSTALL WALL MOUNTED COMPUTER DESK FOR CHILLER OPERATIONS.	CLOSED	O&M	DSW	6/12/2018
18-156175	ROZ, ADJUST AND REPAIR EXISTING LIGHTING IN THE CHILLER DECK, PUMP ROOM, AND NEAR 1&2 WATER S	CLOSED	O&M	DSW	6/13/2018
18-156282	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	6/15/2018
18-156627	SUR - CUT BACK ROSE BUSH NEAR THE CHILLER AT SURBECK	CLOSED	O&M	DSW	6/22/2018
18-156896	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	6/29/2018
19-157247	ARC - CHILLER ALERT ALARM - ATTN, BILL	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	7/2/2018
19-157475	SCI - POWER OUTAGE TO ACCOMMODATE THE ROZELL CHILLER/ELECTRICAL UPGRADE PROJECT. THIS OUTA	CLOSED	O&M	DSW	7/5/2018
19-157476	ARC - CHILLER ALERT. NO AUDIBLE ALARM. CWST IS IN RANGE. TOM CHASSES WAS CALLED OUT ON THE LC	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	7/5/2018
19-157783	ROZ, REPLACE EXISTING LIGHTS WITH NEW LED LIGHTING IN CHILLER PLANT	CLOSED	REPAIR	REPLACEMENT	7/13/2018
19-157788	DBH, CHILLER NOT RUNNING PLEASE CHECK	CLOSED	O&M	DSW	7/13/2018
19-157795	SUR - CHILLER IS NOT WORKING	CLOSED	O&M	DSW	7/16/2018
19-157837	SUR - CHILLER IS NOT WORKING	CLOSED	O&M	DSW	7/16/2018
19-157989	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	7/20/2018
19-158028	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	7/20/2018
19-158235	DBH, CHECK CHILLER, LOOKS LIKE IT MIGHT BE TURNED OFF	CLOSED	O&M	DSW	7/26/2018
19-158304	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	7/27/2018
19-158398	DBH, CHECK AND RESET CHILLERS	CLOSED	O&M	DSW	7/31/2018
19-158400	SUR, CHILLER NOT WORKING	CLOSED	O&M	DSW	7/31/2018
19-158549	URC CIMCO CHILLER- WEEKLY	CANCEL	O&M	PM	8/3/2018
19-158550	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/3/2018
19-158590	DBH, RESTART CHILLER	CLOSED	O&M	DSW	8/3/2018
19-158791	CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	8/10/2018
19-158815	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/10/2018
19-158897	DBH - REPLACE CONDENSER FAN MOTOR ON CHILLER	CLOSED	O&M	DSW	8/13/2018
19-159072	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/17/2018
19-159351	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/24/2018
19-159589	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/31/2018
19-159625	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	8/31/2018
19-159732	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/7/2018
19-160035	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/14/2018
19-160253	ROZ, OPEN CHILLER CONDENSER'S & PUNCH TUBES.	CLOSED	O&M	DSW	9/19/2018
19-160338	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/21/2018
19-160374	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	9/21/2018
19-160575	URC, PURCHASE AND INSTALL TEMPORARY AMMONIA GAS SENORS FOR GAS DETECTION IN CHILLER AREA	CLOSED	O&M	DSW	9/27/2018
19-160642	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/28/2018
19-160673	ROZELL CHILLER SHUTDOWN	CANCEL	O&M	PM	9/28/2018
19-160712	URC, THE BLAST CHILLER IN THE ROOST BACK KITCHEN IS GIVING SOME SORT OF ERROR CODE AND IS NOT \	CLOSED	O&M	DSW	9/28/2018
19-160953	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/5/2018
19-161132	ARC - UPGRADE CHILLER PANEL TO BACK NET IP-DELTA	CLOSED	O&M	DSW	10/10/2018
19-161204	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/12/2018
19-161326	MAR - CHILLER PUMP REPAIR ON AIR HANDLER #4	CLOSED	O&M	DSW	10/15/2018
19-161327	HUS- CHILLER PUMP REPAIR	CLOSED	O&M	DSW	10/15/2018
19-161339	CHILLER PLANT AIR HANDLER SOUNDS LIKE BELT CAME OFF AND NEEDS CHECKED.	CLOSED	O&M	DSW	10/15/2018
19-161445	ROZ, ON CHILLER DECK, PICK UP WOOD POST AND RELOCATE TO BLDG MAINT POLE BARN	CLOSED	O&M	DSW	10/18/2018
19-161463	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/19/2018
19-161489	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	10/19/2018
19-161696	URC, REPLACE SIDE STREAM FILTERS ON CIMCO CHILLER	CLOSED	O&M	DSW	10/25/2018
19-161718	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/26/2018
19-161893	ROZ, CHECK EXSESSIVE HEAT IN PRINTER ROOM ON CHILLER DECK	CLOSED	O&M	DSW	11/1/2018
19-161931	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/2/2018
19-162059	ROZ - INSTALL VENT VALVES ON ALL CHILLER CONDENSER BARRELS.	CLOSED	O&M	DSW	11/6/2018
19-162154	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/9/2018
19-162230	ROZ, ON 11-07-18, GET ALL CONTROLS FOR CHILLER PLANT DRY COOLER POWERED UP AND READY FOR SYS	CLOSED	O&M	DSW	11/13/2018
19-162374	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING - DRE	CLOSED	O&M	PM	11/16/2018
19-162392	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/16/2018
19-162650	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/26/2018
19-162860	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/30/2018
19-163095	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/7/2018
19-163367	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/14/2018
19-163574	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/20/2018
19-163602	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	12/20/2018
19-163785	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/2/2019
19-163921	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/4/2019
19-164266	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/11/2019
19-164467	ROZ, SURPLUS PICK UP FROM ROZELL CHILLER DECK. (LOADING DOCK).	CLOSED	O&M	DSW	1/17/2019
19-164517	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	1/18/2019
19-164531	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/18/2019
19-164556	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	1/18/2019
19-164761	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/28/2019
19-164823	ROZ, REBUILD OR REPLACE STEAM TRAP ON CHILLER PLANT AIR HANDLER CONDENSATE LINE.	CLOSED	O&M	DSW	1/29/2019
19-164824	ROZ, CLOSE #3, #4 & #5 CHILLER CONDENSERS.	CLOSED	O&M	DSW	1/29/2019
19-164977	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	2/1/2019
19-165056	ROZ, REPLACE REMAINDER OF OLD FLUORESCENT FIXTURES IN ROZELL BASEMENT TO MATCH NEW LED ON	CLOSED	O&M	DSW	2/4/2019

Chiller Maintenance and Repair

2018 - 2022

Work Order	Description	Status	Type	Category	Date Created
19-165209	CHILLER SEMI ANNUAL- HOUSING, DBH	CLOSED	O&M	PM	2/8/2019
19-165229	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	2/8/2019
19-165408	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	2/15/2019
19-165659	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	2/22/2019
19-165852	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	3/1/2019
19-165891	CHILLER EVAPORATION PUMP ANNUAL	CLOSED	O&M	PM	3/1/2019
19-165893	CHILLER CONDENSOR PUMP ANNUAL	CLOSED	O&M	PM	3/1/2019
19-166078	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	3/8/2019
19-166294	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	3/15/2019
19-166526	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	3/22/2019
19-166562	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	3/22/2019
19-166617	ARC - WORK WITH CARRIER TECHNICIAN REPLACING BACNET INTERFACE BETWEEN THE DELTA EMS PANEL /	CLOSED	O&M	DSW	3/25/2019
19-166755	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	3/29/2019
19-166787	ROZELL CHILLER STARTUP ANNUAL	CLOSED	O&M	PM	3/29/2019
19-166846	ARC, CHILLER UNIT OUT BACK, 1 FAN IS REALLY LOOSE AND WOBBLY, PLEASE ADDRESS	CLOSED	O&M	DSW	4/1/2019
19-167023	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	4/5/2019
19-167184	ROZ, ADD CHILLER ALARM POINTS TO CRITICAL ALARM IN ROZELL, ATTN: TOM CHASSE.	CLOSED	O&M	DSW	4/10/2019
19-167252	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	4/12/2019
19-167504	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	4/19/2019
19-167531	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	4/19/2019
19-167643	SNR, REPLACE CHILLER PUMPS ON AIR HANDLER 3 AND 4	CLOSED	O&M	DSW	4/22/2019
19-167746	ROZ - ADD REFRIGERANT TO #3 CHILLER WHEN RUNNING.	CLOSED	O&M	DSW	4/26/2019
19-167762	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	4/26/2019
19-167784	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	4/26/2019
19-167983	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	5/3/2019
19-168076	DBH - HVAC, START UP CHILLER AT DOROTHY BREWSTER HALL.	CLOSED	O&M	DSW	5/7/2019
19-168152	ROZ, TROUBLESHOOT CHILLER 5 AND COOLING TOWER MOTOR	CLOSED	O&M	DSW	5/8/2019
19-168162	DBH, SNOW VALLEY ASSIST TO CHECK CHILLER FOR BLDG	CLOSED	O&M	DSW	5/8/2019
19-168231	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	5/10/2019
19-168348	ROZ - CHILLER PLANT SOUTH DOOR BY OLD CHLORINE ROOM OFF OF CEDAR STREET, DOOR WON'T CLOSE A	CLOSED	O&M	DSW	5/14/2019
19-168349	ROZ - CHILLER PLANT EAST SIDE DOOR OFF THE LOADING DOCK DOES NOT CLOSE ALL THE WAY. REPORTED	CLOSED	O&M	DSW	5/14/2019
19-168397	URC, ASSIST SNOW VALLEY FOR CHILLER REPAIR	CLOSED	O&M	DSW	5/15/2019
19-168477	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	5/17/2019
19-168495	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	5/17/2019
19-168769	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	5/24/2019
19-168975	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	5/31/2019
19-169011	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	5/31/2019
19-169188	ROZ, REPLACE HEAT EXCHANGERS ON #1 & #2 CHILLERS. JOHNSON CONTROLS TO DO WORK.	CLOSED	O&M	DSW	6/6/2019
19-169247	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	6/7/2019
19-169449	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	6/14/2019
19-169675	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	6/21/2019
19-169704	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	6/21/2019
19-169932	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	6/28/2019
19-169953	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	6/28/2019
20-170587	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	7/5/2019
20-170753	URC - CHECK AND REPAIR AMMONIA LEAK ON CHILLER	CLOSED	O&M	DSW	7/11/2019
20-170765	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	7/12/2019
20-170972	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	7/19/2019
20-170989	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	7/19/2019
20-171015	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	7/19/2019
20-171207	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	7/26/2019
20-171224	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	7/26/2019
20-171414	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/2/2019
20-171667	CHILLER SEMI ANNUAL- HOUSING - DBH	CLOSED	O&M	PM	8/9/2019
20-171691	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/9/2019
20-171762	JFK - AH #7, CHILLER WATER PUMP IS IN ALARM	CLOSED	O&M	DSW	8/12/2019
20-171923	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/16/2019
20-172150	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	8/23/2019
20-172396	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/3/2019
20-172424	CHILLER OIL COOLER STRAINER ANNUAL	CANCEL	O&M	PM	9/3/2019
20-172568	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/6/2019
20-172816	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/13/2019
20-173069	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/20/2019
20-173104	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	9/20/2019
20-173384	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	9/27/2019
20-173408	ROZELL CHILLER SHUTDOWN	CANCEL	O&M	PM	9/27/2019
20-173587	ROZ, OPEN CHILLERS & CLEAN CONDENSER TUBES	CLOSED	O&M	DSW	10/2/2019
20-173588	ROZ, CHECK/CLEAN ALL CHILLER PLANT PUMP STRAINERS.	CLOSED	O&M	DSW	10/2/2019
20-173687	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/4/2019
20-173846	ROZ - POWER DOWN ON CHILLER PLANT SIDE. CALLED OUT STEVE W. REPORTED THAT THE UP STREAM FEE	CLOSED	O&M	DSW	10/9/2019
20-173953	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/11/2019
20-174242	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/18/2019
20-174273	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	10/18/2019
20-174500	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	10/25/2019
20-174762	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/1/2019
20-174972	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/8/2019
20-175147	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/15/2019
20-175317	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	11/22/2019
20-175335	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	11/22/2019
20-175583	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/4/2019
20-175584	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/4/2019

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20-175616	IWA 1016 - CP1039 - URC ICE RINK CHILLER REPAIRS - INTERNAL WORK AGREEMENT	OPEN	IMPROVEMENT	MAINT SVCS SUPP	12/5/2019
20-175836	ROZ, CHILLER PLANT ROLL UP DOOR NOT WORKING PROPERLY. THE DOOR SWITCH ISN'T OPENING THE DOC	CLOSED	O&M	DSW	12/11/2019
20-175912	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/16/2019
20-175966	ROZ, REQUESTING FORKLIFT TO PICK UP (1) NEW CONTROL PANEL FROM CHILLER DECK AND RELOCATE TO	CLOSED	O&M	DSW	12/16/2019
20-176129	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/22/2019
20-176157	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	12/22/2019
20-176235	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	12/26/2019
20-176320	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/3/2020
20-176593	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/10/2020
20-176866	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	1/17/2020
20-176880	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/17/2020
20-176906	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	1/17/2020
20-177085	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/24/2020
20-177315	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	1/31/2020
20-177544	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	2/6/2020
20-177730	CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	2/14/2020
20-177746	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	2/14/2020
20-177836	ROZ, CENTRIFUGAL CHILLER SERVICE INSPECTION CHILLER #1, #2, #3, #4, AND #5.	CLOSED	O&M	DSW	2/14/2020
20-177974	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	2/21/2020
20-178163	CIMCO CHILLER- BIANNUAL	CLOSED	O&M	PM	2/28/2020
20-178164	CIMCO CHILLER- ANNUAL	CLOSED	O&M	PM	2/28/2020
20-178165	CIMCO CHILLER- QUARTERLY	CLOSED	O&M	PM	2/28/2020
20-178166	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	2/28/2020
20-178201	CHILLER EVAPORATION PUMP ANNUAL	CLOSED	O&M	PM	2/28/2020
20-178203	CHILLER CONDENSOR PUMP ANNUAL	CLOSED	O&M	PM	2/28/2020
20-178290	DBH, CHILLER SERVICE PROPOSAL 2020	CANCEL	WORK FOR OTHERS	DSW, NON-RPIE	3/3/2020
20-178382	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	3/6/2020
20-178415	ROZ, CLOSE CHILLER CONDENSERS.	CLOSED	O&M	DSW	3/6/2020
20-178424	ARC, PLEASE SET BACK UP THE SYSTEM TO SEND US ALERTS WHEN THE ARCHIVES BUILDING IS HAVING AIR	OPEN	WORK FOR OTHERS	DSW, NON-RPIE	3/6/2020
20-178576	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	3/13/2020
20-178709	ROZ, PHYSICAL PLANT, REPLACE 19EX CHILLER HEAT EXCHANGERS	CLOSED	O&M	DSW	3/19/2020
20-178837	ROZ, EMERGENCY EXIT DOOR IN THE NEW MCC ROOM OF THE CHILLER DECK IS NOT PROPERLY CORED AND	CLOSED	O&M	DSW	3/25/2020
20-178881	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	3/27/2020
20-178977	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/3/2020
20-178978	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/3/2020
20-179059	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	4/3/2020
20-179060	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	4/3/2020
20-179104	ROZELL CHILLER STARTUP ANNUAL	CLOSED	O&M	PM	4/3/2020
20-179217	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/10/2020
20-179230	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	4/10/2020
20-179350	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	CLOSED	O&M	PM	4/17/2020
20-179351	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/17/2020
20-179368	URC CIMCO CHILLER- WEEKLY	CLOSED	O&M	PM	4/17/2020
20-179402	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	4/17/2020
20-179517	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/24/2020
20-179547	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	4/24/2020
20-179655	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	5/1/2020
20-179750	URC, CHECK CIMCO CHILLER DUE TO AMMONIA SMELL	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	5/5/2020
20-179929	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	5/15/2020
20-180110	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	5/22/2020
20-180122	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	5/22/2020
20-180298	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	5/29/2020
20-180344	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	5/29/2020
20-180494	ARC, CHECK OPERATIONS OF THE CHILLERS AT ARC, DUE TO SERVER ROOM BEING TOO WARM, SEE RELATEI	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	6/4/2020
20-180499	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	6/5/2020
20-180663	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	6/12/2020
20-180815	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	6/19/2020
20-180885	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	6/19/2020
20-180929	SUR, REPAIR CHILLER SENSORS FOR SUPPLY AND RETURN GLYCOL AT SURBECK SERVICES.	CLOSED	O&M	DSW	6/23/2020
20-180986	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	6/26/2020
20-180987	CHILLER - CIMCO - SNO VALLEY - ANNUAL	CLOSED	O&M	PM	6/26/2020
20-180988	CHILLER - CIMCO - SNO VALLEY - ANNUAL	CLOSED	O&M	PM	6/26/2020
20-181053	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	6/26/2020
21-181420	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/2/2020
21-181505	DRE, REPAIR WATER LEAK IN DOMESTIC WATER CHILLER	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	7/2/2020
21-181839	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/14/2020
21-181898	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	CLOSED	O&M	PM	7/17/2020
21-181899	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/17/2020
21-182092	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/24/2020
21-182105	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	7/24/2020
21-182149	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	7/24/2020
21-182218	SUR, CHECK CHILLER AT SURBECK DUE TO NOT RUNNING.	CLOSED	O&M	DSW	7/28/2020
21-182278	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/30/2020
21-182319	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	7/30/2020
21-182335	CHILLER PLANT LOADING DOCK ROLL UP DOOR NOT WORKING SEEMS LIKE NO POWER AT SWITCH.	CLOSED	O&M	DSW	7/31/2020
21-182355	ROZ, INSTALL CONTROLS FOR EMERGENCY HAND OPERATION OF CHILLER PLANT.	CLOSED	O&M	DSW	7/31/2020
21-182370	SUR, CHECK CHILLER, NOT COOLING	CLOSED	O&M	DSW	8/3/2020
21-182432	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	8/7/2020
21-182544	SCI, CHECK FISH ROOMS CHILLER WARM WATER	CLOSED	O&M	DSW	8/11/2020
21-182589	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	8/14/2020
21-182602	CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	8/14/2020

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21-182767	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	8/21/2020
21-182946	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	8/27/2020
21-182995	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	8/27/2020
21-183129	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	9/4/2020
21-183255	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	9/11/2020
21-183342	SUR, CHILLER IS NOT STARTING.	CLOSED	O&M	DSW	9/14/2020
21-183418	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	9/18/2020
21-183655	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	9/29/2020
21-183723	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	9/29/2020
21-183809	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	10/2/2020
21-183860	ROZELL CHILLER SHUTDOWN	CLOSED	O&M	PM	10/2/2020
21-183914	DBH, SHUT DOWN AND DRAIN CHILLER FOR SEASON AND START UP BOILERS FOR HEAT.	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	10/6/2020
21-183969	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	10/9/2020
21-184133	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	CLOSED	O&M	PM	10/15/2020
21-184134	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	10/15/2020
21-184289	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	10/23/2020
21-184337	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	10/23/2020
21-184472	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	10/30/2020
21-184612	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	11/6/2020
21-184747	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	11/13/2020
21-184901	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	11/20/2020
21-184908	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	11/20/2020
21-185036	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	11/30/2020
21-185179	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/4/2020
21-185297	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/11/2020
21-185448	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/18/2020
21-185501	ROZ - STEAM VALVE NOT WORKING ON CHILLER PLANT AIR HANDLER, NEEDS CHECKED OUT.	CLOSED	O&M	DSW	12/21/2020
21-185543	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/24/2020
21-185605	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	12/24/2020
21-185667	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/31/2020
21-185822	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	1/8/2021
21-185957	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	CLOSED	O&M	PM	1/15/2021
21-185958	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	1/15/2021
21-186098	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	1/22/2021
21-186107	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	1/22/2021
21-186158	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	1/22/2021
21-186261	ROZ, WIRE BRUSH CHILLER CONDENSER COVERS AND CHILLER ENDS, COAT WITH RUST TREATMENT.	CLOSED	O&M	DSW	1/28/2021
21-186277	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	1/29/2021
21-186426	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	2/5/2021
21-186589	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	2/12/2021
21-186604	CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	2/12/2021
21-186726	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	2/19/2021
21-186910	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	2/26/2021
21-187005	ROZ, CLOSE CHILLER CONDENSERS	CLOSED	O&M	DSW	3/1/2021
21-187088	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	3/5/2021
21-187134	CHILLER EVAPORATION PUMP ANNUAL	CLOSED	O&M	PM	3/5/2021
21-187136	CHILLER CONDENSOR PUMP ANNUAL	CLOSED	O&M	PM	3/5/2021
21-187200	URC, REPAIR LEAKING SIDE FILTER ON ICE CHILLER	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	3/10/2021
21-187206	URC, REPLACE DIM AND BURNT OUT BULBS IN URC CHILLER ROOM ATTN STEVE	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	3/11/2021
21-187224	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	3/12/2021
21-187364	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	3/19/2021
21-187508	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	3/26/2021
21-187581	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	3/26/2021
21-187677	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/2/2021
21-187745	ROZELL CHILLER STARTUP ANNUAL	CLOSED	O&M	PM	4/2/2021
21-187833	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/9/2021
21-187929	BOILER/CHILLER CONTRACTOR REPAIR WORK, FY21	CLOSED	REPAIR	MINOR REPAIR	4/13/2021
21-187986	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	CLOSED	O&M	PM	4/16/2021
21-187987	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/16/2021
21-188143	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/23/2021
21-188199	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	4/23/2021
21-188354	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/30/2021
21-188395	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	4/30/2021
21-188464	ROZ, ADD R-134A REFRIGERANT TO #3 CHILLER, ROZELL BASEMENT. FOR SHOP 200	CLOSED	O&M	DSW	5/4/2021
21-188515	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	5/7/2021
21-188683	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	5/14/2021
21-188871	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	5/21/2021
21-188878	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	5/21/2021
21-189014	DBH, ENABLE CHILLER	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	5/26/2021
21-189050	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	5/28/2021
21-189097	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	5/28/2021
21-189191	DBH, CHECK CHILLER AT DOROTHY BREWSTER HALL DUE TO NO COOLING.	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	6/4/2021
21-189197	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	6/4/2021
21-189368	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	6/11/2021
21-189510	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	6/18/2021
21-189582	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	6/18/2021
21-189704	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	6/25/2021
21-189705	CHILLER - CIMCO - SNO VALLEY - ANNUAL	CLOSED	O&M	PM	6/25/2021
21-189706	CHILLER - CIMCO - SNO VALLEY - ANNUAL	OPEN	O&M	PM	6/25/2021
21-189769	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	6/25/2021
21-189867	SUR, CHECK CHILLER OPERATION	CLOSED	O&M	DSW	6/30/2021

Chiller Maintenance and Repair

2018 - 2022

Work Order	Description	Status	Type	Category	Date Created
21-189870	SUR, CLEAR OUT CANADIAN THISTLE AND ROSE BUSH BEHIND CHILLER TO MAINTAIN ACCESS	OPEN	O&M	DSW	6/30/2021
22-189916	DBH, RESET CHILLER	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	7/1/2021
22-190180	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/2/2021
22-190660	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/9/2021
22-190798	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	CLOSED	O&M	PM	7/16/2021
22-190799	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/16/2021
22-190946	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/23/2021
22-190954	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	7/23/2021
22-191004	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	7/23/2021
22-191110	URC, CHECK CIMCO CHILLER DUE TO COMPRESSOR ALARM.	CLOSED	O&M	DSW	7/29/2021
22-191127	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	7/30/2021
22-191189	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	7/30/2021
22-191355	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	8/6/2021
22-191433	DBH, RESET CHILLER	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	8/9/2021
22-191513	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	8/13/2021
22-191539	CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	8/13/2021
22-191762	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	8/20/2021
22-191944	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	8/27/2021
22-191986	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	8/27/2021
22-192149	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	9/3/2021
22-192302	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	9/10/2021
22-192456	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	9/17/2021
22-192741	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	9/24/2021
22-192794	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	9/24/2021
22-192966	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	10/1/2021
22-193036	ROZELL CHILLER SHUTDOWN	CLOSED	O&M	PM	10/1/2021
22-193200	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	10/8/2021
22-193360	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	CLOSED	O&M	PM	10/15/2021
22-193361	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	10/15/2021
22-193585	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	10/22/2021
22-193623	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	10/22/2021
22-193657	URC - REPAIR SIMCO CHILLER GLYCOL LEAK	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	10/22/2021
22-193676	ARC - REPLACE DISCHARGE SERVICE VALVES AND FILTER DRIERS ON CIRCUIT B ON CHILLER AT ARCHIVES. S	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	10/25/2021
22-193914	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	11/5/2021
22-194116	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	11/12/2021
22-194284	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	11/19/2021
22-194363	URC, CHILLER COMPRESSOR #2 IN ALARM, TOM PECHA WAS CALLED OUT, CAN WAIT TIL MORNING	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	11/22/2021
22-194419	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	11/24/2021
22-194428	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	11/24/2021
22-194635	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/3/2021
22-194743	ROZ - CLEAN CHILLER CONDENSER ENDS AND COVERS WITH WIRE WHEEL, COAT WITH RUST TREATMENT.	OPEN	O&M	DSW	12/7/2021
22-194807	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/9/2021
22-195051	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/21/2021
22-195086	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/23/2021
22-195200	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	CLOSED	O&M	PM	12/23/2021
22-195271	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	12/30/2021
22-195462	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	1/7/2022
22-195652	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	CLOSED	O&M	PM	1/14/2022
22-195653	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	1/14/2022
22-195795	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	1/20/2022
22-195814	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	1/20/2022
22-195859	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	1/20/2022
22-195980	URC, CIMCO CHILLER OF IN ALARM, CHECK OPERATIONS	CLOSED	WORK FOR OTHERS	DSW, NON-RPIE	1/26/2022
22-196017	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	1/28/2022
22-196100	ROZ - CLOSE #1, #2, #3 & #5 CHILLER CONDENSERS.	CLOSED	O&M	DSW	2/1/2022
22-196193	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	2/4/2022
22-196334	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	2/11/2022
22-196429	ROZELL PLANT CHILLER SERVICE PROPOSAL 2022 - CONTRACTOR PREVENTIVE MAINTENANCE - SNO VALLEY	OPEN	O&M	PM	2/14/2022
22-196526	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	2/18/2022
22-196538	CHILLER SEMI ANNUAL- HOUSING	CLOSED	O&M	PM	2/18/2022
22-196918	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	3/4/2022
22-197001	CHILLER EVAPORATION PUMP ANNUAL	OPEN	O&M	PM	3/4/2022
22-197003	CHILLER CONDENSOR PUMP ANNUAL	OPEN	O&M	PM	3/4/2022
22-197172	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	3/11/2022
22-197356	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	3/18/2022
22-197531	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	3/25/2022
22-197615	CHILLER SEMI ANNUAL	OPEN	O&M	PM	3/25/2022
22-197771	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/1/2022
22-197929	URC, REPLACE MOTOR BEARINGS ON COMPRESSOR 2 ON THE CIMCO ICE CHILLER	OPEN	WORK FOR OTHERS	DSW, NON-RPIE	4/5/2022
22-198022	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/8/2022
22-198197	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	OPEN	O&M	PM	4/15/2022
22-198198	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	4/15/2022
22-198346	ARC, CHECK OUTSIDE CHILLER DUE TO ALARM ON CIRCUIT A	OPEN	WORK FOR OTHERS	DSW, NON-RPIE	4/21/2022
22-198372	CHILLER/EVAPORATOR - CIMCO - WEEKLY	CLOSED	O&M	PM	4/22/2022
22-198435	CHILLER SEMI ANNUAL	CLOSED	O&M	PM	4/22/2022
22-198576	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	4/29/2022
22-198625	CHILLER OIL COOLER STRAINER ANNUAL	OPEN	O&M	PM	4/29/2022
22-198773	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	5/6/2022
22-198923	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	5/13/2022
22-199112	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	5/20/2022
22-199130	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	OPEN	O&M	PM	5/20/2022

Chiller Maintenance and Repair

2018 - 2022

Work Order	Description	Status	Type	Category	Date Created
22-199323	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	5/27/2022
22-199356	CHILLER OIL COOLER STRAINER ANNUAL	CLOSED	O&M	PM	5/27/2022
22-199504	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	6/3/2022
22-199704	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	6/10/2022
22-199844	URC - CLEAN OUT SIDE FILTERS ON CIMCO BRINE CHILLER.	OPEN	WORK FOR OTHERS	DSW, NON-RPIE	6/14/2022
22-199895	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	6/16/2022
22-200071	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	6/24/2022
22-200141	DOMESTIC WATER CHILLER SEMI ANNUAL- JFK	OPEN	O&M	PM	6/24/2022
22-200313	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	6/30/2022
22-200314	CHILLER - CIMCO - SNO VALLEY - ANNUAL	OPEN	O&M	PM	6/30/2022
22-200315	CHILLER - CIMCO - SNO VALLEY - ANNUAL	OPEN	O&M	PM	6/30/2022
22-200396	CHILLER OIL COOLER STRAINER ANNUAL	OPEN	O&M	PM	6/30/2022
23-200763	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	7/8/2022
23-200866	ARC - CHECK ARCHIVES CHILLER DUE TO ALARM BEING SEEN.	OPEN	WORK FOR OTHERS	DSW, NON-RPIE	7/12/2022
23-200893	SUR - CHECK CHILLER ITS NOT RUNNING	OPEN	O&M	DSW	7/12/2022
23-201076	CHILLER/EVAPORATOR - CIMCO - QUARTERLY	OPEN	O&M	PM	7/15/2022
23-201077	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	7/15/2022
23-201197	SUR - CHECK ON THE CHILLER	OPEN	O&M	DSW	7/19/2022
23-201272	CHILLER/EVAPORATOR - CIMCO - WEEKLY	OPEN	O&M	PM	7/22/2022
23-201291	DOMESTIC WATER CHILLER SEMI ANNUAL- HOUSING	OPEN	O&M	PM	7/22/2022
23-201338	CHILLER SEMI ANNUAL	OPEN	O&M	PM	7/22/2022

Appendix G – Reasonable Estimates

APPENDIX G

Cost Estimates

Central Steam Production

MSI ENGINEERS

EWU - Boiler Replacements - Phase 2

2022 - Capital Budget Cost Estimates

6/27/2022
MSI# 22.06
By: B. Snow

EWU CENTRAL PLANT - STEAM BOILER REPLACEMENTS - PHASE 2

Replace Steam Boiler #2 (25 KPPH)

Replace Steam Boiler B-2 - 25,000 PPH

	Unit	Quantity	$/unit	Cost	
Boiler & Piping Demolition					
Remove Ex. Boiler #2	job	1	$ 20,000.00	$ 20,000	
Crane Rental & Hauling	job	1	$ 10,000.00	$ 10,000	
Remove Steam Piping & supports	job	1	$ 5,000.00	$ 5,000	
Remove Stack & Breeching	job	1	$ 10,000.00	$ 10,000	
Remove FD Fan & Ductwork	job	1	$ 5,000.00	$ 5,000	
Remove Feedwater Piping	job	1	$ 2,500.00	$ 2,500	
Remove Gas Piping	job	1	$ 2,500.00	$ 2,500	
Remove Fuel Oil Piping	job	1	$ 2,500.00	$ 2,500	
Remove Catwalk Piping	job	1	$ 5,000.00	$ 5,000	
Remove Catwalk	job	1	$ 10,000.00	$ 10,000	
Misc. Demo (Lower Level Piping)	job	1	$ 15,000.00	$ 15,000	
					$ 87,500
New Steam Boiler					
25 kpph IWT Steam Boiler - 30 ppm, dual fuel	job	1	$ 1,500,000.00	$ 1,500,000	
Rig, Set & Mount Boiler	job	1	$ 40,000.00	$ 40,000	
Rig, set & Mount Stack Economizer	job	1	$ 15,000.00	$ 15,000	
Rig, Set & Mount Burner & FD Fan	job	1	$ 15,000.00	$ 15,000	
Start-up	job	1	$ 15,000.00	$ 15,000	
Testing	job	1	$ 15,000.00	$ 15,000	
Commissioning	job	1	$ 5,000.00	$ 5,000	
Training	job	1	$ 7,500.00	$ 7,500	
					$ 1,612,500
Steam Piping					
Trap Set	ea	1	$ 5,000.00	$ 5,000	
Steam Piping - 10" sched 40 steel welded	lf	100	$ 250.00	$ 25,000	
Steam Piping - Fittings	%	125	$ -	$ 31,250	
Steam Piping - Insulation	%	50	$ -	$ 28,125	
Atomizing Steam Piping, Valve, Insul.	job	1	$ 10,000.00	$ 10,000	
Condensate Piping, Valves, Insul.	job	1	$ 15,000.00	$ 15,000	
Misc.	ea	0	$ 5,000.00	$ -	
					$ 114,375
Feedwater Piping					
Feedwater Piping - 2" sched 40 steel welded	lf	50	$ 60.00	$ 3,000	
Feedwater Piping - Fittings	%	100	$ -	$ 3,000	
Feedwater Piping - Insulation	%	50	$ -	$ 3,000	
2" BF Valves	ea	3	$ 500.00	$ 1,500	
Feedwater Recirc. Piping	job	1	$ 7,500.00	$ 7,500	
Equip. Connections	ea	3	$ 250.00	$ 750	
Gauges, Drains, Etc.	ea	1	$ 3,500.00	$ 3,500	
					$ 22,250
Boiler Auxiliary Piping					
Blowdown Piping - 2" sched 40 steel welded	lf	150	$ 65.00	$ 9,750	
Blowdown Piping - Fittings	%	50	$ -	$ 4,875	
Blowdown Piping - Insulation	%	25	$ -	$ 3,656	
Surface Blow Down Piping & Valving	job	1	$ 7,500.00	$ 7,500	
Gas Piping Tie-in & Valves	job	1	$ 1,500.00	$ 1,500	
Fuel Oil Piping Tie-in & Valves	job	1	$ 5,000.00	$ 5,000	
Gas Vent Piping	job	1	$ 5,000.00	$ 5,000	
Relief Valve Piping	job	1	$ 5,000.00	$ 5,000	
Misc. Drain Piping, etc.	job	1	$ 5,000.00	$ 5,000	
Chemical Feed Piping	job	1	$ 5,000.00	$ 5,000	
Instrument Air Piping	job	1	$ 5,000.00	$ 5,000	
Hot Standby Loop Piping	job	1	$ 5,000.00	$ 5,000	
					$62,281.25
New Boiler Controllers					
CB Hawk 4500 Control Panel, AB PLC & HMI	ea	1	$ 50,000.00	$50,000	

Wire Field Controllers and Devices (3 men, 2.5 weeks)	mh	320	$ 160.00	$51,200		
Field Control - Steam Meter, FW Meter, etc.	job	1	$ 15,000.00	$15,000		
Misc. materials, control wiring, etc.	job	1	$ 15,000.00	$15,000		
Boiler Control Panel Integration and Program (2 men, 2.0 wks)	mh	160	$ 160.00	$25,600		
Update SCADA & Workstation	ea	1	$ 5,000.00	$5,000		
Misc. work	job	1	$ 5,000.00	$5,000		
					$	166,800
Boiler Plant Plant Auxiliaries						
Overhead Pipe Support Members	job	1	$ 5,000.00	$ 5,000		
Spring Pipe Hangers	job	1	$ 5,000.00	$ 5,000		
Seismic Support & Engineering	job	1	$ 5,000.00	$ 5,000		
Pipeline Painting & ID	job	1	$ 5,000.00	$ 5,000		
Valve Tagging	job	1	$ 2,500.00	$ 2,500		
Catwalk Work	job	1	$ 25,000.00	$ 25,000		
Misc.	job	1	$ 10,000.00	$ 10,000		
					$	57,500
Stack and Breeching						
Boiler Stack Breeching to Ex. Stack Manifold - S.S.	job	1	$ 25,000.00	$ 25,000		
Stack Insulation	job	1	$ 15,000.00	$ 15,000		
Connection Modifications	job	1	$ 5,000.00	$ 5,000		
Stack Supports and Hangers	job	1	$ 7,500.00	$ 7,500		
					$	52,500
Electrical Modifications						
Demo Existing Boiler and FD Fan Power	job	1	$10,000.00	$10,000		
Install Power to Boiler and FD Fan	job	1	$25,000.00	$25,000		
Test & Balance, Start-up & Commissioning	job	1	$5,000.00	$5,000		
Electrical Upgrades/Connections	jobe	1	$15,000.00	$15,000		
					$	55,000
			BARE COSTS - SUBTOTAL	**$ 2,230,706**		
	%	20	Design Contigency	$445,942.72		
	%	15	G.C. OH&P	$334,606		
			Boiler #2 - TOTAL	**$3,011,255**		

MSI ENGINEERS

EWU - Boiler Replacements - Phase 2

2022 - Capital Budget Cost Estimates

6/27/2022

MSI# 19.59

By: B. Snow

EWU CENTRAL PLANT - STEAM BOILER REPLACEMENTS - PHASE 2
CAPITAL BUDGET BUDGET PRICE SUMMARY

	Budget Cost Estimate
Replace Steam Boiler #2 (25 KPPH)	
Direct Construction Costs:	$3,011,255
Design Costs @ 12%:	$361,351
Subtotal:	$3,372,605
State Sales Tax @ 8.8%	$296,789
CONSTRUCTION COSTS - GRAND TOTAL:	$3,669,395
AGENCY PROJECT MANAGEMENT, ADMIN., & OTHER COSTS@ 25% -	$917,349
TOTAL PROJECT COSTS -	$4,586,743

Chilled Water Production

MSI ENGINEERS

EWU - Chiller Plant Upgrade
2022 - Chiller Plant Capacity Upgrade Phase 2
Budgetary Level Cost Estimates
6/16/2022
MSI# 22.06
By: B. Snow

CHILLED WATER SYSTEM - CAPACITY UPGRADE PH-2 - DETAIL

Chiller Plant - Phase 2

Replace Chiller #3

	Unit	Quantity	$/unit	Cost
Replace Chiller #3 - 1500 tons				
1500 Ton Water-Cooled Cent. Chiller with VFD - York	ea	1	$500,000.00	$500,000
Demo Ex. Chiller #3	ea	1	$25,000.00	$25,000
Rig & Set - Crane Rental	job	1	$15,000.00	$15,000
Demo Piping & Valves	job	1	$35,000.00	$35,000
New Conc. Pad	ea	1	$15,000.00	$15,000
Chiller Loop Tie-in Piping, Valves & Insulation	job	1	$50,000.00	$50,000
Tower Loop Tie-in Piping, Valves & Insulation	job	1	$50,000.00	$50,000
BAS Upgrades & Control Valves	job	1	$125,000.00	$125,000
Test & Balance, Start-up & Commissioning	job	1	$20,000.00	$20,000
Misc. Piping & Modifications	job	1	$25,000.00	$25,000
Electrical for Chiller Upgrade	job	1	$35,000.00	$35,000
Water Treatment and Cleaning	job	1	$25,000.00	$25,000
Replace Cooling Towers #4 with new Tower				
Demo Existing Cooling Towers	ea	1	$10,000.00	$10,000
Crane & Rigging	job	1	$20,000.00	$20,000
Induced Draft Open Cooling Towers w/ VFDs - 1500 tons	ea	1	$300,000.00	$300,000
Piping modifications & Connections	ea	1	$35,000.00	$35,000
Roof Structural Support Modifications	ea	1	$50,000.00	$50,000
Test & Balance, Start-up & Commissioning	lot	1	$25,000.00	$25,000
BAS Controls & Control Valves	ea	1	$30,000.00	$30,000
Electrical Upgrades/Connections	ea	1	$17,500.00	$17,500
Upgrade Plant Electrical Gear				
Demo Obsolete Electrical MCC in Rozell	job	1	$10,000.00	$10,000
Install new MCC in Rozell	job	1	$50,000.00	$50,000
Test & Balance, Start-up & Commissioning	job	1	$5,000.00	$5,000
Electrical Upgrades/Connections	jobe	1	$15,000.00	$15,000
			Subtotal	$1,487,500
	%	20	Design Contigency	$297,367.61
	%	15	G.C. OH&P	$223,125
			CH-3 - TOTAL	**$2,007,993**

MSI ENGINEERS

EWU - Chiller Plant Upgrade
2022 - Chiller Plant Capacity Upgrade Phase 2
Budgetary Level Cost Estimates

6/16/2022

MSI# 22.06

By: B. Snow

Chiller Plant - Phase 2

Replace Towers #4 & #5

	Unit	Quantit	$/unit	Cost
Replace Cooling Towers #4 & #5 with new Towers				
Demo Existing Cooling Towers	ea	2	$10,000.00	$20,000
Crane & Rigging	job	1	$35,000.00	$35,000
Induced Draft Open Cooling Towers w/ VFDs - 1500 tons	ea	2	$300,000.00	$600,000
Piping modifications & Connections	ea	2	$35,000.00	$70,000
Roof Structural Support Modifications	ea	1	$50,000.00	$50,000
Test & Balance, Start-up & Commissioning	lot	1	$25,000.00	$25,000
BAS Controls & Control Valves	ea	2	$30,000.00	$60,000
Electrical Upgrades/Connections	ea	2	$17,500.00	$35,000
			Subtotal	$895,000
	%	20	Design Contigency	$178,920.35
	%	15	G.C. OH&P	$134,250
			Towers - TOTAL	**$1,208,170**

MSI ENGINEERS

EWU - Chiller Plant Upgrade
2022 - Chiller Plant Capacity Upgrade Phase 2
Budgetary Level Cost Estimates
6/16/2022
MSI# 22.06
By: B. Snow

EWU CHILLER PLANT CAPACITY UPGRADE - PHASE 2
PRE-DESIGN BUDGET PRICE SUMMARY

	Budget Cost Estimate
Chiller Plant Capacity Upgrade - Phase 2	
Replace Chiller #3	$2,007,993
Replace Towers #4 & #5	$1,208,170
CHILLER PLANT UPGRADE - PHASE 2- CONST. COSTS - GRAND TOTAL-	$3,216,163
AGENCY PROJECT MANAGEMENT, ADMIN., & OTHER COSTS@ 25% -	$804,041
TOTAL PROJECT COSTS -	$4,020,204

Medium Voltage Electrical Distribution Switch Upgrades

Original & Updated Cost Estimate

Updated switch pricing

ELECTRICAL UPGRADES

EWU Medium Voltage Electrical Distribution Switch & Conductor Upgrades Estimate

NAC ENGINEERING

7/13/2018
BY: NBH

Campus Switch Upgrades:				
Action Item Description	***Quantity***	***Material Cost***	***Labor Cost***	***Total Cost***
De-energize feeders (one-by-one or batches) - BPA may charge for shut-downs	(28) Possible Shutdowns	$0	$28,000	$28,000
Confirm de-energize (meters or visual open)	(28) Switch locations	$0	$2,800	$2,800
Disconnect bussing/feeders from existing switches	(28) Switch locations	$0	$5,600	$5,600
Sever bussing/feeders and remove from tunnels	(28) Switch locations	$0	$11,200	$11,200
Remove existing switch from tunnels (existing openings or via saw-cutting new holes)	(28) Switch locations	$0	$5,600	$5,600
Pour new pads for each new switch	(28) Switch locations	$14,000	$5,600	$19,600
Provide new above ground switches	(28) New Switches	$560,000	$700,000	$1,260,000
Provide new raceway to/from vaults	(120) LF per Switch (28 switch locations)	$28,000	$84,000	$112,000
Provide new utility vaults for splicing to bussing/feeders	(2) Vaults per Switch (28 switch locations)	$112,000	$168,000	$280,000
Provide excavation for new vaults/raceway	(25) LF per Switch (28 switch locations)	$0	$10,500	$10,500
Provide termination at each new switch	(28) Switch locations	$0	$14,000	$14,000
Provide new labels and location tape	(28) Switch locations	$0	$3,500	$3,500
Training for new systems	Estimated Lot Cost	$0	$50,000	$50,000
Re-energize system (one-by-one or batches) - BPA may charge for shut-downs	(28) Possible Shutdowns	$0	$28,000	$28,000
	Sub Total	$714,000	$1,118,800	$1,830,800
	Design @ 20%	$142,800	$223,360	$366,160
	Construction Contingency	$142,800	$223,360	$366,160
	G.C. Overhead & Profit	$107,100	$167,520	$274,620
	WA Sales Tax (8.8%)	$97,389.60	$152,331.52	$249,721
	Switch Upgrade Final Total*	**$1,300,000**	**$1,900,000**	**$3,200,000**

Campus Conductor Upgrades:				
Action Item Description	***Quantity***	***Material Cost***	***Labor Cost***	***Total Cost***
De-energize feeders (one-by-one or batches) - BPA may charge for shut-downs	(28) Possible Shutdowns	$0	$28,000	$28,000
Remove existing 15KV bussing/feeders for entire campus	(2,250) LF per Switch (28 switch locations)	$0	$453,600	$453,600
Provide new 15KV bussing/feeders for entire campus	(2,250) LF per Switch (28 switch locations)	$1,512,000	$2,268,000	$3,780,000
Provide termination at each new switch	(28) Switch locations	$0	$14,000	$14,000
Hi-Pot (dielectric testing)	Estimated Lot Cost	$0	$10,000	$10,000
GFCI testing	Estimated Lot Cost	$0	$10,000	$10,000
Coordination Study	Estimated Lot Cost	$0	$20,000	$20,000
Re-energize system (one-by-one or batches) - BPA may charge for shut-downs	(28) Possible Shutdowns	$0	$28,000	$28,000
	Sub Total	$1,512,000	$2,831,600	$4,343,600
	Design @ 20%	$302,400	$566,320	$868,720
	Construction Contingency	$302,400	$566,320	$868,720
	G.C. Overhead & Profit	$226,800	$424,740	$651,540
	WA Sales Tax (8.8%)	$206,237	$386,230	$592,467
	Conductor Upgrade Final Total*	**$2,600,000**	**$4,800,000**	**$7,400,000**
	Combined Total	**$3,900,000**	**$6,700,000**	**$10,600,000**

*rounded up to two significant figures

Due to decreased FY2019-21 funding allocation none of this work was accomplished.

Carry estimated costs into FY2021-23

$560,000/28 Switches

= $20,000/switch

Old/Out of Date

Switch price reference.

Updated Switch Pricing

Kenneth Hagerman
Pad-Mount Sales & Application Engineer
P.O. Box 8200 • Bristol, VA 24203-8200
(276) 645-8245 • FAX (276) 645-8206
ken.hagerman@electro-mechanical.com

FEDERAL PACIFIC
Division of Electro-Mechanical Corporation

FP QUOTATION

* EWU to purchase 24 Switches w/ FY 2021-23 Funds.

TO: Chad Saville – Power Plus Reps

COPY: **Tom Streeter – Federal Pacific**

* 24 Switches X $40,661/switch

DATE: July 8, 2022

= $975,864.00 + Tax, Shipping, Storage

SUBJECT: RFQ for MW Engineers
FP Quotation #: 545706

TOTAL NUMBER OF PAGES 2 (including this sheet)

Remove $1M from "MW" 6/28/22 Estimate

THE FOLLOWING BILL OF MATERIAL CONSTITUTES OUR COMPLETE OFFERING; NO OTHER WRITTEN SPECIFICATIONS WILL APPLY.

Item	Qty	Description
1	1	PSE-10-44400-HR-K1-T7-UL-200

15KV, 95KV BIL, **Dead-front, Air Insulated, UL Listed** Padmounted Switchgear with four (4) 3-pole 600 amp group operated Auto-jet rovided with 200 amp bushing wells (one (1) per phase).

Included are:

- HR - Hinge access roof sections over cable compartments
- K1 - Anti-paralleling key interlocks to prevent paralleling of switches in compartments 1 & 2
- T7 - Mounting provisions only with viewing window to accommodate one (1) three-phase fault indicator in each switch compartment with fault indicator viewing window on associated door
- UL - UL listed at 40ka

Unit will be provided with all 200 Amp bushing wells

Pricing..$ 40,661.00 each

Fuse holders, fuses, and Load Break Inserts are NOT included in this Pricing.

Comments and Clarifications:

This quotation is based upon information supplied to the Factory, which may or may not have been complete. Customer is responsible for reviewing this quotation for compliance, deviations, exclusions, and improper information supplied. If you feel an error or omission has been made, please contact Factory immediately.

1. Specifications were not made available at time of inquiry and therefore, none are accounted for in our proposal
2. Elbows and inserts are not included as part of our proposal.
3. This quotation is valid for 30 days. In the event you delay the Shipment Date for any reason, we reserve the right to revise the prices listed herein or revoke the quote in its entirety.
4. Payment Terms are NET 30 Days.
5. Federal Pacific Reserves the right to update our pricing at the time of order.

Normal shipments shall begin within approximately **22-24 weeks** after our acceptance of your formal purchase order so long as you have provided all technical details and data required to release the equipment for manufacture (the "Shipment Date"). If a better shipping schedule is required, please consult the Factory for review of our current manufacturing schedule. When drawing approval is required, the Shipment Date will be delayed by the time necessary for the drawing approval process. Approval drawings (if required) will be submitted within approximately **3-4 weeks** after our acceptance of an order. Hold for approval orders not released within **30 days** shall be reviewed and subject to price increases. The Shipment Date is subject to change at time of order release based on current production backlog.

Freight Terms

(1) **Freight will be EXW Factory with seller paying freight to WA.**

(2) The seller will determine the method of transportation and the routing of the shipment to the purchaser's chosen domestic terminal. Where the purchaser requires shipment by a method of transportation or routing other than that of the seller's selection, any additional transportation and/or packing expense (including but not limited to export packaging and clearance of goods) is to be borne by the purchaser.

All transactions are subject to EMC's Sales Terms and Conditions found at:
https://www.electro-mechanical.com/sales-terms-and-conditions/
Please contact your customer service representative if you are unable to access the site listed above.

MW Engineers

EWU Campus Medium Voltage Switch Upgrades

Estimate of Probable Cost

Date Prepared: 06/28/2022

Prepared By: RDA

Campus Medium Voltage Switch Upgrades	**Quantity**	**Material**	**Labor**	**Total**
Outage	24	$0	$48,960	$48,960
Demo elbows and MV feeder connections from (E) switches	288	$0	$73,440	$73,440
Demo MV taps from bolted-T splices in TER to (E) switches	288	$0	$73,440	$73,440
Capture insulating gas from existing switches prior to demo	24	$36,000	$32,640	$68,640
Remove existing switches from tunnel and dispose	24	$0	$32,640	$32,640
Concrete pad for new switch	24	$42,000	$65,280	$107,280
New switches - See Note 2.	24	$0	$122,400	$122,400
Trenching	96	$259,200	$1,036,800	$1,296,000
Patching Hardscaping	24	$750,000	$268,800	$336,000
New ductbank and feeder from TER point to new switch	48	$597,600	$265,200	$862,800
New ductbank and feeder from new switch to transformer	48	$398,400	$224,400	$622,800
New vaults to connect to existing feeders	5	$18,750	$6,800	$25,550
Terminations in tunnel at termination point	288	$21,600	$97,920	$119,520
Terminations at new switches	288	$21,600	$97,920	$119,520
Power Study	3	$45,000	$20,400	$65,400
General Conditions	3	$75,000	$150,000	$225,000
Labeling	3	$18,750	$18,750	$37,500
Temporary Work and Phasing	3	$45,000	$20,400	$65,400
Subtotal Building - Electrical		$2,328,900	$2,656,190	$4,302,290
Contractor OH&P		$349,335	$398,429	$645,344
Contingency		$465,780	$531,238	$860,458
Design (20%)		$465,780	$531,238	$860,458
WA Sales Tax (8.9%)		$279,817	$319,141	$516,920
Total - Electrical		**$3,889,612**	**$4,436,236**	**$7,185,470**

Notes:

1. Amounts shown are in June 2022 dollars.

2. New switch material costs are deleted from this estimate as EWU will pre-purchase with FY2021-23 remaining funds. See Federal Pacific July 8, 2022 quote.

Appendix H – Campus Infrastructure Renewal 2014 - Steam System Evaluation

The full document can be viewed at this link:

https://in.ewu.edu/facilities/wp-content/uploads/sites/191/2020/08/2014-EWU-Steam-System-Evaluation.pdf

APPENDIX H1

EASTERN WASHINGTON UNIVERSITY

Campus Infrastructure Renewal

STEAM SYSTEM EVALUATION

August 1, 2014

CAMPUS INFRASTRUCTURE RENEWAL
Project AE1368
STEAM SYSTEM EVALUATION

FOR

EASTERN WASHINGTON UNIVERSITY

Cheney, Washington

By

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

MSI Engineers Inc.
108 N. Washington, Suite 505
Spokane, WA 99201
July 2014
MSI # 14.01

Under Contract to NAC|Engineering

TABLE OF CONTENTS

INTRODUCTION

The following report summarizes the evaluation of the Eastern Washington University, EWU, Central Campus Steam Plant and Campus Steam Distribution piping system with regard to current configuration, condition, capacity, and opportunities for expansion to serve future facilities as envisioned under the 2013 Comprehensive Campus Master Plan.

The goal of this steam system evaluation is to identify deficiencies with the present campus wide infrastructure that should be corrected or upgraded, in order to support the ongoing and long term growth of the campus. This report contains recommendations (potential projects) for correcting the noted infrastructure deficiencies, along with corresponding rough order of magnitude cost estimates for these upgrades, in order to assist EWU in putting together their capital funding requests for the upcoming biennium.

- Replacement schedule based on system age.
- Modification/expansion required to accommodate master plan.
- Modification/renovation required to provide operational efficiencies.

EXISTING CAMPUS STEAM SYSTEM

Rozell Central Campus Steam Heating Plant

The Central Campus Steam Plant is located in the Rozell facility at the north end of campus. The steam plant furnishes high pressure steam, 100 psig, to the majority of the campus building through a network of underground tunnels and shallow utilidors, to provide for the space heating and domestic hot water needs of the campus facilities.

There are five high-pressure (100 psig) steam boilers located in the Rozell Heating Plant. All are capable of firing on either natural gas or No. 2 fuel oil. Natural gas is supplied to the plant by AVISTA. Fuel oil is stored in two 15,000 gallon underground storage tanks, installed inside concrete vaults adjacent to the plant.

Steam Boilers

The Rozell Central Campus Steam Plant consists of the following boilers:

Boiler # 1	Babcock & Wilcox, Watertube Natural Gas & #2 Fuel Oil Fired 1,600 Boiler Horsepower 56,000 lb/hr Built 1974
Boiler # 2	E. Keeler, Watertube Natural Gas & #2 Fuel Oil Fired 715 Boiler Horsepower 25,000 lb/hr Built 1960
Boiler # 3*	Union Iron Works, Watertube (*Not in Service) Natural Gas & #2 Fuel Oil Fired 715 Boiler Horsepower 25,000 lb/hr Built 1966
Boiler # 4	Babcock & Wilcox, Watertube Natural Gas & #2 Fuel Oil Fired 1,342 Boiler Horsepower 47,000 lb/hr Built 1969
Boiler # 5	Nebraska, Watertube Natural Gas & #2 Fuel Oil Fired 2,542 Boiler Horsepower 89,000 lb/hr Built 2001

Total Plant Capacity: <u>217,000 lb/hr*</u>

(*Capacity does not include Boiler #3, which is presently not in service, awaiting repairs)

Boilers #1, #3 and #5 are provided with boiler feedwater stack economizers, used to pre-heat the pre-heat the boiler feedwater using hot stack gases through a heat exchanger.

The newest boiler, #5, is equipped with a low NOX burner. None of the other, older boilers, are equipped with low NOX burners.

These five boilers provide high pressure (approx. 100 psig) steam to a common header. This header has multiple branches that distribute steam to the Rozell steam plant for plant heating and deaerator duty, with a main 12" steam main that feeds out in to the campus utility tunnel for distribution to the University buildings.

Normal Plant operating steam pressure readings are between 110 and 100 psig. For the purposes of modeling and calculations, 100 psig was used. In Spokane, this correlates to an absolute pressure of 113.5 psia.

Boiler Plant Auxiliaries

The central steam boiler plant is supported by several auxiliary pieces of equipment to support the plant operation.

Deaerator; The boiler plant is equipped with a 150,000 pph capacity low pressure deaerator unit, used to deoxygenate and condition the make-up water and feed water. A continuously pumped and pressurized feedwater loop supplies feedwater to the various boilers that utilize modulating feedwater valves for water level maintanence. Three (3) 30 hp vertical multistage feedwater pumps supply the system and are staged and modulated with VFDs for capacity control. A separate, steam-powered boiler feedwater pumps is available and is utilized when steam loads exceed approximately 25,000 pph. Exhaust from the steam-powered pump is directed in to the DA tank.

Feedwater Tank: Located in the lower level of the Rozell plant, the feedwater storage tank receives pumped condensate return from the campus steam distribution system. Condensate return temperatures are typically in the range of 150 deg. F to 160 deg. F. A set of three electric single speed DA feedwater pumps provide continuous pressurized supply to the deaerator tank. Staging of the DA feedwater pumps is semi-automatic based on system demand.

Water Treatment Equipment: The chemical water treatment equipment for the steam boiler plant is also located in the lower level of the plant. Dosing pumps and monitoring devices provide chemical feed of corrosion inhibitors and PH maintenance. Make-up water is pre-treated through an ion exchange water softener plant. The steam distribution system appears to be fairly tight, as condensate return is reported to be fairly efficient, returning approximately 95% of the steam condensate back to the plant. Hence, make-up water levels are minimized.

Boiler Stack

Each steam boiler is provided with uptake breeching that connects to a common stack manifold inside the plant. This manifold is then routed through the west sidewall of the

Rozell facility, where it ties in to a single tall concrete and masonry stack. The interior condition of this stack is unknown, but reports from the EWU maintenance staff suggest some of the lining brick may be deteriorating. A full analysis of this boiler plant stack is beyond the scope of this report, but for the long term viability of the campus steam plant, it is recommended that a full study as to the condition and seismic viability of this stack be commissioned.

Plant Operation

The steam boilers are manually staged by the plant operators depending on weather conditions and campus steam load.

During summer months, the smallest boiler, Boiler #2, is used to support campus building domestic hot water demands, with Boiler #4 kept on hot standby for back up.

During the shoulder seasons, spring and fall, Boilers #1 and #4 are used.

During the winter heating season, Boiler #5 is used as the lead boiler, with either Boiler #1 or #4 used as hot standby or for peaking duty.

Fuel Firing Issues

The steam boilers are capable of firing on either natural gas or No. 2 fuel oil as back-up. Because of present limitations with AVISTA's natural gas supply capacity to the City of Cheney, peak gas consumption to the Rozell Plant is limited by contract to approximately 56,000 pph firing rate. Above this level of consumption gas supply pressures drop off due to other gas demands in the campus neighborhood. At this point the standby boilers, #1 or #4, are fired on No. 2 fuel oil, to handle demand greater than 56,000 pph. It is not desirable to have to fire on fuel oil, due to added wear and tear on the burners, loss of efficiency and stack emission issues.

Until such time as AVISTA addresses their gas supply capacity issue to the City of Cheney, this situation will not change. Timing of such an upgrade is unknown and is in the hands of AVISTA.

Campus Steam Tunnel Distribution System

General:

High pressure steam is delivered to the campus through a piping network that is located mostly within an accessible (walkable) underground concrete utility tunnel, that provides a loop around the campus to serve all the major academic & residence hall buildings.
Steam supply and condensate return systems distribute out from the Rozell central plant, through the tunnel network and into the building mechanical spaces. In certain limited cases, the connections from the main tunnel to the buildings, is through shallow, non-accessible, concrete utility trenches, referred to as utilidors. These utilidors generally follow surface sidewalks, and pipes can be accessed by removing the lids of the utilidors if necessary. There are a few instances of direct-buried piping connections from the tunnel to a few of the older buildings.

High pressure steam supply to each building generally terminates at a steam pressure reducing station (PRV), which reduces the steam pressure from 100 psig down to 15 psig, low pressure steam, for distribution within the building. Low pressure steam generally feeds various heating equipment, air handling unit coils, heat exchangers and domestic water heaters. In some buildings the intermediate steam pressure, 60 psig, is used for laundry or cooking equipment.

Pipe Materials & Installation:

It is understood that the steam distribution piping system, supply, pumped return and gravity condensate lines, are constructed of Sched. 40 steel piping. Piping smaller than 2" size is generally threaded, while all piping larger than 2" is welded. Valves are installed with flanges while expansion joints are welded in the pipeline.

The steam piping is generally installed on steel framing, with roller supports, spider alignment guides and inline expansion joints where necessary. Anchors are generally tied directly in to the concrete walls. Steam condensate drip traps are provided at low points, branch take-offs and other drainage points. A dedicated gravity condensate drainage system handles drip traps within the tunnel, with periodic condensate pumps installed to handle the liquid condensate. A separate pump condensate return piping system parallels the steam supply piping. Pumped condensate from each building is delivered in to this line which makes it way back to the feedwater hot well storage tank in Rozell.

Configuration:

The steam distribution piping is configured in a looped manner around the majority of the campus buildings. The west-side loop (known as the HPE loop), exits from Rozell and travels south, parallel to Washington Street, along the edge of the Woodward Field parking lot. The east-side loop (known as the Rozell loop), exits from Rozell, travels east along Cedar Street, turns south to the PUB, bends to the SE to Tawanka, turns to the SW and continues through the central plaza to the Art Complex. Just north of the Communications Building, the east and west loops join together.

There are several notable branches that come off of the looped main:

- HPE Complex Branch
- CEB & Cheney Hall Branch
- WSP & Archives Branch
- Huston & Sutton Branch
- Senior & Kingston Hall Branch

The looped configuration of the HP steam supply main piping allows the steam system to be back-fed from either direction, in the case of maintenance or repair work on any section of the piping. Most pipe branch take-offs have isolation valves on both sides of the branch piping, which allows feed or isolation to occur on either side of the take-off. This provides great flexibility and allows most of the campus to be supplied with steam during service shut-downs on limited sections. Without a looped system, everything downstream from the shut-off point would be without service.

Access:

Access to the utility tunnel is provided in a number of locations. The main entrance, and the beginning of the tunnel, starts in the lower level of the Rozell Plant. Most other major buildings that are connected to the full size tunnel have basement or lower level mechanical rooms with doors that access the tunnel. At a few points along the tunnel route, there are stairway, with doors and surface structures for access or exiting. The original tunnel system also had some manholes with ladders, and a few ventilation turrets with access lids. Most of the manhole lids are sealed or rusted closed.

Age:

The utility tunnel, as well as most of the steam (and chilled water) distribution piping, was constructed in the early 1970s, along with the construction of the new Rozell Central Plant. This plant, and the utility tunnels, replaced the original steam plant (now the PLU bulding) and older direct buried steam distribution system. The tunnel has been expanded over the years to connect new buildings or sections of the campus as growth occurred. Most of the piping in the tunnel is therefore over 40 years old.

Condition:

Despite being over 40 years old, most of the steam supply and condensate return piping systems are in very good condition and have been well maintained. An end-to-end survey of the utility tunnel was conducted and all main branches, tees and major features were photographed for documentation as part of this report.

Most of the main steam supply shut-off valves have been changed from OS&Y gate valves to high performance butterfly valves, which give excellent performance and help to extend the life expectancy of the system. High pressure steam leaks at valves and fittings are virtually non-existent within the tunnel.

Insulation jacketing on the piping and valves was mostly intact and in good condition. Damage due to maintenance or water intrusion appeared minimal.

Capacity:

As part of this analysis, at steam flow model was created for the entire campus steam supply system (see analysis below). This model used information about the existing connected steam loads (PRV stations in each building) and existing steam pipe sizing information, to develop a dynamic tool to help understand steam flow paths through the looped system, and to determine pressure losses from the Rozell Plant to the remote ends of the distribution system.

Both the east and west main loops coming from Rozell are sized as 10" pipes. On the west (HPE) loop, the 10" size continues all the way past the junction to the Art complex, and up to the JFK branch take-off. On the east (Rozell) loop, the 10" pipe continues up to the PUB branch, where is reduces to 8" pipe. This 8" pipe continues in the main tunnel up to the other side of the JFK branch.

Based on historical steam demand diversity for the campus, the steam flow model analysis indicates that the existing 10" & 8" looped steam mains will have sufficient capacity to deliver adequate steam to the campus, including future demands for the expected growth of the Gateway Athletic complex and the Science I & II Buildings. Expected peak pipeline steam velocities do not exceed normal limits and the resultant drop-off pressures to remote building remains manageable.

Tunnel Gravity Condensate System & Pumps:

As noted above, the steam distribution system is provided with a dedicated gravity condensate system to handle drip traps that are located in the tunnel. This is a good design feature as not all campus steam systems have this feature and drip traps are often piped back in to the pumped return lines, which can cause bothersome water hammer and noisy return lines.

The use of electric condensate pumps within the tunnel to collect and return this condensate, is an ongoing issue with the EWU maintenance staff. Electric condensate pumps have issues with the severe conditions experienced in the tunnels, including elevated condensate temperatures that lead to pump seal failure, hot and humid tunnel conditions that impact pump controls and fittings. Maintenance and reliability is an concern for these pumps.

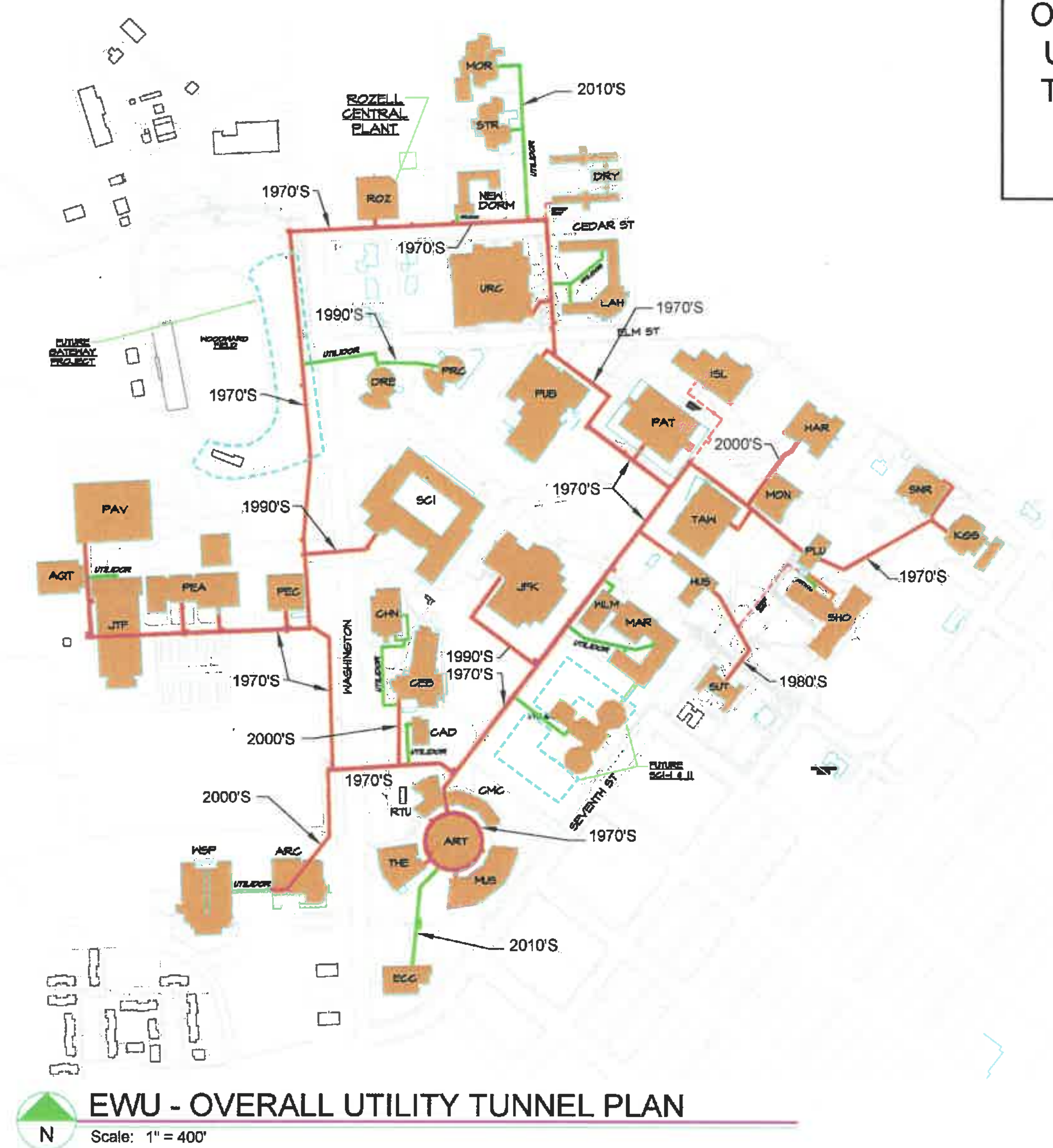
The gravity condensate return piping itself is also a point of concern for possible future failure. Although the present piping appears to be in good condition without reported leaks, it is understood that this piping is standard wall thickness Sched. 40 piping, rather than the more robust Sched. 80 piping. Generally, the heavier wall Sched. 80 piping is used in steam condensate systems to combat the corrosive affects created by the presence of air (oxygen) and carbonic acid (a natural constituent of condensed gases) that occurs in condensate lines. Because the thinner walled piping has been utilized for the gravity condensate piping, the conventional wisdom is that the results of the normal corrosion process has likely accelerated the aging of this pipe (reduced wall thicknesses) to the point that it is a candidate for system-wide replacement.

Life Expectancy:

Based on the observations of the tunnel-wide survey conducted for this report, it appears that the steam supply piping is in good condition without evidence of failures or major leaks. Reports from the EWU maintenance staff indicate that when the piping has been opened for new branch tie-ins or valve work, that the interior of the piping does not show undue corrosion or pitting. Although the majority of the main loop piping is over 40 years, it is reasonable to expect another 15 to 25 years of service life, assuming the same level of care and maintenance in to the future.

Likewise, the pumped condensate return system is also in a condition similar to the supply piping, and being a pressurized system, not subject to effects of condensing steam, it's future life expectancy should also be another 15 to 25 years.

The gravity condensate return piping, as noted above, is more suspect as to its condition, due to the use of thinner walled Sched. 40 piping, and the deteriorating effects of steam condensate action. Without conducting a series of wall thickness field measurement, it is difficult to know to what degree the condensate pipe wall has been degraded, but it is likely much greater that either the supply or pumped lines. Because of that it is reasonable to assume that the gravity condensate piping is nearing the end of its useful life.



TUNNEL CONSTRUCTION KEY

1970'S INDICATES DECADE IN WHICH TUNNEL □ PIPING WAS BUILT

TUNNEL LEGEND

UTILITY TUNNEL
UTILIDOR
DIRECT BURIED PIPE

EASTERN WASHINGTON UNIVERSITY

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EASTERN WASHINGTON UNIVERSITY
CAMPUS INFRASTRUCTURE RENEWAL
PROJECT AE1368
CHENEY, WASHINGTON

NAC NO	111-13508
FILE	
DRAWN	NAH
CHECKED	JBS
DATE	05-30-2014

M-1

CAMPUS STEAM FLOW MODELING & CALCULATIONS

Purpose & Goals

The existing EWU campus steam distribution system was modeled using commercial flow modeling software, in order to help evaluate and understand existing flow pathways though the campus loop, steam main velocities and drop-off delivery pressures to individual buildings. Several models were created to look at various flow demands in order to help determine if the existing steam distribution system has the capacity to handle future campus growth.

Methodology

Using the computerized flow modeling software tools, and schematic plan representing the campus steam piping network was created. This plan was then populated with information regarding existing pipe sizes, pipe lengths, valves and fittings, in order to give an accurate representation of the system geometry.

Next, the various campus buildings were connected to the model as steam "flow demand" points, representing the steam demand for each building. Basically this is the point where the high pressure steam enters the building at the PRV header. Piping beyond the steam header was not modeled, as the goal of the analysis was to see how much residual steam pressure was available from the campus supply, up to the PRV connection point.

Steam Load Data Source

Available construction drawings for each building were pulled from the EWU drawing library and PRV steam load sizing data was extracted from these plans. PRV station data was generally given as maximum design lbs/hr at the expected upstream and downstream pressures. A number of actual building PRV stations were examined in order to spot-check the accuracy of these drawings. The plans were found to be in general agreement with the field installations, so the modeling inputs for steam load are based the information gathered from the available construction documents.

Diversity

Utilizing only the design peak steam demand for all facilities simultaneously does not take into account the actual dynamics of building occupancy and results in an unrealistically high demand on the Central Campus Steam Plant. For example, occupancy levels often don't reach 100% and can therefore reduce the demand for both heating and hot water. In addition, the peak demand for hot water often does not coincide with the peak demand for heating. On a larger scale, peak demand in a given building is often balanced by a reduction in demand in other facilities as students migrate from the dorms to the classrooms, offices and gyms. This 'diversity' results in an overall demand reduction on the expected central steam plant.

According to the EWU steam plant operators, the largest steam demand ever witnessed by the boiler plant occurred this past February during sub-zero weather. This coincided with the remodeled Patterson Hall coming on line for the first time again in about three years, along with its new exterior snow melt system that was active.

The historical peak demand for the boiler plant was noted as 75,000 lbs/hr.
Based on a total campus connected steam load, the sum of all PRV stations, that is

approximately 234,000 lbs/hr, the 75,000 pph represents a diversified load of 32% (of total capacity). Based on a steam boiler plant total capacity of 217,000 pph, this represents a 35% load of plant capacity.

For steam flow modeling purposes, the diversified peak historic steam load was modeled at 40% of peak connected capacity. This value was selected to be somewhat conservative relative to the historic peak of 32%, and also to allow for unknowns an simplifications used in the modeling assumptions, variations of load diversity within the actual campus network, and a safety factor for extreme weather events.

COMPUTERIZED STEAM FLOW MODEL

Modeling Software

Pipe-Flow Professional, Version 12 (2014) by Engineered Software, Inc., was used to construct a computerized steady-state flow model of the steam distribution system. This software utilizes the Darcy-Weisbach formula with Bernoulli's theorem along with an extensive fluid and hardware properties database to solve complex networks including the effects of temperature, pressure, density, enthalpy, and steam quality. Its algorithms and equation solving techniques permit the program to automatically correct logical errors entered by the user (over-constrained system, reverse flow directions, inverted pressures, mismatched pipe sized, etc). Once the user defines the piping network within the software using actual pipe lengths, sizes, fittings, valves, and controls, the program solves the mass and energy balances and returns the solution along with all corresponding fluid properties.

Modeling Approach

Three (3) basic steam models (cases) were developed for the campus distribution analysis.

<u>Case-1: Maximum Design - 100% Connected Loads</u>

Basically this was an academic exercise to set-up the model for actual diversified loads, and it treated all connected buildings as having 100% steam load demand concurrently, with no system diversity. This model was used to validate that the sum of the connected building loads matched the expected values. The results of the flow are not really applicable to the actual steam system operation, which is highly diversified, but it is interesting to note the high resultant pipeline velocities near Rozell with the flow is maximum, and the steep drop off in delivery pressures throughout the network due to the theoretically undersized piping.

<u>Case-2: Historic Peak - 40% Connected Loads</u>

This model is basically the baseline expected peak steam flow demand for the actual existing campus system, based on the historic peak diversified demand of 40% of connected load (see above for diversity discussion).

<u>Case-3: Future Peak - 40% Connected Loads</u>

This model adds in the future steam loads, for the planned Gateway Athletic complex as well as for the new Science I & II facility, to the historic peak loads of Case-2. The diversified load factor of 40% was used for this model.

STEAM FLOW MODEL RESULTS

See the graphic steam piping network drawings that are included with this report.

Case-1: Maximum Design - 100% Connected Loads

Not applicable. This was the model set-up. See discussion above.

Case-2: Historic Peak - 40% Connected Loads

Pipe Velocities:

Results of the steam flow model for this case show that anticipated peak, diversified steam flows and corresponding velocities in the existing piping network, do not exceed accepted values for good engineering practice. Up to 15,000 fpm (250 fps) maximum velocity for steam mains. Peak velocities occur near Rozell where the combined steam flows are the greatest, with the two main 10" branch loops below 6,000 fpm and the 12" plant main at 7,500 fpm. This indicates, and confirms, adequate pipe sizes for the actual existing historic peak loads for the campus.

Pressure Drops:

Results of the steam flow model for this case show peak drop-off pressures to the hydraulically most remote buildings of about 85 psig (to the ECC building at the south end of the campus), or about a 15 psig loss in the piping network. Most buildings show a supply pressure in the low 90 psi range, or better. This indicates that adequate pressure can be maintained throughout the campus at expected peak flow periods.

Case-2: Future Peak - 40% Connected Loads

Pipe Velocities:

With the addition of more steam load to the model to account for future buildings, the results of the steam flow model for this case again show that anticipated peak, diversified steam flows and corresponding velocities in the future piping network, still do not exceed accepted values for good engineering practice. Up to 15,000 fpm (250 fps) maximum velocity for steam mains.

Future peak velocities occur near Rozell where the combined steam flows are the greatest, with the west side main 10" branch loops around 7,500 fpm and the east side 10" main below 6,000 fpm. The 12" plant main at increases to about 9,000 fpm. This indicates, and confirms, adequate pipe sizes for the anticipated future peak campus steam loads for the campus.

Pressure Drops:

The impact of greater future steam flows for this case show peak drop-off pressures to the hydraulically most remote buildings of about 83 psig (to the ECC building at the south end of the campus), or about a 17 psig loss in the piping network, which is only 2 psig more than the present conditions. Most buildings still show a supply pressure in the upper 80 psig or low 90 psi range. This indicates that adequate delivery pressure can be maintained throughout the existing campus distribution system, even with allowance for future steam loads.

STEAM FLOW MODEL CONCLUSIONS

Steam Distribution Piping Capacity for Future Growth

The existing steam distribution piping is adequately sized to handle the current steam loads plus anticipated future growth.

Boiler Plant Capacity for Future Growth

According to the EWU operations staff, the historical peak campus heating load, seen this last winter, was approximately 75,000 lbs/hr.

Based on the anticipated Master Plan campus growth for the New Science I & II projects, the new Gateway Athletic Project, the expected addition of future campus steam load is approximately 34%. Based on a peak historic load of 75,000 pph, a 34% increase would put the future campus steam load at slightly over 100,000 pph, which is approximately 50% of the steam plant's present total capacity 217,000 pph.

Due to anticipated future campus growth, which will increase expected plant peak steam loads by over 30%, the added loads will start to impact boiler plant redundancy & operational flexibility, especially since existing Boiler #3 is no longer operational. In order to return the boiler plant capacity to full original output, it is recommended that Boiler #3 be either repaired and returned to service, or, due to it's advanced age (over 50 years), be replaced entirely with a new boiler. As such, either a repaired, or new boiler, will allow plant operation and redundancy to be maintained well in to the future. Providing a new boiler, instead of repairing an old boiler, would also increase plant operational efficiencies.

CAMPUS STEAM SYSTEM UPGRADE RECOMMENDATIONS

The existing Central Campus Steam Plant has sufficient spare capacity to handle expected future loads, however, the presence of an aging and broken down boiler somewhat limits the plant's spare capacity and operational flexibility. The high pressure steam distribution piping is mostly run to the campus buildings in a underground tunnel system, which is generally well configured to handle future building connections, and has the advantage of being looped, in order to allow for back-feeding the campus to avoid outages for maintenance or new tie-ins. A computerized flow model of the campus steam network, that was prepared as part of this analysis, indicates that the existing steam supply piping is adequately sized to handle expected future growth. The gravity steam condensate piping system within the utility tunnel network is nearing the end of its life expectancy and is a candidate for replacement.

Proposed Campus Steam System Infrastructure Upgrade Projects:

Steam System Recommended Project Summary List

Project No.	Title	Description	ROM Budget Price
SP	Steam Plant		
SP-1	Replace Boiler #3	Replace out-of-service Boiler #3 with a new 40,000 pph boiler to restore plant capacity & redundancy.	$3,500,000
SP-2	Install Feedwater Stack Economizers, Boilers #2 & #4	Install boiler feedwater stack economizers on Boilers #2 & #4 to improve system efficiency and to match other boilers.	$350,000
SP-3	Upgrade Boiler Feedwater Pumps	Replace or supplement the deaerator boiler feedwater pumps to achieve full design capacity of the DA unit.	$200,000
SP-4	Repair Rozell Boiler Stack	Further investigation recommended to determine if the concrete boiler stack at Rozell is sound for continued operation in to the future.	Unknown. (Further Study Required)
SP-5	Upgrade AVISTA Gas Service Capacity	AVISTA needs to upgrade the natural gas capacity to Cheney and EWU in order to allow maximum firing of the natural gas boilers.	By AVISTA
SD	Steam Distribution		
SD-1	Replace Utility Tunnel Gravity Steam Condensate Piping	Due to age and questionable condition the gravity steam condensate piping in the utility tunnels is due for replacement in order to provide reliability for future service.	$1,225,000
SD-2	Replace Utility Tunnel Condensate Pumps	The existing electric condensate pumps in the utility tunnel are problematic and should be replaced with more robust steam powered pumps.	$200,000
SD-3	Label Piping & Identify Branch Take-offs	Utility tunnel piping and branch take-offs are poorly labeled and confusing.	$150,000

		Adding labels and identifiers will assist with future maintenance and repair work.	
SD-4	Upgrade Piping in PLU & Repurpose Building	The decommissioned space inside the old, original steam plant, which presently serves as a piping junction in the tunnel network, could be better utilized if the piping was modernized/upgraded and the space reorganized.	$125,000

Central Campus Steam Plant (SP)

Overall the existing Central Campus Steam Plant is in good condition, and has been very well maintained, despite running with several boilers that are over 40 years old. Basically the steam plant, and has sufficient capacity to handle the anticipated steam loads for the 10 year master plan growth, but due to one boiler being out of service, redundancy is limited. Several projects have been identified below to provide some added plant reliability/capacity, and to increase system efficiencies.

SP-1: Replace Boiler #3

Description:

Replace existing 25,000 pph steam Boiler #3.

- Replace: Install a new 40,000 pph high pressure steam boiler with dual fuel (oil & gas) low NOX burner. Install new correctly sized stack economizer (boiler feedwater pre-heater).

  (This recommendation is a concurrence of the boiler replacement "1.02-ROZ" as previously suggested by McKinstry in their *2012 Energy Efficiency & Sustainability Report*)

Analysis/Justification:

The existing steam Boiler #3 has been out of service for a number of years due to several outstanding breakdowns and lack of repair funds. Boiler #3 is almost 50 years old and parts are difficult to find. Despite being maintained in excellent condition over the years by the EWU staff, this boiler is basically near the end of its life expectancy.

Future campus growth will increase expected plant steam loads by over 30%, which will start to impact boiler plant redundancy & operational flexibility. A repaired, or new boiler, will allow plant operation and redundancy to be maintained in to the future. A new boiler would increase operational efficiencies.

According to the EWU operations staff, the historical peak campus heating load, seen this last winter, is approximately 75,000 lbs/hr.

Based on the anticipated master plan campus growth for the New Science I & II projects, the new Gateway Athletic Project, the expected addition of future campus steam load is approximately 34%. Based on a peak historic load of 75,000 pph, a 34% increase would put the future campus steam load at over 100,000 pph, which is approximately 50% of the steam plant's present total capacity 217,000 pph.

Sequence / Category:

Capital Master Plan.

Cost:

SP-1: $3,500,000

SP-2: Install Boiler Feedwater Stack Economizers on Boilers #2 & #4.

Description:

Install new boiler feedwater stack economizers on existing steam boilers #2 & #4. This installation would allow these boiler configurations to match boilers #1 & #5, which already have stack economizers in operation.

(This recommendation is a concurrence of the stack economizer installation "1.00-ROZ" as previously suggested by McKinstry in their *2012 Energy Efficiency & Sustainability Report*)

Analysis/Justification:

The existing steam Boilers #2 and #4, which are mostly operated in the shoulder and summer seasons, are not provided with boiler feedwater stack economizers, which are present on the other plant boilers. As a result, the operational efficiencies of these boilers are not a high as is possible, thereby reducing the plant's overall energy efficiency.

Also, because of the different feedwater configuration that these two boilers use, compared to the other boilers, the feedwater pumping loop must be run at differing pressures, which complicates plant operation. New boiler feedwater stack economizers would increase boiler plant operational efficiencies, and simplify feedwater system operation.

Sequence / Category:

Improve Operational Efficiencies.

Cost:

SP-2: $350,000

SP-3: Upgrade Boiler Feedwater Pumps

Description:

Replace the aging feedwater tank transfer pumps and upgrade or supplement the undersized Deaerator unit boiler feedwater pumps.

Analysis/Justification:

The existing single speed feedwater transfer pumps that provide feeddwater from the condensate return storage tank to the deaerator tank, are old and in questionable condition. This project would replace these pumps with new high efficiency pumps with improved controls for staging and monitoring.

The existing VFD driven boiler feedwater pumps that are part of the deaerator unit were recently installed as part of an energy retrofit to the plant, but, according to the plant operators, are having trouble keeping up with the feedwater demands of the boilers. These newer VFD driven pumps were downsized to 30 hp each, from the original single speed 50 hp feedwater pumps. Capacity reduction is unknown, but appears to be a factor in plant operation, requiring the operators to run the auxiliary steam-driven feedwater pump during peak loads. Redundancy is questionable with this configuration, so it is proposed that the new feedwater pumps be replaced with larger pumps or supplemented with an additional pump.

Sequence / Category:

Capital Master Plan.

Cost:

SP-3: $200,000

SP-4: Repair Rozell Heating Plant Boiler Stack

Description:

Repair the existing Rozell Heating Plant concrete/masonry boiler stack.

Analysis/Justification:

The condition of the existing exterior concrete/masonry boiler stack at the Rozell heating plant is the subject of some concern. According to EWU staff, there is reason to suspect some of the interior lining material has started to fail and/or fall off. Further, it is unknown if the original construction and/or present condition of this stack is up to present seismic standards.

A full analysis of the existing boiler stack condition is not in the scope of this study. Further analysis is recommended.

Sequence / Category:

Maintenance & Repair.

Cost:

SP-4: Unknown (Requires Further Study)

SP-5: Upgrade Natural Gas Service from AVISTA

Description:

Increase the natural gas supply capacity to the Central Campus Steam Plant from the utility provider, AVISTA.

Analysis/Justification:

The existing steam boilers are limited in the amount of natural gas that they are allowed to consume at a given peak instant by agreement with the gas utility provider, AVISTA. Reportedly the high pressure gas supply distribution to the City of Cheney is limited based on AVISTA transmission gas line capacity. This issue is limits the steam boiler plant to a maximum consumption rate of approximately 56,000 lbs/hr, at which point the plant has to supplement its capacity by burning #2 fuel oil (diesel).

Because it is not beneficial to fire the boilers on fuel oil due to emission concerns, efficiency reductions and added wear and tear, the ability to fire a greater percentage of the boiler plant on natural gas is desired.

Sequence / Category:

Unknown. Pending AVISTA natural gas infrastructure upgrades to the City of Cheney.

Cost:

SP-5: Unknown. (Further study required. Capital costs for gas capacity increase to Campus would presumably be paid for by AVISTA as part of their normal growth plans.)

Campus Steam Distribution System (SD)

Overall the existing Campus Steam Distribution System is in good condition, and has been very well maintained; despite piping that is mostly over 40 years old. Assuming that the existing distribution system piping, valves, and insulation jacketing is maintained as well in the future, the system should have a life expectancy of at least 15 to 25 more years.
A computerized flow model of the campus steam network, that was prepared as part of this analysis, indicates that the existing steam supply piping is adequately sized to handle expected future growth. Several projects have been identified below to provide ongoing piping system reliability in to the future.

SD-1: Replace Utility Tunnel Condensate Piping

Description:

Replace aging gravity condensate piping system & components in utility tunnels. New piping to be heavier wall thickness, Sched. 80, compared to the existing standard wall Sched. 40 piping presently installed. New steam trap stations and valves would be provided.

Analysis/Justification:

Although the existing gravity condensate drainage piping system, that serves the high pressure steam distribution within the utility tunnels, appears to be in good condition and has been well maintained, most of this piping is around 40 years old. Although there have not been reports of major leaks or failures, this piping system is nearing the end of its useful life.

Because the condensate piping system is subjected to more severe service than the steam supply piping, on account of the presence of oxygen and other condensed gases, such as carbolic acid, internal corrosion is much more likely. This leads to premature pipe wall failure and leaks, as well as damage to components, such as valve and steam traps.

Sequence / Category:

Improve Operational Efficiencies.

Cost:

SD-1: $1,225,000

SD-2: Replace Utility Tunnel Electric Condensate Pumps with Steam-Powered Pumps

Description:

Replace existing simplex type electric condensate pumps in the utility tunnel with new steam-powered condensate pumps.

Analysis/Justification:

The existing simplex type electric condensate pumps, that are situated in various locations throughout the utility tunnel and are used to handle steam distribution condensate loads, are on ongoing point of malfunction and problematic maintenance. These condensate pumps are generally located in hot and wet locations of the tunnel and are subjected to severe service due to the hot condensate that they handle from the high pressure steam drip traps. Seal failures on the pumps are common and electric components do not stand up well to the environmental conditions within the tunnel.

Because of the severe service these tunnel condensate pumps experience, it is recommended that they be replaced throughout the tunnel system with more robust steam powered (non-electric) condensate pump assemblies. Such steam-powered condensate are more or less oversized steam traps and are made of similar materials that can handle steam service, without the weakness inherent in electric motor driven condensate pumps.

Sequence / Category:

Improve Maintenance Efficiencies.

Cost:

SD-2: $200,000

SD-3: Label Piping and Identify Branches & Valves

Description:

The existing steam (and chilled water) distribution piping system, located in the utility tunnel network, is poorly labeled and branch take-offs and valves are not identified. This project would provide better labeling and identification to help with maintenance and troubleshooting activities.

Analysis/Justification:

After spending several days surveying the condition of the existing utility tunnel piping and valving, it is evident that there would be value to the maintenance staff, and to contractors doing future work, if the existing piping system was better labeled and identified. Such labeling could help locate and isolate failures or problem areas, as well as to better direct traffic for repair or new construction. Likewise, there is a certain amount of abandoned devices (mostly electrical wall switches), that provide confusion over the tunnel lighting circuits. These should be removed and the active light switches better identified (as to which section they serve). Branches take-offs to buildings could be better identified, as could routes to exits or manholes.

Sequence / Category:

Improve Maintenance Efficiencies.

Cost:

SD-3: $150,000

SD-4: Upgrade Piping in Plant Utilities Building (PLU) and/or Repurpose the Space

Description:

Upgrade the existing steam and chilled water piping and systems inside the PLU building in order to better configure the space usage for storage or other purposes.

Analysis/Justification:

The existing steam (and chilled water) distribution piping system, located in the old original central campus steam plant, now the Plant Utilities Building (PLU), has been disturbed over time due to the use of much of this building as an ad-hoc storage space. Pipe insulation jacketing is damaged or missing, much of the old piping is deactivated and abandoned in place, and some of the valving appears to be fairly old. There is some old pneumatic controls and abandoned steam piping still in place but deactivated, and nothing is labeled. Filter boxes and other surplus material is stacked on and around the piping. Access is difficult.

Sequence / Category:

Improve Maintenance Efficiencies.

Cost:

SD-4: $125,000

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EWU - Campus Infrastructure Renewal
Proposed Mechanical Upgrades
Budgetary Level Cost Estimates
7/11/2014
MSI# 14-01
By: B. Snow

STEAM SYSTEMS - INFRASTRUCTURE UPGRADE BUDGET PRICE SUMMARY

	Budget Cost Estimate
Steam Plant	
SP-1: Replace Boiler #3	$3,500,000
SP-2: Install Boiler Feedwater Stack Economizers on Boilers #2 & #4	$350,000
SP-3: Upgrade Boiler Feedwater Pumps	$200,000
SP-4: Repair Rozell Heating Plant Boiler Stack	Unknown
SP-5: Upgrade Natural Gas Service From AVISTA	Unknown
STEAM PLANT (SP) -	$4,050,000
Steam Distribution	
SD-1: Replace Utility Tunnel Steam Gravity Condensate Piping	$1,225,000
SD-2: Replace Utility Tunnel Electric Condensate Pumps with Steam Powered Pumps	$200,000
SD-3: Label Piping & Identify Branches & Valves - Repair Insulation	$150,000
SD-4: Upgrade Piping in PLU Building and/or Repurpose the Space	$125,000
STEAM DISTRIBUTION (SD) -	$1,700,000
STEAM SYSTEM TOTAL -	$5,750,000

MSI ENGINEERS
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STEAM SYSTEMS - INFRASTRUCTURE UPGRADE BUDGET PRICE SUMMARY

Steam Plant (SP)

SP-1: Replace Boiler #3

	Unit	Quantity	$/unit	Cost
Demo existing Boiler #3	ea	1	$50,000.00	$50,000
Demo exisisting power and controls	ea	1	$25,000.00	$25,000
Demo existing catwalks	ea	1	$25,000.00	$25,000
Demo existing boiler stack	ea	1	$25,000.00	$25,000
Demo existing boiler piping	ea	1	$25,000.00	$25,000
Remove portion of wall or roof for access	ea	1	$25,000.00	$25,000
New 40,000 pph 250 psi low NOX steam boiler	ea	1	$1,500,000.00	$1,500,000
Set & Install new boiler & crane work	ea	1	$150,000.00	$150,000
Update boiler foundations	ea	1	$75,000.00	$75,000
New boiler service catwalk	ea	1	$75,000.00	$75,000
New stack economizer	ea	1	$75,000.00	$75,000
New boiler stack connections	ea	1	$50,000.00	$50,000
New piping and valving connections	ea	1	$100,000.00	$100,000
New naturgal gas piping	ea	1	$25,000.00	$25,000
New fuel oil piping	ea	1	$50,000.00	$50,000
New controls and instrumentation	ea	1	$100,000.00	$100,000
Power & electrical upgrades	ea	1	$100,000.00	$100,000
Rozell building wall/roof replacement for access	ea	1	$150,000.00	$150,000
Start-up, testing & trouble-shooting	ea	1	$25,000.00	$25,000
Commissioning & Licensing	ea	1	$25,000.00	$25,000
Central Control Wonderware updates	ea	1	$17,308.00	$17,308
			Subtotal	$2,692,308
	%	20	Design Contigency	$538,462
	%	10	G.C. OH&P	$269,231
			SP-1 - Total	**$3,500,000**

SP-2: Install Boiler Feedwater Stack Economizers on Boilers #2 & #4

	Unit	Quantity	$/unit	Cost
Demo portions of existing stacks	ea	2	$15,000.00	$30,000
New 25 kpph stack economizer	ea	1	$35,000.00	$35,000
New 47 kpph stack economizer	ea	1	$60,000.00	$60,000
Install new stack economizers	ea	2	$15,000.00	$30,000
New/modified feedwater piping & control valves	ea	2	$35,000.00	$70,000
Control modifications	ea	2	$15,000.00	$30,000
Start-up & testing	ea	2	$5,000.00	$10,000
Misc.	ea	1	$5,000.00	$5,000
Commissioning	ea	2	$5,000.00	$10,000
			Subtotal	$280,000
	%	15	Design Contigency	$42,000
	%	10	G.C. OH&P	$28,000
			SP- 2 - Total	**$350,000**

SP-3: Upgrade Boiler Feedwater Pumps

	Unit	Quantity	$/unit	Cost
Demo existing hot well transfer pumps	ea	3	$500.00	$1,500
New hot well transfer pumps HWP-1,2,3 - 7.5 hp	ea	3	$10,000.00	$30,000
New VFDs for HWPs	ea	3	$3,500.00	$10,500
Update piping & valves for HWPs	ea	3	$5,000.00	$15,000
New 50 hp boiler feedwater pump (add to ex. 3 pumps)	ea	1	$15,000.00	$15,000

New VFD for FWP - 50 hp	ea	1	$7,500.00	$7,500
Update piping & valves for FWP	ea	1	$15,000.00	$15,000
Misc.	ea	1	$13,000.00	$13,000
Control modifications	ea	4	$7,500.00	$30,000
Electrical connections	ea	4	$2,500.00	$10,000
Start-up & testing	lot	1	$5,000.00	$5,000
Commissioning	lot	1	$7,500.00	$7,500
			Subtotal	$160,000
	%	15	Design Contigency	$24,000
	%	10	G.C. OH&P	$16,000
			SP-3 - Total	**$200,000**

SP-4: Repair Rozell Heating Plant Boiler Stack

Unknown - Requires Further Study	ea	0	$0.00	$0
			Subtotal	$0
	%	0	Design Contigency	$0
	%	0	G.C. OH&P	$0
			SP-4 - Total	**Unknown**

SP-5: Upgrade Natural Gas Service From AVISTA

Unknown - Work to be done by Utility Co.	ea	0	$0.00	$0
			Subtotal	$0
	%	0	Design Contigency	$0
	%	0	G.C. OH&P	$0
			SP-5 - Total	**Unknown**

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

EWU - Campus Infrastructure Renewal
Proposed Mechanical Upgrades
Budgetary Level Cost Estimates
7/11/2014
MSI# 14-01
By: B. Snow

STEAM SYSTEMS - INFRASTRUCTURE UPGRADE BUDGET PRICE SUMMARY

Steam Distribution (SD)

SD-1: Replace Utility Tunnel Steam Gravity Condensate Piping

	Unit	Quantity	$/unit	Cost
Demo existing piping	lf	12,500	$5.00	$62,500
New 1-1/2" (Avg.) Sched. 80 condensate piping	lf	12,500	$35.00	$437,500
Pipe fitting allowance	%	35%		$153,125
Insulation and jacketing	lf	12,500	$7.50	$93,750
Drip traps, valve sets, flex piping, etc.	ea	40	$5,000.00	$200,000
Expansion joints/loops	ea	10	$2,000.00	$20,000
Pressure testing, flushing & cleaning	lot	1	$5,000.00	$5,000
Misc.	ea	1	$8,125.00	$8,125
			Subtotal	$980,000
	%	15	Design Contigency	$147,000
	%	10	G.C. OH&P	$98,000
			SD-1 - Total	**$1,225,000**

SD-2: Replace Utility Tunnel Electric Condensate Pumps with Steam Powered Pumps

	Unit	Quantity	$/unit	Cost
Demo existing electric condensate pumps	ea	10	$250.00	$2,500
Install new pressure powered condensate pumps	ea	12	$7,500.00	$90,000
Modify piping and valving	ea	12	$5,000.00	$60,000
Start-up & testing	ea	12	$625.00	$7,500
			Subtotal	$160,000
	%	15	Design Contigency	$24,000
	%	10	G.C. OH&P	$16,000
			SD- 2 - Total	**$200,000**

SD-3: Label Piping & Identify Branches & Valves - Repair Insulation

	Unit	Quantity	$/unit	Cost
Label steam piping (1 label every 50 ft ±)	ea	500	$25.00	$12,500
Label condensate piping	ea	500	$25.00	$12,500
Label chilled water piping	ea	500	$25.00	$12,500
Label Misc. piping	lot	100	$25.00	$2,500
Label & Tag valves	ea	1,000	$15.00	$15,000
Label/ID plaques for branch take-offs to buildings	ea	50	$200.00	$10,000
Repair misc. insulation & jacketing	lot	1	$25,000.00	$25,000
Repaint sections of pipe jackteing	lot	1	$15,000.00	$15,000
Valve tag schedule data base	ea	1	$1,000.00	$1,000
Repair/replace damaged or missing valve insul. jackets	lot	1	$14,000.00	$14,000
			Subtotal	$120,000
	%	15	Design Contigency	$18,000
	%	10	G.C. OH&P	$12,000
			SD-3 - Total	**$150,000**

SD-4: Upgrade Piping in PLU Building and/or Repurpose the Space

	Unit	Quantity	$/unit	Cost
Demo & cap abandoned piping	ea	1	$5,000.00	$5,000
Replace gate valves with butterfly valves	ea	1	$15,000.00	$15,000
Reroute exisitng branch piping to free-up bldg space	ea	1	$25,000.00	$25,000

Repair/reinsulate & label piping	ea	1	$15,000.00	$15,000
Misc. modifications	lot	1	$25,000.00	$25,000
Rework access catwalks	ea	1	$15,000.00	$15,000
			Subtotal	$100,000
	%	15	Design Contigency	$15,000
	%	10	G.C. OH&P	$10,000
			SD-4 - Total	**$125,000**

Reducing Scope 1 & 2 Emissions

Executive Report

ROZELL BUILDING

The Rozell building contains the central heating and cooling generating equipment for the entire campus.

HEATING PLANT

There are five high-pressure steam boilers located in the central steam plant at Eastern Washington University. All are capable of firing off of natural gas and No. 2 fuel-oil. Boiler #1 is rated at 56,000 lbs/hr, Boiler #2 at 25,000 lbs/hr, Boiler #3 at 25,000 lbs/hr, Boiler #4 at 47,000 lbs/hr, and Boiler #5 at 89,000 lbs/hr. With the exception of boiler #5, which was installed and fired in 2003, all of the boilers are more than fifty years old—and some are more than sixty years old. Boiler #3 broke down three years ago and it remains out of service to this day. Boilers #1, #3, and #5 have boiler feedwater economizers installed in their exhaust stack; Boilers #2 and #4 do not. Typically during the cooling season, only Boiler #2 operates. Boilers #1 and #4 operate during the shoulder seasons and Boiler #5 operates during the peak months of the heating season. Boiler #5 is the only boiler with a low-nitrogen-oxide burner; the other boilers' burners should be upgraded to low-NOx burners as well.

Condensate from the campus is pumped into a large tank in the lower level of the Rozell Building's boiler room. If required, make-up water is introduced into the system with the campus condensate. From this tank the water is then pumped to the De-aerator (DA) tank which is located in the boiler room. From the DA tank the water is then pumped into the respective boilers based on their need, using the dedicated floor-mounted feedwater pumps. These pumps are capable of pumping the water into the boilers directly, as in the case of Boiler #2 or Boiler #4 or into the economizers on Boilers #1 and #5. The boiler feedwater being pumped into the stack economizers must be under an elevated pressure in order to ensure it does not flash off to steam in the heat exchanger in the exhaust stack. After taking the heat out of the exhaust stack gases, the feedwater is then introduced into the boiler.

The facility has three 50-horsepower boiler feedwater pumps, all taken from another system. These well-used pumps have had several seal and impeller failures, sometimes simultaneously, placing the entire feedwater load on the steam turbine pump—which can only operate when the minimum load is 20,000 lb/hr or greater, thus risking complete steam plant shut down.
The methodology in which chemicals are introduced into the steam system should be analyzed as well, as this may produce significant savings in both energy and chemicals.

COOLING PLANT

The University's cooling system is comprised of three 1,000-ton, water-cooled Carrier centrifugal chillers and two 500-ton water-cooled Carrier Centrifugal chillers, producing a total cooling capacity of 4,000 tons. Each chiller has a dedicated primary chilled water pump and condenser water pump, as well as a dedicated cooling tower. All of the towers are induced-draft, open-circuit Marley cooling towers. The three 1,000-ton towers are sized to deliver 85 degree water to the chillers, while the 500-ton towers were originally sized to deliver the water at 85 degrees as well. Due to age, the 500-ton towers can deliver only 88-90 degree water during the peak of the cooling season.

The chilled water distribution system is a primary/secondary, variable-volume pumping system with tertiary pumps at the building or load source. There are three secondary system pumps that serve the campus loop. They are brought online/ offline based on being able to maintain 14 inches Water Column (WC) between the supply and return lines. Only one of the secondary pumps is controlled with a variable-frequency drive, while the other two have two-speed motors. For some reason, the tertiary pumps in the buildings or at the coils are only turned on when the outdoor air temperature reaches 85 to 90 degrees. Peak-season cooling is between 2,300 and 2,400 tons.

There are two plate-and-frame heat exchangers for free cooling. The older unit is approximately fourteen years old and has 300 tons of cooling capacity. The newer unit, installed by McKinstry in 2003, has a cooling capacity of 200 tons. Each unit has a one-degree approach.

AIR DISTRIBUTION SYSTEM

Rozell's office area is served by a variable-volume air handler with VAV boxes and hot water reheat coils. The unit is mounted on the roof of next to the cooling towers. Other constant-volume variable-temperature air handling units serve the boiler room and the refrigeration mechanical room.

Reducing Scope 1 & 2 Emissions

Detailed Report

EASTERN WASHINGTON UNIVERSITY/ROZELL CENTRAL PLANT BUILDING

FIELD NOTES FROM PRELIMINARY ENERGY AUDIT – AUGUST 2010

OVERVIEW

The Rozell Central Heating and Cooling Plant building is a support services facility of Eastern Washington University and is located on the northern side of the EWU campus in Cheney Washington. A preliminary energy audit was conducted on all of the systems in Rozell.

ROZELL CENTRAL PLANT BUILDING

The Rozell Central Plant Building is a two-story brick building which was built in 1970. The latest upgrades and renovations were completed in the 2002 – 2003 time frame. This is a 56,000 square foot facility which houses the Campus's Central Steam Plant and the central chilled water plant. It also houses the university's Construction and Planning Department, as well as the Director of Maintenance and the energy management office and Facilities Information Technology offices. Facilities I.T. is responsible for architecting and administering the support systems and server farm for all of Facilities and Planning. The Central Heating and Cooling Plants provide high pressure steam and chilled water to the Utility Tunnel System that basically brings the steam and chilled water to most buildings on the EWU campus. Condensate return is also brought back from the buildings on campus through the utility tunnel system.

PREVIOUS ENERGY RETROFITS

McKinstry has previously completed retrofits of the Rozell Central Plant building in 2003. At that time McKinstry installed a new 1,000 Ton Open Circuit, Induced Draft Marley Cooling Tower and its associated condenser water pump. McKinstry installed a 200 Ton Plate and Frame heat exchanger, and associated pumps, as well as automating the chilled water plant with Delta Digital Controls. McKinstry also installed a small cooling only fan coil for the UPS systems in the lower level mechanical room. Prior to that, a lighting retrofit was done throughout the building that saw all of the T12 fluorescent lamps and standard ballasts getting retrofitted with T8 Lamps and electronic ballast. The only area of Rozell that still has an opportunity to save energy on lighting is in the Boiler room itself, with the high bay lighting fixtures.

HEATING SYSTEM

There are (5) five high pressure steam boilers located in the central steam plant at EWU. All are capable of firing off of natural gas and No. 2 fuel-oil. Boiler #1 is rated at 56,000 lbs/hr, Boiler #2 at 25,000 lbs/hr, Boiler #3 at 25,000 lbs/hr, Boiler #4 at 47,000 lbs/hr, and Boiler #5 at 89,000. With the exception of boiler #5 which was installed and fired in 2003, all of the boilers range in age from 50 plus years old to 60 plus years old. Three years ago, Boiler #3 had significant issues which caused it to shut down and to this day it has not been brought back on line. Boilers #1, #3, and #5 have boiler feedwater economizers installed in their exhaust stack; boilers #2 and #4 do not. Typically during the cooling season, only boiler #2 operates. Boilers #1 and #4 operate during the shoulder seasons and boiler #5 operates during the peak months of the heating season. Boiler #5 is the only boiler with a Low NOx Burner. The other 4 boilers would be excellent candidates to have their burners swapped out with Low NOx Burners.

Reducing Scope 1 & 2 Emissions

Condensate from around the campus is pumped into a large tank in the lower level of the Rozell Building's boiler room. If required, make up water is introduced into the system with the campus condensate. From this tank the water is then pumped up to the Deaerator tank which is located in the boiler room. From the DA tank the water is then pumped into the respective boilers based on their need using the dedicated floor mounted boiler feedwater pumps. These pumps are capable of pumping the water into the boilers directly, as in the case of Boiler #2 or Boiler #4 or into the economizers on Boilers #1 and #5. The boiler feedwater being pumped into the stack economizers must be under an elevated pressure in order to ensure is doesn't flash off to steam in the heat exchanger in the exhaust stack. After taking the heat out of the exhaust stack gases, the feedwater is then introduced into the boiler.

Currently Eastern Washington University has (3) three 50 HP boiler feedwater pumps, these pumps were taken from another system to be used for the feedwater system. As a result of making use of these (3) three used pumps, there have been several seal and impeller failures which has resulted in simultaneous outages in all (3) three pumps. This has placed the entire feedwater load on the steam turbine pump, a pump that can only operate when the minimum load is 20,000 lb/hr or greater, thus placing the steam plant at risk of being completely shut down.

The way chemical is introduced into the steam system should be analyzed. It has been McKinstry's experience that this usually leads to significant savings from an energy perspective as well as a capital dollars expenditure on less chemicals.

COOLING SYSTEM

The university's cooling system is comprised of (3) 1,000 ton water cooled Carrier centrifugal chillers, and (2) 500 ton water cooled Carrier Centrifugal chillers. In all there is a cooling capacity of 4,000 tons. Each chiller has a dedicated primary chilled water pump and condenser water pump, as well as a dedicated cooling tower. All of the towers are induced draft, open circuit Marley cooling towers. The three 1,000 ton towers are sized to deliver 85 degree water to the chillers, while the (2) 500 ton towers were originally sized to deliver the water at 85 degrees as well. The age of the (2) 500 ton towers and their ability to reject heat to the atmosphere has deteriorated through the years and are only able to deliver 88 to 90 degree water during the peak of the cooling season.

The chilled water distribution system is a primary / secondary variable volume pumping system with tertiary pumps out at the building or load source. There are three secondary system pumps that serve the campus loop. They are brought on / off line based on being able to maintain 14 in. WC between the supply and return lines. Only one of the secondary pumps is controlled with a VFD, while the other 2 are 2-speed motors. For some reason, the tertiary pumps in the buildings or at the coils are only turned on when the outdoor air temperature reaches 85 to 90 degrees.

According to the Plant Supervisor, Kevin Beckwith, told McKinstry that the largest cooling load that the plant personnel see during the peak of the cooling season is approximately between 2,300 tons and 2,400 tons.

There are 2 plate and frame heat exchangers for free cooling. The older of the 2 is approximately 14 years old and has 300 tons of cooling capacity while the newer of the 2 that McKinstry installed in 2003, has a cooling capacity of 200 tons. Each plate and frame heat exchanger has a 1 degree approach.

AIR DISTRIBUTION SYSTEM

The ventilation system serving the office area of Rozell is comprised of a variable volume air handling unit with VAV boxes with hot water reheat coils. This unit is mounted on the roof of the Rozell Building next to the cooling towers.

Reducing Scope 1 & 2 Emissions

SEQUENCE OF OPERATIONS

1. The VAV AHU operates 24/7, and is controlled with Staeffa Digital controls. No night setback or start/stop controls.
2. There is no morning purge, morning warm-up / morning cool-down.
3. It is not known if the air handler has economizer controls or not.

AREAS OF INTEREST

1. Boiler Feed Water Pump Retrofits.
2. Retrofit #3 Boiler that is sized to deliver 40,000 lbs/hr of high pressure steam.
3. Install Boiler Feed Water Economizers on #2 and #4 Boilers.
4. Install Low NOx Burners on Boilers #1, #2, and #4.
5. Retrofit the high bay lighting fixtures in the boiler room with T5HO fixtures.
6. Install VFDs on the chiller compressors, and on the (3) 1,000 ton cooling towers.
7. Install (2) new Cooling Towers with VFDs, sized to deliver 75 degree water during peak loads.
8. Swap out the (2) 2-speed motors with inverter duty ready motors and pumps and control them with VFDs and map them into the Delta Digital Control system.
9. Examine the feasibility of adding another 1,000 Ton Water-Cooled Chiller and corresponding cooling tower with associated pumps.

Efficient & Sustainable Campus Systems

Executive Report

3. Campus Infrastructure

A. BOILER PLANT (BIO-MASS/BIO-DIESEL)

A detailed description of the central heating and cooling plant equipment is in the page 17-18 Rozell Building description.

i. Boiler Plant Biomass/Biodiesel Fuel Switching

McKinstry evaluated the feasibility of switching to Bio-Mass/Bio-Diesel as a secondary fuel source for the existing boilers in the central plant, considering a number of factors in the process:

ii. Fuel Source Reliability – The reliability of the fuel source is high. Contracts for the fuel are usually a year in length. We evaluated two local Bio-Mass/Bio-Diesel fuel suppliers in eastern Washington. At the time of study, the price of Bio-Mass/Bio-Diesel fuel was lower than for #2 fuel oil but higher than for natural gas. The BTU content per gallon on average ranges between 125,000 to 130,000 BTUs per gallon for Bio-Diesel and 135,000 to 137,000 BTUs per gallon for Bio-Mass.

iii. To accommodate the new fuel we would remove and dispose of the old bunker oil tank and associated fuel lines, and we would either convert or replace the boiler burners to burn the new fuel.

B. UPGRADES TO THE EXISTING CENTRAL STEAM PLANT

Given Eastern Washington University's growth plans, McKinstry recommends further analysis to determine the University's future needs for steam plant capacity. As detailed in Table 2, we suggest several plant improvements:

i. Install boiler feedwater economizers on Boilers #2 and #4.
ii. Replace #3 Boiler with a new, more efficient boiler.
iii. Replace the burners on #1, #2 and #4 with low-nitrogen-oxide burners.

C. CENTRAL CHILLED WATER PLANT

The central chilled water plant has 4,000 tons of mechanical cooling capacity and another 500 tons of free cooling capacity through two plate-and-frame heat exchangers. According to plant personnel the peak load during the cooling season on the central chilled water plant is between 2,300 and 2,400 tons.

The chillers and their corresponding cooling towers vary in age. The three 1,000-ton chillers, two 500-ton chillers and their respective cooling towers were all installed in 1996. The third 1,000-ton cooling tower was installed in 2003, and the two 500-ton cooling towers were installed over 25 years ago. Both 500-ton cooling towers have outlived their useful service lives and are becoming inefficient.

D. UPGRADING THE EXISTING CENTRAL CHILLED WATER PLANT'S EFFICIENCY

As outlined in accompanying Table 3, there are several clear options to improve the chilled water plant's efficiency:

i. Install variable-frequency drives (VFDs) on the chiller compressors and cooling tower fans.

ii. Replace the two-speed chilled water pumps with two new pumps and VFDs on the system loop.
iii. Replace both 500-ton towers with energy-efficient, open-circuit, induced-draft, VFD-equipped cooling towers sized to deliver 75-degree water at peak conditions.

E. ADDING CHILLED WATER CAPACITY

After study, it appears that expanding the existing chilled water plant would be preferable to building a second one on campus. Although the University's plans to build Science 1 and Science 2 will increase chilled water needs, some of that new demand will be offset by efficiency improvements in other buildings as they remodeled, such as the Science Building, where much can be done to reduce the cooling load.
Further study is needed to accurately gauge future demand, but our initial recommendation is to enlarge the existing central plant, adding another 1,000-ton water-cooled centrifugal chiller, a 1,000-ton cooling tower and their associated pumps. These costs are presented in Table 3.

F. ADDING A THERMAL STORAGE TANK – Although the need for a thermal storage tank has been studied, more information is needed before recommendations can be made.

In time, a thermal storage tank may prove worthwhile, adding cooling capacity and improving the chilled water system's efficiency. Using the thermal storage tank as a primary source of cooling during the day, while shutting down or reducing use of chillers, is a very energy-efficient way to meet the University's cooling needs. In this scenario, the tank acts like a larger chilled water battery, charging during night when the cost to produce power is less. However, the utility rate that Eastern Washington University pays is not ratcheted as in other regions, which reduces the incentive to build such a system—making cost variables in site selection all the more important. For these reasons, further study would be wise.

Efficient & Sustainable Campus Systems

Detailed Report

Eastern Washington University/Campus Infrastructure

OVERVIEW

This section of the report is dedicated to Eastern Washington University's central heating and cooling plant. Most of the buildings and facilities on campus are served by the central heating and cooling plant. A preliminary energy audit was conducted on August 18, 2010 by McKinstry.

ROZELL CENTRAL PLANT

See write up in section 2 under Rozell Building.

PREVIOUS ENERGY RETROFITS

McKinstry retrofitted the existing boiler feedwater pumps with new vertical turbine feedwater pumps controlled with Variable Frequency Drives. The drive and pumps will be controlled through the ABB/Wonderware Control System.

BOILER PLANT BIOMASS/BIO-DIESEL FUEL SWITCHING

McKinstry evaluated the feasibility of switching to biomass/biodiesel as a secondary fuel source for the existing boilers in the central plant, considering a number of factors in the process:

- Fuel Source Reliability – The reliability of the fuel source is high. Contracts for the fuel are usually a year in length. We evaluated two local biomass/biodiesel fuel suppliers in eastern Washington. At the time of study, the price of biomass/biodiesel fuel was lower than for #2 fuel oil but higher than for natural gas. The BTU content per gallon on average ranges between 125,000 to 130,000 BTUs per gallon for biodiesel and 135,000 to 137,000 BTUs per gallon for biomass.

- To accommodate the new fuel we would remove and dispose of the old bunker oil tank and associated fuel lines, and we would either convert or replace the boiler burners to burn the new fuel.

We suggest further study, as bio-fuels could reduce both carbon emissions and fuel costs. However, the latter depends upon further discussion with bio-fuel suppliers, who insist on confidentiality agreements from McKinstry personnel before committing to prices. If EWU is interested, we will be more than happy to obtain firm fuel quotes.

UPGRADES TO THE EXISTING CENTRAL STEAM PLANT

Given EWU's growth plans, McKinstry recommends further analysis to determine the university's future needs for steam plant capacity. The Facility Improvement Measures detailed in Table 4.2 represent improvements to the plant as it stands today:

- Install boiler feedwater economizers on Boilers #2 and #4.

- Replace #3 Boiler with a new, more efficient boiler.

- Replace the burners on #1, #2 and #4 with Low-NOx burners.

CENTRAL CHILLED WATER PLANT

The central chilled water plant has 4,000 tons of mechanical cooling capacity and another 500 tons of free cooling capacity through two plate-and-frame heat exchangers. According to plant personnel the peak load during the cooling season on the central chilled water plant is between 2,300 and 2,400 tons.

The chillers and their corresponding cooling towers vary in age. The three 1,000-ton chillers, two 500-ton chillers and their respective cooling towers were all installed in 1996. The third 1,000-ton cooling tower was installed in 2003, and the two 500-ton cooling towers were installed over 25 years ago. Both 500-ton towers have outlived their useful service lives and are becoming increasingly energy inefficient. Their original design called for the towers to deliver 85 degree water back to their respective chillers. Currently in their existing condition they are only able to supply 88 degree water back to the chillers.

McKinstry believes there are many ways to improve the efficiency of the chilled water plant and to add capacity in the future:

UPGRADING THE EXISTING CENTRAL CHILLED WATER PLANT'S EFFICIENCY

As outlined in Table 4.2, EWU has several clear options that could make the chilled water plant more efficient:

- Install VFDs on the chiller compressors and cooling tower fans.
- Replace the two-speed chilled water pumps with two new pumps and VFDs on the system loop.
- Replace both 500-ton towers with energy-efficient, open-circuit, induced-draft , VFD-equipped cooling towers sized to deliver 75-degree water at peak conditions.

ADDING CHILLED WATER CAPACITY

After further study, McKinstry concludes that expanding the existing chilled water plant would be preferable to building a second and separate chilled water plant somewhere on the south side of the campus. Although the university's plans to build Science 1 and Science 2 will increase the overall chilled water load, some of that new demand will be offset by efficiency improvements in other buildings as they get remodeled and upgraded with energy efficient systems.

Further study is needed to accurately gauge future demand, but our initial recommendation is to enlarge the existing central plant, adding another 1,000-ton water-cooled centrifugal chiller, a 1,000-ton cooling tower and their associated pumps. These costs are presented in the Table 4.2 for this section.

ADDING A THERMAL STORAGE TANK

Although McKinstry studied the need for a thermal storage tank, we do not believe we yet have enough information to judge its practicality, so we recommend further analysis if EWU is interested. McKinstry has engineered and built this kind of system before at universities in the Pacific Northwest, and can certainly plan, engineer and build this if the university so chooses. However, costs vary depending on the site chosen and the site work required, as such, the cost estimate ranges have not yet been estimated.

In time, a thermal storage tank may prove worthwhile for EWU by adding cooling capacity and energy efficiency. Using the thermal storage tank as a primary source of cooling during the day, while shutting down or reducing use of chillers, is a very energy-efficient way to meet the university's cooling needs. However, the utility rate that EWU pays is not ratcheted as in other regions of the country, which reduces the incentive to build such a system—making cost variables in site selection all the more important. For these reasons, McKinstry recommends further study.

Facility Improvement Measure (FIM) Summary - Rough Order of Magnitude (ROM)

Eastern Washington University
Central Plant + Water + Irrigation
November 17, 2011

LEGEND:
1 - High Priority
2 - Medium Priority
3 - Neutral Priority

[illegible]	[illegible]	[illegible]	[illegible] *		[illegible]		[illegible] **	[illegible] ***	Estimated Net Custo[illegible]		[illegible]		[illegible]	[illegible]	[illegible]
			Min	Max	Min	Max			Min	Max	Min	Max			
10.xx-EWU: Campus Wide Water Re-Commissioning	McKinstry proposes to replace all internal plumbing components and recommission all toilets, sinks, urinals, and shower heads in all buildings across campus. New internal components will have variable flow technology.	Campus	$508,175	$844,437	$41,382	$45,959	$19,170	$0	$508,175	$804,437	8.7	11.4	200	1. [illegible] gallons of water saved annually. 2. Reduction of maintenance costs and plumbing fixture upgrades. 3. Increased consistency and performance of the system.	1
10.02-EWU: Campus Wide Irrigation Upgrades	McKinstry proposed to replace all manual irrigation controllers with WeatherTrak controllers and install rain sensors.	Campus	$241,909	$295,667	$3,184	$3,524	$0	$0	$241,909	$295,667	68.6	92.7	18	1. Only deliver the water required for adequate irrigation across the EWU campus. 2. 13,832,200 gallons of water saved through a reduction in irrigation systems operation.	2
1.00-ROZ: Boiler Feed Water Economizers	Boilers #2 and #4 do not have the economizers and thus use more energy when the feed water is pumped into each of the boilers. McKinstry proposes to install boiler feed water economizers into the boiler's exhaust stack.	Rozell Central Plant	$173,773	$212,388	$70,381	$77,700	$0	$0	$173,773	$212,388	2.2	3.0	684	1. Significant energy savings. 2. Feed water system can now operate at the same pressure.	1
1.01-ROZ: Low NOx Burners	McKinstry proposes to install new dual fuel Low NOx burners. The primary fuel source will be natural gas while the back up fuel source will be #2 fuel oil.	Rozell Central Plant	$1,611,225	$1,909,275	$55,438	$72,324	$0	$0	$1,611,225	$1,909,275	27.3	38.1	567	1. Decrease of pollutants and efficient combustion of fossil fuel.	3
1.02-ROZ: Replace Boiler #3	McKinstry proposes to remove and dispose of the existing 25,000 lb/hr high pressure steam Boiler #3 and replace it with a new energy efficient 40,000 lb/hr high pressure steam boiler. The new boiler will be equipped with a new Low NOx Dual Fuel Burner.	Rozell Central Plant	$1,190,314	$1,699,772	$105,000	$117,136	$0	$0	$1,190,314	$1,699,772	11.9	16.0	910	1. Installation of a 40,000 lb/hr boiler that replaces the 25,000 lb/hr boiler that hasn't worked for three years. 2. Replacing a boiler that is over 40 years old with a larger more energy efficient boiler with a Low NOx Burner, and a boiler feed water economizer.	1
2.00-ROZ: VFD Upgrades	McKinstry proposes to furnish and install Variable Frequency Drives on the chillers compressor motors, remove the existing 2-speed motors in the cooling towers, and install inverter duty ready motors and the VFDs the cooling tower fan motors. The drives and their respective points will be mapped into the existing controls system.	Rozell Central Plant	$824,706	$1,007,974	$38,424	$42,460	$0	$59,850	$764,856	$948,124	18.0	24.7	211	1. Making the existing chillers and towers energy efficient. 2. Maximize the cooling efficiency of the entire cooling plant.	1
2.01-ROZ: CHW Pump Upgrades and Reconfiguration	McKinstry proposes to furnish and install new inverter duty ready motors for the (2) secondary chilled water pumps and install the necessary control points and VFDs. The secondary chilled water pumps will be brought on line as the load in the buildings dictate. The lead pump will ramp up to 100% before the next secondary pump is brought on-line.	Rozell Central Plant	$74,018	$90,466	$9,105	$10,061	$0	$1,133	$72,885	$89,333	7.2	9.8	50	1. Maximize the cooling efficiency of the chilled water loop pumping system.	1
2.02-ROZ: Install New Chiller and Tower	McKinstry proposes to furnish and install new primary chilled water pumps that are dedicated to their respective chiller. The primary pumps will be piped in parallel. This will allow the horse powers on these pumps to be significantly decreased. McKinstry also proposes to furnish and install new inverter duty ready motors for the (2) secondary chilled water pumps and install the necessary control points and VFDs. The secondary chilled water pumps will be brought on line as the load in the buildings dictate. The lead pump will ramp up to 100% before the next secondary pump is brought on-line.	Rozell Central Plant	$1,818,7[illegible]	$2,222,867	$39,891	$44,090	$0	$46,913	$1,771,796	$2,175,954	40.2	54.5	219	1. This will give EWU a level of redundancy in the future that they may not have today as buildings and facilities are connected to the campus chilled water loop.	3
2.04-ROZ: Install 2 new energy efficient cooling towers	McKinstry proposes to install new energy efficient, open circuit, induced draft cooling towers with VFDs on their fan motors. The new cooling towers will be sized for supplying 75 degree water to the chillers during peak load conditions.	Rozell Central Plant	$328,496	$401,495	$11,479	$12,688	$0	$5,917	$322,519	$395,518	25.4	34.5	63	1. This will allow the (2) 500 Ton water cooled chillers to operate efficiently by receiving condenser water at 75 degrees, instead of the 88 degree water they have been receiving. 2. The new energy efficient cooling towers will prolong the life of their corresponding chillers.	1
			$7,031,325	$8,593,841	$38[illegible],468	$426,043	$19,170	$113,873	$6,917,452	$8,479,968	15.5	21.0	#REF!		

* Since design cost, audit cost, etc. are distributed among the FIMs, the total project cost will not go up or down by exactly the amounts shown here if a FIM or FIMs are dropped.
** For non recurring operational savings, the values are averaged over the 1 year length of this analysis.
*** Incentives are contingent on final approval and are not guaranteed. Funds are shown for reference only.

APPENDIX H2

EWU - ROZELL CENTRAL ENERGY PLANT
- INSTALL NEW BOILER -
PRE-DESIGN STUDY
(CP-1056)

Eastern Washington University
Cheney, WA

Prepared by:

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

MSI Engineers
108 N. Washington Street, Suite 505
Spokane, WA 99201

Prepared for:
EWU Facilities and Planning
April 17, 2020
MSI# 19.59

EWU - Rozell Central Energy Plant

- Install New Boiler -

(CP-1056)

Pre-Design Study

Eastern Washington University
Cheney, WA

The technical report listed above has been prepared under the primary direction of the Professional Engineer, registered in the State of Washington, whose seal and signature appear below. This PE stamp covers the overall report preparation as well as detailed mechanical engineering discipline specific elements. Additional engineering and architectural analysis has been provided by the consultants listed on the following page.

MSI Engineers
108 N. Washington, #505
SPOKANE, WA 99201

MSI Job No. 19.59

Eastern Washington University

Cheney, Washington

Rozell Central Energy Plant - Install New Boiler - Pre-Design Report

Project No. CP-1056

Planning Team

EWU Facilities & Planning — **Shawn King**, **Steve Schmedding, PE**

MSI ENGINEERS
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1.0 STUDY SCOPE and RECOMMENDATIONS

1.1 Purpose of Pre-Design Study

A. The general purpose of this *Pre-Design Study* is to provide an evaluation of the existing EWU Rozell Central Energy Plant's steam heating system capacity and steam boiler systems, in terms of reliability, robustness, efficiency and life expectancy, and then to consider possible options for plant upgrades and modernization as may be deemed desirable or necessary. The main goal of this pre-design study is to provide scoping and recommendations for the replacement of existing Boiler #3, which is no longer operational, along with budget level cost estimates in order to establish the MACC for the proposed work.

B. Scope of Services – Per the Eastern Washington University Request for Qualifications (RFQ):

Eastern Washington University seeks engineering programming and design services for the Rozell Central Energy Plant – Install New Boiler, (CP1056) on the EWU Campus in Cheney, Washington. This project will replace aged existing boiler(s) and increase EWU's campus steam capacity to meet future heating needs in support of the current capital master plan, provide sufficient redundancy during scheduled maintenance operations, and to increase operating efficiencies. The existing campus heating system is comprised of five boilers that initially provided a total capacity of one hundred thirty four thousand (134,000pph) pounds per hour. One boiler has been removed from the train, thus reducing capacity to 116,000pph. Historical records indicate a peak heating load of about seventy five thousand (75,000pph) has been experienced at the plant. Based on anticipated master plan growth, the increased heat load is expected to be approximately 34%, or around 100,000pph. The addition of approximately 40,000pph heating capacity is needed to serve the campus in the future. The MACC for the project is to be determined as a result of the design.

1.2 Install New Boiler Pre-Design Study Objectives

A. In discussions with the EWU Facilities staff and the Rozell plant operators, the following is a general list of the boiler plant capacity upgrade objectives to be addressed in this report.

1) Review boiler capacities, sizing, quantity, growth evaluation and previous studies. Make recommendations for "right sizing" the new boiler capacity, type and brand.

2) Evaluate ancillary boiler plant systems and equipment capacities, performance, condition and reliability.

   - Deaerator and Feedwater System.
   - Condensate Surge Tank (Hotwell) and Transfer Pumps.
   - Make-up Water Treatment and Chemical Feed Systems.
   - Plant Steam Distribution and Components (Non-Return Valves).

- Boiler Plant Controls and SCADA System.
- Boiler Blow-down Systems and Plant Waste-Water Treatment.
- Plant Electrical Power Distribution, Back-up Power and UPS.

3) Evaluate possible alternative installation methods and routes for existing boiler/equipment removal and replacement, within the restricted space of the existing Rozell plant footprint.
4) Evaluate the general plant arrangement with respect to current and future plant upgrades, in terms of design, operations, efficiency, etc.
5) Evaluate any regulatory requirements, including emissions and air quality permitting.
6) Evaluate Rozell plant infrastructure elements, including electrical distribution and capacity, structural impacts to the proposed boiler work, and possible associated architectural work (wall or roof removals, etc.).
7) Develop a prioritized list of recommendations for determining the Scope of Work for the *Install New Boiler* project, along with associated cost estimates as necessary to develop the MACC budget within the level of Capital Funding available.
8) Develop a list of recommendations for possible future plant upgrades and improvements, with associated cost estimates, to help facilitate Capital Funding requests for follow-on infrastructure projects.
9) Design of the New Boiler Installation (Phase 2) should be prepared in a timely manner so as to be ready for public bidding in late 2020, with installation work beginning in early 2021.

1.3 MSI Engineers Study & Design Tasks

A. Based on the Design Proposal agreement between MSI and EWU, dated January 13, 2020, the engineering services will be developed in two design phases.

Phase 1 – Pre-Design Study, Scope of Project Development, Implementation Recommendations and Budgetary Cost Estimates. *(This Report)*

1. Provide analysis and recommendations of proposed boiler replacement and associated plant infrastructure upgrades/modifications.
2. Provide rough order of magnitude (ROM) budget cost estimates of proposed boiler plant work.
3. Discuss timing and delivery methods/phasing for construction and installation of the new boiler and associated work.
4. Provide written detailed Phase 1 Report with recommendations for moving towards detailed Design Construction Documents (Phase 2) and installation/construction.

Phase 2 – Detailed Design and Preparation of Construction (Bid) Documents.

Detailed design and Construction Documents for public bidding will be developed as a follow-up to this pre-design study.

1.4 Executive Summary - Recommendations

A. The following list is the overview of the major tasks that will be required to replace the existing decommissioned Boiler #3 with a new, larger capacity, steam boiler. This is a list of the bare minimum tasks that will be required to install a new boiler, without necessarily addressing or upgrading other associated systems or equipment in the existing plant, that are also being recommended in this study to be upgraded or replaced. These elements are discussed in the next section.

<u>TASK-1: Basic Boiler #3 Replacement Scope</u>

- <u>Install new 40,000 pph steam boiler.</u>

  Replace the existing decommissioned Boiler #3 with a new 40,000 pph rated IWT type steam boiler. Recommended Basis-of-Design boiler manufacturer is Cleaver Brooks.

- <u>Remove a portion of plant wall for installation access.</u>

  Remove a portion of the existing Rozell boiler plant wall, next to the smoke stack, in order to allow for convenient Contractor work access at grade, so as to best facilitate removal of existing boiler and installation of new boiler and its associated auxiliary systems.

- <u>Install removable wall panel system to facilitate future work.</u>

  Reinstall a new removable wall panel system, where the plant wall is to be removed for installation work, so as to better facilitate future equipment replacement through this opening pathway.

- <u>Upgrade building structure to accommodate new boiler.</u>

  The existing Rozell structure and foundations are deemed adequate to support the boiler. However, the new boiler will require that some additional support members be installed in the plant's lower level, in order to accommodate the new footprint and added weight of the equipment. Additional minor structural upgrades will be required to allow for removal and reinstallation of the wall section that is needed for installation access.

- <u>Connect new boiler to the plant piping, controls and auxiliary systems</u>

  New connections from the boiler to the following plant distribution piping systems:

  - Steam
  - Feedwater
  - Natural Gas
  - Fuel Oil
  - Chemical Treatment
  - Blow-down Systems and Drains

Boiler controls will be connected to the plant's new SCADA system.

The new boiler exhaust gases will be reconnected to the existing Rozell breeching and common smoke stack.

- Connect new boiler to the plant electrical power systems/

  The new boiler will be connected to the plant's emergency power and/or UPS electrical distribution power systems to support the following components:

  - Forced Draft Fan
  - Control Panel and Components

B. The following list of potential project upgrades, as funding allows, provides a shopping list of recommended system or equipment modifications and/or replacements, that are proposed by this study. These recommended upgrades will further enhance the steam plant's reliability and performance.

OPTIONAL RECOMMENDED UPGRADE TASKS:

MECHANICAL TASKS:

- Replace Existing Boiler Non-Return Valves.
- Upsize Feedwater Pumps.
- Replace Aging Feedwater Piping.
- Install Redundant Hotwell Tank.
- Replace Obsolete Make-up Water Softeners.
- Install pH Neutralization System on Plant Process Waste.
- Install Redundant Deaerator Unit.

ELECTRICAL TASKS:

- Replace Obsolete Switchboard FM and FME.
- Replace Obsolete Motor Control Center MCC-GMC.
- Replace Obsolete Generator Automatic Transfer Switch (ATS).
- Replace Obsolete Uninteruptible Power Supply (UPS) and UPS Panelboard.

1.5 Preliminary Cost Estimates (MACC Determination) & Capital Funding Allowances

A. The following rough order of magnitude (ROM) preliminary budget costs are provided in order to help establish the final project scope and to better allocate the available Capital Funds provided to EWU as part of the FY 2019-2021 biennium funding cycle (establish project MACC).

B. Cost estimate detail can be found in the appendix.

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

EWU - Install New Boiler
CP-1056
Pre-Design Study Preliminary Cost Estimates
4/15/2020
MSI # 19-59
By: [illegible]

Engineer's Opinion of Probable Costs

EWU - Install New Boiler (CP-1056) - Pre-Design Study Budget Level Cost Estimates

	CONSTRUCTION COSTS Includes Const. Contingency & Contractor O&P	SOFT COSTS Includes Design Contingency, Sales Tax, Design Fees	TOTAL PROJECT COSTS
Task-1: Basic Boiler Replacement: TOTAL COST	$ 4,670,852 75%	$ 1,535,776 25%	$ 6,206,628
Probable Bid Range:	$4.5 M to $5.0 M		
Proposed/Recommended Upgrade Tasks			
Mechanical - Task M-200 Replace Non-Return Valves	$ 136,500	$ 36,637	$ 173,137
Mechanical - Task M-300 Upsize Feedwater Pumps	$ 51,875	$ 13,923	$ 65,798
Mechanical - Task M-400 Replace Feedwater Piping	$ 127,563	$ 41,943	$ 169,505
Mechanical - Task M-500 Install Redundant Hotwell Tank(s)	$ 431,397	$ 141,843	$ 573,240
Mechanical - Task M-600 Replace Water Softeners	$ 64,102	$ 17,205	$ 81,306
Mechanical - Task M-700 Install pH Neutralizer on Process Waste	$ 124,922	$ 48,620	$ 173,542
Mechanical - Task M-800 Install Redundant Deaerator (New Add'n Option)	$ 1,758,688	$ 578,257	$ 2,336,944
Electrical - Task E-200 Replace Swbd FM & FME	$ 122,760	$ 40,364	$ 163,124
Electrical - Task E-300 Replace MCC-GMC	$ 43,356	$ 14,256	$ 57,612
Electrical - Task E-400 Replace Generator ATS	$ 65,943	$ 21,682	$ 87,625
Electrical - Task E-500 Replace UPS & UPS Panel Board	$ 123,604	$ 40,641	$ 164,245
Total Proposed/Recommended Upgrade Costs	$ 3,050,708	$ 995,370	$ 4,046,078
EWU - Install New Boiler Project with Upgrades: TOTALS	$ 7,721,560	$ 2,531,146	$ 10,252,706

C. The above cost estimate summary sheet is organized into two major sections:

- Task - 1: Basic Boiler #3 Replacement:

  This task represents the bare minimum installation work required to replace Boiler #3 with a new, 40 kpph steam boiler. The costs associated with this task includes the removal and replacement of a section of the Rozell boiler plant wall, at-grade, near the smoke stack, as the design team's recommended boiler room installation access option.

- Tasks M-200 to Task E-500: Proposed/Recommended Upgrades:

  These tasks represents a shopping list of potential optional upgrades/enhancements to portions of the existing Rozell plant's infrastructure mechanical and electrical auxiliary systems, that support the operation of the plant's steam boilers.

  During the course of this pre-design study, a number of existing auxiliary systems and/or components have been identified as either unreliable, obsolete, of questionable age/condition, or underperforming. These items have been recommended as possible added scope items to the overall primary boiler replacement work, as funding allows.

  The list of optional upgrades is not given in any particular order of priority or importance, as all these elements are critical to the operation and reliability of the plant. It is expected that Owner review subsequent to receipt of this study, and follow-up discussions, will help to better prioritize this list, as well as to potentially identify other plant systems or components in need of attention.

D. Construction Costs vs. Soft Costs:

- Construction Costs:

  This category lists the actual direct labor and material costs for the contractors to perform the installation work. They include both subcontractor and general contractor mark-ups for overhead and profit, general conditions such as permits, etc. and a construction contingency percentage. This category basically represents the "hard costs" that would be determined through publicly bidding the project work.

- Soft Costs:

  This category represents all the project costs not directly associated with the actual construction work, including State sales tax, design contingency and professional design fees. It does NOT include agency/owner in-house costs to manage or supervise the design or construction.

- Total Project Costs:

  The sum of the direct Construction Costs and the indirect Soft Costs.

1.6 Next Steps

A. System Selection & Budget (MACC): After receipt and review of this report by the EWU Facilities and Planning staff and plant operators, it is proposed, and anticipated, that the recommendations for the new boiler installation and associated boiler plant system upgrades be formally approved, and a funding level (MACC) be established. After that, the next step would be to develop the detailed design and necessary construction documents for the installation of the new boiler and associated systems.

B. Detailed Design: MSI Engineers would further develop the approved new boiler installation and associated plant upgrades, and generate installation drawings, details and specifications for the construction work. MSI design fees will be established as noted above in our Scope of Services under Phase 2.

C. Public Bidding: Once the detailed construction documents are prepared the project will be solicited for open Public Bidding in accordance with Washington State procurement requirements. There may need to be some discussion regarding methods to identify appropriate pre-qualified boiler manufacturers and/or installers, so as to avoid having undesirable/unqualified entities involved in the construction or installation work.

D. Installation and Construction Schedule: It is expected that the detailed design work and preparation of Construction Documents can be completed by late 2020. This would allow for a bid opening to occur in early 2021, with construction beginning by spring of 2021. This should allow for the summer of 2021 to be utilized for critical system shut-downs and tie-ins, when the campus heating load is at a minimum. Full construction and start-up/testing of the new boiler system is anticipated to take approximately 18 months (1-1/2 years) to complete, which would put project completion in mid 2022.

Preliminary Schedule

1. Pre-Design Study & Review – April 2020
2. Design Period – 6-8 months – May to December 2020
3. Bid Period & Award – 2 months – Jan. to Feb. 2021
4. Begin Construction – March 2021
5. Construction Period – 18 Months
6. New Boiler On-Line – Fall 2022

2.0 STEAM PRODUCTION REVIEW and REPLACEMENT BOILER SIZING

2.1 Historical Campus Steam Utilization

The EWU Rozell Boiler Plant provides steam supply to the various Eastern Washington University campus classroom and office buildings, residence halls, sport facilities and adjacent State of Washington Crime Lab and Digital Archives facilities. Steam is distributed to the campus in a large network of underground utilities tunnels. Steam is used for both space heating and domestic water heating purposes. The Rozell steam plant is operated year round, 24-7. Because the steam plant provides for domestic water heating on campus, the plant needs to operate throughout the summer.

According to the EWU steam plant operators, the largest steam demand ever witnessed by the boiler plant occurred the winter of 2014, during a period of extended sub-zero weather. This also coincided with the newly remodeled Patterson Hall coming on line for the first time after three years of renovation, along with the activation of several new campus exterior snow melt systems.

The historical peak demand for the boiler plant was noted as 75,000pph (lbs/hr) during the above noted time period. Based on a total campus connected steam load, the sum of all campus building steam supply PRV stations, of approximately 234,000pph, the 75,000pph peak load represents a diversified campus steam load of 32% (of total connected campus load).

Based on the existing steam boiler plant total capacity of 217,000pph (nameplate), the historic peak load of 75,000pph represents 35% of total available plant nameplate capacity (4 operational boilers).

However, based on a more realistic operational limit of total plant capacity of between 95,000pph to 145,000pph (see 2.3 discussion below), the peak historic campus steam load represents 55% to 78% of the existing, available plant (operational) capacity.

2.2 Campus Steam Load Growth Analysis

In order to validate the correct "right" size (capacity) of the proposed replacement for the obsolete existing Boiler #3, a brief review of the future campus steam loads is in order.

The growth prediction models for the Rozell steam boiler plant capacity for the next 10-20 years were prepared based on the following information:

- The *EWU Comprehensive Campus Master Plan – 2014*, prepared by *mahlum*.
- Recent building construction data for the current ISC construction and recent PUB renovation, provided by *MW Consulting Engineers*.
- Chiller Plant load prediction modeling for the *Chilled Water Capacity Upgrade project Pre-Design Report - 2016*, prepared by MSI Engineers.
- Historic boiler plant operational data and peak loads provide by EWU Physical Plant Staff.

Obviously all of the various predictive growth models are somewhat speculative, depending on to what degree the EWU campus will expand in the next 10 to 20 years.

2.3 Existing Boiler Plant Capacity and Replacement Considerations

There are five (5) high-pressure (100 psig) steam boilers located in the Rozell Boiler Plant, although only four (4) are currently operational. All are capable of firing on either natural gas or No. 2 fuel oil. Natural gas is supplied to the plant by AVISTA. Fuel oil is stored in two 15,000 gallon underground storage tanks, installed inside concrete vaults adjacent to the plant. Decommissioned Boiler #3 is in the middle of the row. *See Figs. 1 &2.*

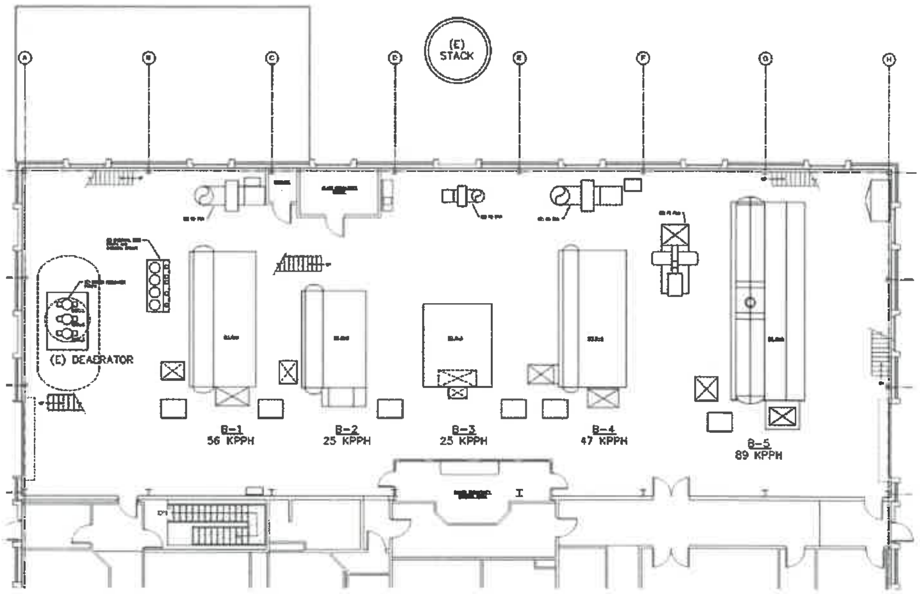


Figure 1 – EWU Rozell Central Boiler Plant General Arrangement

Figure 2 – Existing Decommissioned Boiler #3

Existing Steam Boilers

The Rozell Central Campus Steam Plant consists of the following five (5) high pressure steam boilers:

Boiler # 1: Babcock & Wilcox, Watertube
Natural Gas & #2 Fuel Oil Fired
1,600 Boiler Horsepower
56,000pph
Built 1974

Boiler # 2: E. Keeler, Watertube
Natural Gas & #2 Fuel Oil Fired
715 Boiler Horsepower
25,000pph
Built 1960

Boiler # 3*: Union Iron Works, Watertube ***(*Decommissioned - Not in Service)***
Natural Gas & #2 Fuel Oil Fired
715 Boiler Horsepower
25,000pph
Built 1966

Boiler # 4: Babcock & Wilcox, Watertube
Natural Gas & #2 Fuel Oil Fired
1,342 Boiler Horsepower
47,000pph
Built 1969

Boiler # 5: Nebraska, Watertube
Natural Gas & #2 Fuel Oil Fired
2,542 Boiler Horsepower
89,000pph
Built 2001

Existing Boiler Nameplate Steam Capacity

Boiler # 1:	56,000pph
Boiler # 2:	25,000pph
Boiler # 3:	(25,000pph) ***(*Not in Service)***
Boiler # 4:	47,000pph
Boiler # 5:	89,000pph
Total Plant Capacity:	217,000pph* (Full Nameplate capacity)

**Capacity does not include Boiler #3, which is presently not in service, awaiting replacement under this current project.*

Effective Operational
Plant Capacity: 95,000pph to 145,000pph
(See discussion below)

Effective Operational Plant Capacity: 95,000pph to 145,000pph

In actual operational practice, the peak steam capacity of the plant is substantially less than the full nameplate ratings. This is due to operational procedures that limit individual boiler output to no greater than about 75% of nameplate capacity, so as to reduce wear & tear stresses on the equipment, and an allowance that at least one boiler is always off-line (down) for regular maintenance. This works out to an operational capacity range of about 95,000pph to 145,000pph (depending on which boiler is off-line).
See *Fig. 3* below.

Existing Boiler Plant Steam Production Table

	Nameplate Capacity	Operational Capacity (75%)	Case #1	Case #2	Case #3	Case #4
Boiler # 1:	56 kpph	45 kpph	45	45	45	OFF
Boiler # 2:	25	19	19	19	OFF	19
Boiler # 3:	(0) Off Line	-	-	-	-	-
Boiler # 4:	47	35	35	OFF	35	35
Boiler # 5:	89	67	OFF	67	67	67
Total Plant Capacity:	217 kpph	162 kpph	96	128	144	121

Current Practical Maximum Operational Capacity Range: 95,000 pph to 145,000 pph

Figure 3 – Boiler Plant Steam Production Table

Plant Operation

The steam boilers are manually staged by the plant operators depending on weather conditions and campus steam load.

During summer months, the smallest boiler, Boiler #2, is used to support campus building domestic hot water demands, with Boiler #4 kept on hot standby for back up.
During the shoulder seasons, spring and fall, Boilers #1 and #4 are used.

During the winter heating season, Boiler #5 is used as the lead boiler, with either Boiler #1 or #4 used as hot standby or for peaking duty.

Fuel Firing Issues

The steam boilers are capable of firing on either natural gas or #2 fuel oil as back-up. Because of present limitations with AVISTA's natural gas supply capacity to the City of Cheney, peak gas consumption to the Rozell Plant is limited by contract to approximately 56,000pph firing rate. Above this level of consumption gas supply pressures drop off due to other gas demands in the campus neighborhood. At this point the standby boilers, #1 or #4, are fired on #2 fuel oil, to handle demand greater than 56,000pph. It is not desirable to have to fire on fuel oil, due to added wear and tear on the burners, loss of efficiency and stack emission issues.

Until such time as AVISTA addresses their gas supply capacity issue to the City of Cheney, this situation will not change. Timing of such an upgrade is unknown and is in the hands of AVISTA. Recent discussions with AVISTA suggest that the gas service capacity to Cheney will likely be upgraded in the next year or two. Whether or not this resolves the capacity restriction problem at EWU remains to be seen. In the meantime the Rozell boiler plant will need to regularly be operated with #2 fuel oil during peak heating winter months.

2.4 Proposed Replacement Boiler#3 Sizing Recommendation

Based on the above review of the existing Rozell boiler plant steam production capacity limits, and predictions for future campus steam load increases for the next 10 to 20 years, the following discussion provide guidance and recommendations for sizing the new, replacement, Boiler #3.

1) Current Plant Operational Steam Production Range: 95 kpph – 145 kpph

2) Future (projected) Peak Campus Steam Load: 135 kpph

3) New Boiler #3 Size Range:

   Future Peak Load – Existing Plant Capacity = Boiler #3 Size Required

   a. Best Case: 135 kpph – 145 kpph = -10 kpph required

   b. Worst Case: 135 kpph – 95 kpph = +40 kpph required

4) Analysis:

   Depending upon how the existing four (4) operational boilers are fired, or which boilers are down for maintenance or under repair, it is theoretically feasible that the existing boiler plant could carry the peak campus steam load in the future without replacing Boiler #3 (Best Case scenario above shows a theoretical future spare plant capacity of 10 kpph).

   However, in the Worst Case scenario, with the largest existing Boiler #5 off-line for maintenance, the existing plant would have a deficit capacity of about 40 kpph steam production capability in the future situation.

5) Boiler #3 Sizing Recommendation:

   Allowing for the Worst Case operational scenario for carrying the future campus steam loads, and so as to provide continued reliability and redundancy to the critical function of generating heat for the EWU campus facilities, it is recommended that the most conservative sizing factors be used to establish the proposed size of the new, replacement, Boiler #3 under this project.

   Therefore it is the recommendation of this pre-design study that the new ***Boiler #3 be sized for a steam production capacity of 40,000 pph.***

   This sizing recommendation validates the earlier estimates for a replacement Boiler #3 size, that were originally developed in 2014 under the *Campus Infrastructure Renewal* studies prepared by NAC Engineers, and which were the foundation for the Capital Funding allocation to EWU under which this project (*Install New Boiler, CP-1056*) was developed.

6) Boiler #3 Sizing Limitations – Will it Fit?:

The above recommended replacement Boiler #3 capacity of 40,000 pph, must also be tested against how large of a new boiler will physically fit within the available space where the current boiler #3 sits (or maybe somewhere else), how much the Rozell facility structure can handle, and how best to get the old boiler out and the new boiler in, to the middle line-up of a continuously operational steam plant.

- Physical Size Constraints.
- Installation Access Limitations.
- Structural Limitations.
- Support Infrastructure Limitations (Electrical, Water, etc.)

The good news is that yes, the proposed new boiler will fit (depending on several factors), which will be discussed in further detail in the following sections.

Would an even larger capacity boiler be a better choice to install, and take advantage of economies of scale? Perhaps, however, the physical size of a larger capacity boiler would be beyond the space available inside the plant to accommodate a larger boiler, so such an option is not considered feasible for further analysis in this study.

2.5 Options for Additional Future Boiler Replacements

Because of the advanced age of most of the remaining existing boilers, the oldest boiler, #2, is 60 years old, the youngest boiler #1, is 19 years old, consideration should probably be given to developing a plan for the phased replacement and/or decommissioning these older boilers, since most of them are at or near the end of their useful life expectancies. Basically, except for the newer Boiler #5, most of the boilers are nearing retirement age.

The most obvious first candidate for future replacement and/or removal (see discussion) is Boiler #2, which, at 60 years old, is very near the end of its normal life expectancy. Also, this particular boiler is also the smallest capacity boiler, at 25,000 pph, in the plant, so its contribution to peak heating loads is negligible (this boiler is basically used to handle light summer-time loads).

In view of the reasonable near term need to either replace or retire/remove existing Boiler #2, and the fact that it sits adjacent to the existing Boiler #3, which will be replaced under this current project, this study will provide some preliminary ideas for possible replacement concepts (boiler type, size, footprint, and access) as the plans for setting the new Boiler #3 develop further. In other words, the installation of the new Boiler #3 will respect the space and access issues that would be associated with the future removal and/or replacement of its neighbor, Boiler #2.

The other older boilers in the plant, Boiler #1 is 46 years old, and Boiler #4 is 51 years old, are considered middle aged, but should also be considered for eventual replacement. However, because of the timeframe involved, this work would likely be many years in the future, possible concepts for such replacements are beyond the scope of this study.

3.0 RECOMMENDATIONS FOR BOILER #3 REPLACEMENT

3.1 New Boiler #3 Capacity

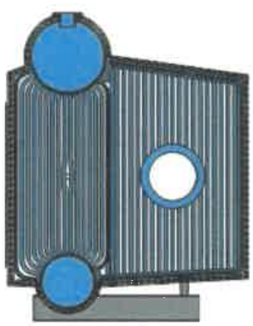
As noted in the previous section, and based on a review of the plant capacity and historical campus steam loads, it is the recommendation of this pre-design study that the new Boiler #3 be sized for a steam production capacity of 40,000pph.

3.2 New Boiler #3 Type

Steam boilers types available in the 40 kpph capacity size range are generally manufactured as Industrial Water Tube (IWT) type units. IWT type of boilers are basically the same general type of units as presently installed in the plant for existing Boilers #1, #2, #4 & #5.

IWT type boilers generally come in two different configurations: A-style and D-style. This refers to the shape of the steam drums and connecting water tubes from the lower to the upper drum. A-style boilers have center drums, with water tube risers branching out on both sides, left and right, basically forming the letter "A" when facing the boiler. D-style have drums located on one side, with the tubes connecting from the upper and lower drums branching out to one side, rising vertically, and back again, forming the letter "D".

For the EWU Boiler Replacement project a D-style boiler is recommended. This is the same configuration as existing Boiler #5, as well as several of the older existing boilers. See *Fig. 4*.



D-STYLE

The D-style is a 100% membrane water-cooled furnace, reducing costly, time-consuming, annual maintenance. The burner throat and the front and rear walls are welded and refractory free, utilizing our burner design. D-style boilers can be customized to provide superheated steam. We offer both single- and dual-stage integral superheater systems with optional temperature control over turndown.

Figure 4 – Example D-style IWT Boiler Arrangement

3.3 New Boiler #3 Make and Model

Because of EWU's long and successful relationship working with Cole Industries for both installation and service work, including the recent boiler plant control upgrade project, and Cole's partnership with Cleaver-Brooks, Inc., it is the recommendation of this pre-design study that the new Boiler #3 be based on available boiler and burner packages as manufactured Cleaver-Brooks, Inc.

- Cleaver Brooks (manufactured in Georgia and represented locally by Cole Industrial out of Lynnwood, WA). See *Fig. 5.*

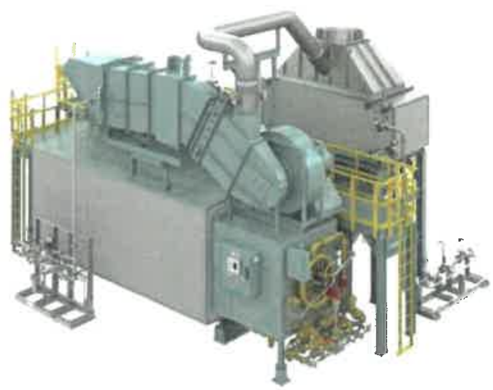


Figure 5 – Example Cleaver-Brooks IWT Boiler Arrangement

Boiler: For a 40,000 pph rated steam boiler the Cleaver-Brooks Model CBCW-040 is proposed as the recommended make and model. See *Fig. 6*.

CBCW Steam Boiler Ratings

		10,000 – 60,000 lb/hr					
Boiler Capacity*	kpph	10	20	30	40	50	60
Ratings							
Furnace Volume	ft³	279	394	452	718	809	901
Furnace Area	ft²	258	336	375	497	546	596
Evaporator Surface Area	ft²	891	1,279	1,473	1,814	2,053	2,291
Total Heating Surface	ft²	1,150	1,615	1,848	2,311	2,599	2,887
Approximate Fuel Consumption at Rated Capacity							
Light Oil Input – 150# Steam[B]	GPH	86	172	258	344	430	516
Natural Gas Input – 150# Steam[C]	SCFH	12,040	24,080	36,120	48,161	60,201	72,241
Power Requirements – 60 Hz, 3-Phase							
Blower Motor Size: Uncontrolled	HP	7.5	15	30	40	60	75
30 ppm	HP	7.5	25	40	50	75	125
9 ppm	HP	Consult Factory					

Note: Above information, while sufficiently accurate for preliminary purposes, must be confirmed for construction by submittals
A Boiler capacity provided in kpph
B Input calculated at nominal 83% efficiency based on 140,000 Btu/gal.
C Input calculated at nominal 83% efficiency for 1,000 Btu/scf gas content

Figure 6 – Cleaver-Brooks CBCW Boiler Ratings

Burner: The proposed CBCW boiler comes equipped with a custom engineered, dual-fuel (gas and oil), high efficiency, low emissions type burner. The forced draft fan assembly is mounted directly to the top of the burner housing, eliminating the need to find limited floor area to mount the remote fan and run the ductwork, as was the case with the previous installation of Boiler #5. See *Fig. 7.*

Figure 7 – Cleaver-Brooks CBCW Boiler Ratings

Economizer: The proposed CBCW boiler comes equipped with an integral flue-gas stack economizer assembly, mounted on a support stand adjacent to the boiler's furnace section. Flue Gas Recirculation (FGR) for enhanced emission control is ducted from the outlet of the economizer, back to be re-burned through the boiler. See *Fig. 8.*

Figure 8 – Cleaver-Brooks Integral Stack Economizer

Appendix I – Campus Infrastructure Renewal 2014 - Chilled Water

The full document can be viewed at this link:

https://inside.ewu.edu/facilities/2014-ewu-chilled-waster-system-evaluation/

APPENDIX I1

EASTERN WASHINGTON UNIVERSITY

Campus Infrastructure Renewal

CHILLED WATER SYSTEM EVALUATION

August 1, 2014

CAMPUS INFRASTRUCTURE RENEWAL
Project AE1368
CHILLED WATER SYSTEM EVALUATION

FOR

EASTERN WASHINGTON UNIVERSITY

Cheney, Washington

By

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

MSI Engineers Inc.
108 N. Washington, Suite 505
Spokane, WA 99201
July 2014
MSI # 14.01

Under Contract to NAC|Engineering

TABLE OF CONTENTS

INTRODUCTION

The following report summarizes the evaluation of the Eastern Washington University, EWU, Central Campus Chiller Plant and Campus Chilled Water Distribution piping system with regard to current configuration, condition, capacity, and opportunities for expansion to serve future facilities as envisioned under the 2013 Comprehensive Campus Master Plan.

The goal of this steam system evaluation is to identify deficiencies with the present campus wide infrastructure that should be corrected or upgraded, in order to support the ongoing and long term growth of the campus. This report contains recommendations (potential projects) for correcting the noted infrastructure deficiencies, along with corresponding rough order of magnitude cost estimates for these upgrades, in order to assist EWU in putting together their capital funding requests for the upcoming biennium.

- Replacement schedule based on system age.
- Modification/expansion required to accommodate master plan.
- Modification/renovation required to provide operational efficiencies.

EXISTING CAMPUS CHILLED WATER SYSTEM

Rozell Central Campus Chiller Plant

The Central Campus Chiller Plant is located in the Rozell facility at the north end of campus. The chiller plant furnishes chilled water at approximately 45 deg. F, to the majority of the campus building through a network of underground tunnels and shallow utilidors, to provide for the space cooling and air conditioning needs of the campus facilities.

There are five (5) water-cooled centrifugal chillers located in the lower level of the Rozell Central Plant. These chillers were installed in 1996 as part of a major plant upgrade. All chillers utilize environmentally friendly R-134a refrigerant.

Chillers

The Rozell Central Campus Chiller Plant consists of the following five, centrifugal type, single speed, water-cooled chillers:

Chiller # 1	Carrier Model 19 XL 50534 93CP Water-Cooled, Centrifugal, R-134a 500 Tons Built 1996
Chiller # 2	Carrier Model 19 XL 50534 93CP Water-Cooled, Centrifugal, R-134a 500 Tons Built 1996
Chiller # 3	Carrier Model 19 EX 3133-736DK621 S Water-Cooled, Centrifugal, R-134a 1,000 Tons Built 1996
Chiller # 4	Carrier Model 19 EX 3133-736DK621 S Water-Cooled, Centrifugal, R-134a 1,000 Tons Built 1996
Chiller # 5	Carrier Model 19 EX 3133-736DK621 S Water-Cooled, Centrifugal, R-134a 1,000 Tons Built 1996

Total Plant Capacity: 4,000 Tons

Cooling Towers

Each chiller is coupled to a dedicated matching cooling tower. The plant cooling towers are located on the roof of the Rozell Central Plant. The two smallest towers are original, pre-1996 upgrade vintage, while the two of the other three larger towers are from the 1996 expansion, and one of the other larger towers was installed in about 2009.

The cooling towers for the central plant consist of two (2) original vintage, 500 ton capacity towers and three (3) newer, 1,000 ton capacity towers. All the cooling towers are open type design with induced draft, draw-through propeller fans. Fan motors are all 2-speed type for some capacity control.

Free Cooling Heat Exchangers

The chiller plant is equipped with two (2) plate & frame type heat exchangers that provide partial cooling capacity to the chilled water distribution piping system during shoulder seasons, before the chillers are energized. These heat exchangers are located in the lower level of the Rozell plant, near the pump gallery. Each free cooling heat exchanger is coupled to a cooling tower, in order to provide for indirect heat rejection from the campus chilled water loop, during mild weather, without having to operate the plant's compressorized chillers.

One heat exchanger has a nominal capacity of about 300 tons and was installed in about 1998. The other heat exchanger has a nominal capacity of about 200 tons and was installed in 2003. Each heat exchanger is designed with a 1 deg. F approach. Total free cooling capacity is 500 tons.

Chiller Plant Pumps

Pumps for the chillers and the cooling towers are located in the lower level of the Rozell Central Plant. Condenser water (tower loop) and primary chilled water (evaporator loop) piping for each chiller-tower pair is provided by dedicated single speed pumps. The condenser water pump motors are furnished with soft starters.

The chilled water distribution system is configured at the central plant level as a Primary-Secondary pumping system. The primary chilled water pumps produce flow through the individual chiller evaporator barrels. The secondary chilled water pumps produce flow to the campus chilled water piping network that serves individual buildings. There are three (3) secondary chilled water pumps that supply the campus loop. Two of these pumps have 2-speed motors and the third pump has a VFD drive for capacity control.

The various campus buildings generally utilize tertiary chilled water pumps to supply the cooling coils and other cooling loads at the building level. In some cases the buildings are decoupled from the campus loop with a plate & frame heat exchanger.

Chiller Plant Auxiliaries

Water Treatment Equipment: The chemical water treatment equipment for the open cooling towers plant is located in the lower level of the Rozell plant. Dosing pumps and monitoring devices provide chemical feed of corrosion inhibitors, biodides and PH maintenance. Make-up water is pre-treated through an ion exchange water softener plant. The campus chilled water distribution loop utilizes plain water, rather than a glycol-water anti-freeze solution, which therefore requires that the building system HVAC air coils be drained in the winter. The chilled water distribution system is also chemically treated with corrosion inhibitors and PH controllers.

Chiller Plant Operation

The several chillers, and their corresponding cooling towers and pumps, are manually staged on and off by the plant operators depending on weather conditions and campus cooling load. The chillers are rotated in service based on run times.

Chilled water is generally produced and delivered to the campus at about 45 deg. F. Chilled water return water temperatures vary with load and flow rates, but at times are as warm as about 64 deg. F (a 19 deg. delta T for the campus).

The cooling season generally runs from May through mid October. During the shoulder seasons, when cooling loads are light and the weather is mild, the free cooling heat exchangers are utilized to provide campus loop cooling, before the chillers are energized. Mechanical cooling (chillers) is generally needed whenever the outdoor air temperatures climb above 60 deg. F or so.

Chilled water is delivered to the campus using any number of the three (3) secondary chilled water pumps, depending upon load demands. The largest pumps is rated at about 2800 gpm and is run with a VFD drive at a variable speed/flow to maintain a differential pressure between the campus supply main and the campus return main of about 15 psig (34 ft hd). The other two secondary chilled water pumps are each 2-speed pumps, rated at a nominal 1100/700 gpm. These pumps are staged on as the campus demand increases and are run in conjunction with the VFD drive pump to maintain the differential pressure in the campus loop.

During the winter months, the campus chilled water distribution system is still circulated, but at a greatly reduced flow rate, in order to help keep the distribution piping and valves free from corrosion using the inherent chemistry protection provided by the treated chilled water flow. There are several valved bypasses located at the ends of the tunnel distribution system, that are opened in the winter to help maintain total network circuit flow paths.

Campus Chilled Water Tunnel Distribution System

General:

The chilled water is delivered to the campus through a piping network that is located mostly within an accessible (walkable) underground concrete utility tunnel, that provides a loop around the campus to serve all the major academic & some hall buildings.
Chilled water supply and return piping systems distribute out from the Rozell central plant, through the tunnel network and into the building mechanical spaces. In certain limited cases, the connections from the main tunnel to the buildings, is through shallow, non-accessible, concrete utility trenches, referred to as utilidors. These utilidors generally follow surface sidewalks, and pipes can be accessed by removing the lids of the utilidors if necessary. There are a few instances of direct-buried piping connections from the tunnel to a few of the older buildings.

Chilled water supply to each building is generally routed to the various HVAC system air handling unit and other cooling system coils that are distributed throughout the building. Most air handling unit coils are provided with dedicate tertiary pumps, that provide a boost to the chilled water flow from the plant and help to maintain good heat transfer through the coils. Control valves at each coil regulate the amount of cold, 45 deg. F, chilled water from the central plant, that is consumed by the coil. Warmer return chilled water then exits the building where it returns to the plant via the same utility tunnel network. Depending upon the weather conditions and the type of HVAC system control strategy employed, the coil tertiary pumps are not energized until hot weather, and instead the cooling coils derived their flow from the central plant pumps.

Pipe Materials & Installation:

It is understood that the chilled water supply and return distribution piping system lines, are constructed of Sched. 40 steel piping. Piping smaller than 2" size is generally threaded, while all piping larger than 2" is welded. Valves are installed with flanges while expansion joints are welded in the pipeline.

The chilled water piping is generally mounted on support stands off the tunnel floor, with supply and return lines run on opposite sides. In some cases the piping is installed on steel framing, in common with the steam piping, with roller supports, spider alignment guides and inline expansion joints where necessary. Anchors are generally tied directly in to the concrete walls. All the chilled water piping is insulated, mostly with fiberglass insulation, with jacketing that varies from coated paper ASJ type, to PVC to corrugated metal, depending upon location, age and service locations.

Configuration:

The chilled water distribution piping is configured in a looped manner around the majority of the campus buildings. The west-side loop (known as the HPE loop), exits from Rozell and travels south, parallel to Washington Street, along the edge of the Woodward Field parking lot. The east-side loop (known as the Rozell loop), exits from Rozell, travels east along Cedar Street, turns south to the PUB, bends to the SE to Tawanka, turns to the SW and continues through the central plaza to the Art Complex. Just north of the Communications Building, the east and west loops join together.

There are several notable sub-branches that come off of the looped main:

- HPE Complex Branch
- CEB & Cheney Hall Branch
- WSP & Archives Branch
- Huston & Sutton Branch
- Senior & Kingston Hall Branch

The looped configuration of the chilled water main piping allows the chilled water system to be back-fed from either direction, in the case of maintenance or repair work on any section of the piping. Most pipe branch take-offs have isolation valves on both sides of the branch piping, which allows feed or isolation to occur on either side of the take-off. This provides great flexibility and allows most of the campus to be supplied with chilled water during service shut-downs on limited sections. Without a looped system, everything downstream from the shut-off point would otherwise be without service.

Access:

Access to the utility tunnel is provided in a number of locations. The main entrance, and the beginning of the tunnel, starts in the lower level of the Rozell Plant. Most other major buildings that are connected to the full size tunnel have basement or lower level mechanical rooms with doors that access the tunnel. At a few points along the tunnel route, there are stairway, with doors and surface structures for access or exiting. The original tunnel system also had some manholes with ladders, and a few ventilation turrets with access lids. Most of the manhole lids are sealed or rusted closed.

Age:

The utility tunnel, as well as most of the chilled water (and steam) distribution piping, was constructed in the early 1970s, along with the construction of the new Rozell Central Plant. This plant, and the utility tunnels, replaced the original steam plant (now the PLU bulding) and older direct buried steam distribution system. The tunnel has been expanded over the years to connect new buildings or sections of the campus as growth occurred. Most of the piping in the tunnel is therefore over 40 years old.

Condition:

Despite being over 40 years old, most of the steam supply and condensate return piping systems are in very good condition and have been well maintained. An end-to-end survey of the utility tunnel was conducted and all main branches, tees and major features were photographed for documentation as part of this report.

Most of the main and branch chilled water shut-off valves are butterfly valves with worm gear operators, which give excellent performance and help to extend the life expectancy of the system. Chilled water leaks at valves and fittings are virtually non-existent within the tunnel.

Insulation jacketing on the piping and valves was mostly intact and in good condition. Damage due to maintenance or water intrusion appeared minimal.

Capacity:

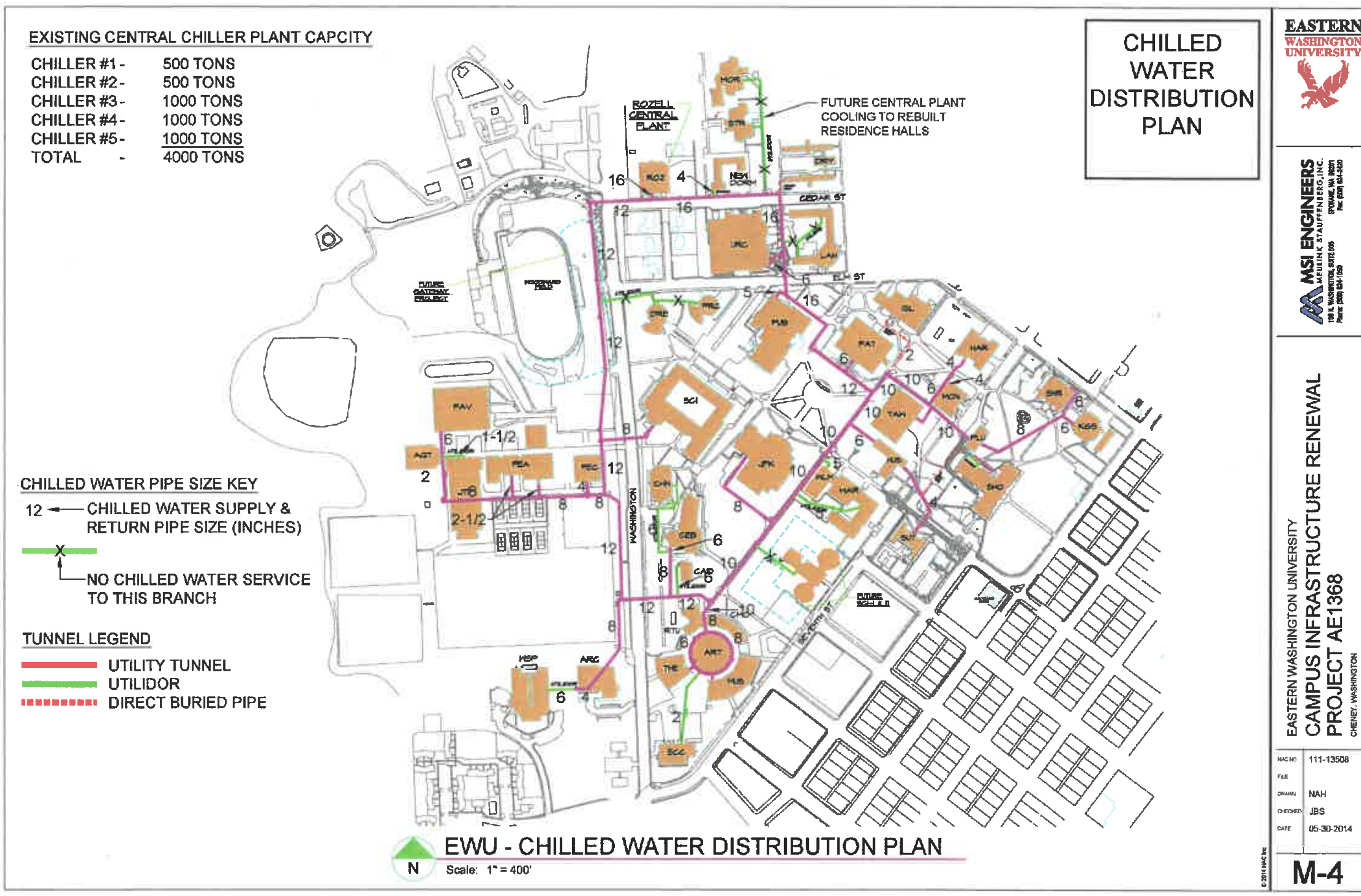
As part of this analysis, at chilled water system flow model was created for the entire campus chilled water distribution system (see analysis below). This model used information about the existing connected chilled water (air handling unit cooling coil loads in each building) and existing chilled water pipe sizing information, to develop a dynamic tool to help understand chilled water flow paths through the looped system, and to determine pressure losses from the Rozell Plant to the remote ends of the distribution system.

The main chilled water supply and return line exit from Rozell as 16" pipes. At the main junction just south of the plant the west (HPE) loop reduces to 12" size continues all the way down t the junction at the Art complex, where it reduces to a 10" pipe up to the east branch tee near Patterson Hall. The east (Rozell) loop stays at a 16" pipe and continues to a point just past the PUB branch, where it reduces to 12" pipe up to tee junction past Patterson. At this point the 10" pipe runs south to JFK Library and to the north and east to the PLU building.

See the discussions and analysis in the flow modeling section for recommendations relative to pipe size and capacity.

Life Expectancy:

Based on the observations of the tunnel-wide survey conducted for this report, it appears that the chilled water supply and return piping is in good condition, and without evidence of failures or major leaks. Reports from the EWU maintenance staff indicate that when the piping has been opened for new branch tie-ins or valve work, that the interior of the piping does not show undue corrosion or pitting. Although the majority of the main loop piping is over 40 years, it is reasonable to expect another 15 to 25 years of service life, assuming the same level of care and maintenance in to the future.


EXISTING CENTRAL CHILLER PLANT CAPCITY
CHILLER #1 - 500 TONS
CHILLER #2 - 500 TONS
CHILLER #3 - 1000 TONS
CHILLER #4 - 1000 TONS
CHILLER #5 - 1000 TONS
TOTAL - 4000 TONS
CHILLED WATER PIPE SIZE KEY
12 CHILLED WATER SUPPLY & RETURN PIPE SIZE (INCHES)
NO CHILLED WATER SERVICE TO THIS BRANCH
TUNNEL LEGEND
UTILITY TUNNEL
UTILIDOR
DIRECT BURIED PIPE
ROZELL CENTRAL PLANT
FUTURE CENTRAL PLANT COOLING TO REBUILT RESIDENCE HALLS
CEDAR ST
ELM ST
WASHINGTON
CHILLED WATER DISTRIBUTION PLAN
EWU - CHILLED WATER DISTRIBUTION PLAN
N
Scale: 1" = 400'
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CAMPUS INFRASTRUCTURE RENEWAL
PROJECT AE1368
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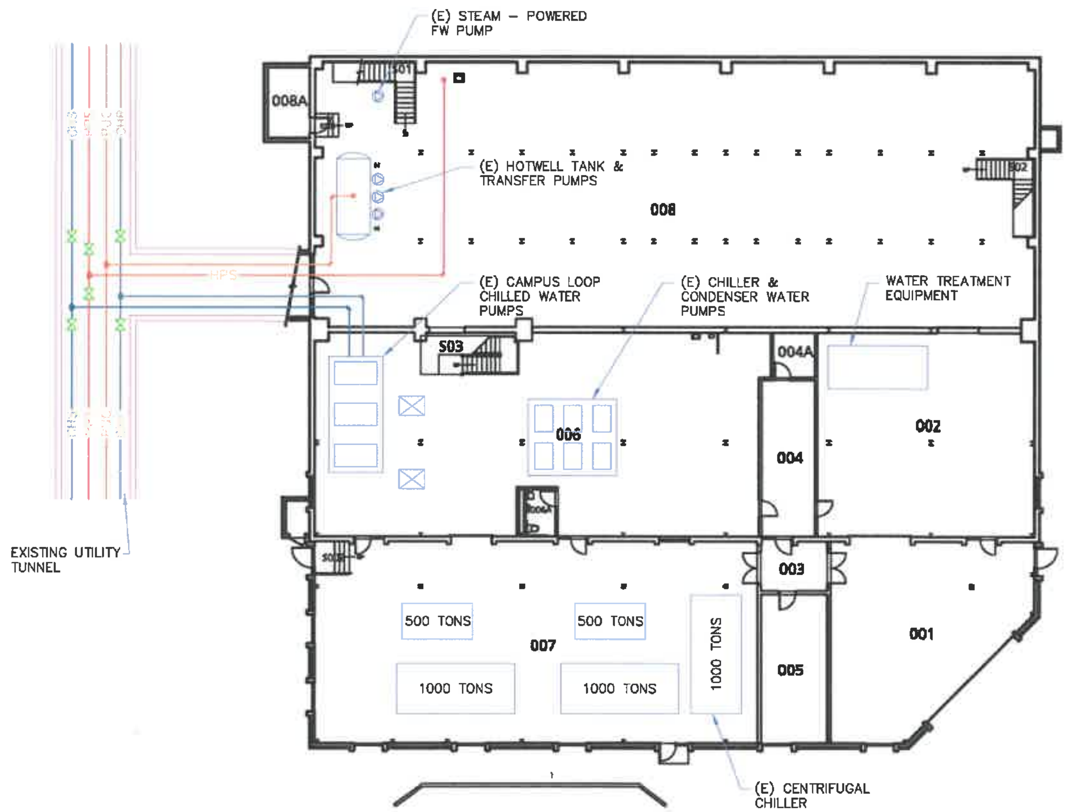

EWU - ROZELL CENTRAL PLANT - LOWER LEVEL

Scale: NTS

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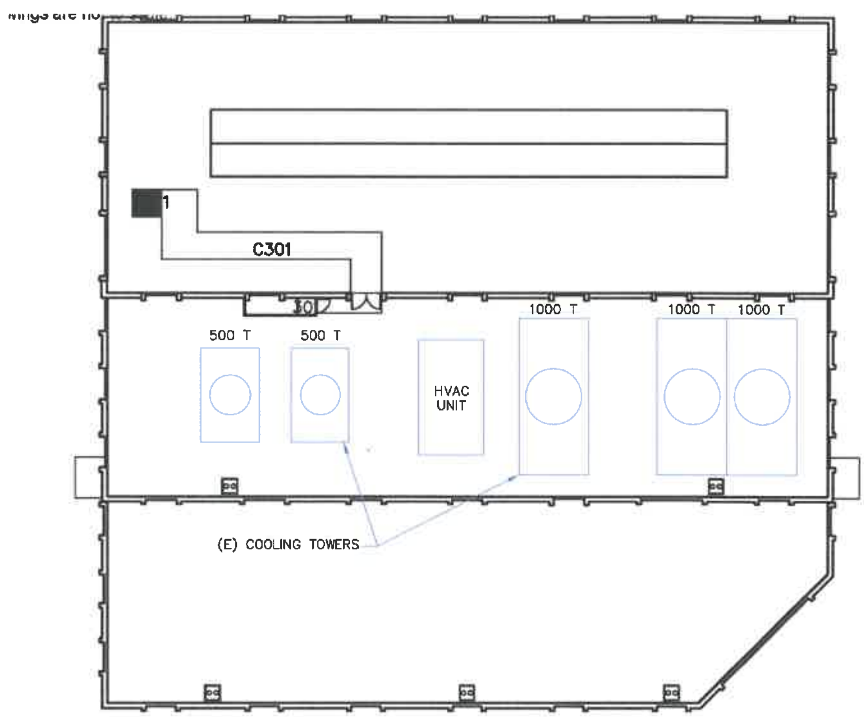
ROZ-1



EWU - ROZELL CENTRAL PLANT - ROOF

Scale: NTS

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ROZ-3

CAMPUS CHILLED WATER SYSTEM FLOW MODELING & CALCULATIONS

Purpose & Goals

The existing EWU campus steam distribution system was modeled using commercial flow modeling software, in order to help evaluate and understand existing flow pathways though the campus loop, chilled water main pipe velocities and drop-off delivery pressures to individual buildings. Several models were created to look at various flow demands in order to help determine if the existing chilled water distribution system has the capacity to handle future campus growth.

Methodology

Using the computerized flow modeling software tools, and schematic plan representing the campus steam piping network was created. This plan was then populated with information regarding existing pipe sizes, pipe lengths, valves and fittings, in order to give an accurate representation of the system geometry.

Next, the various campus buildings were connected to the model as individual building chilled water flow demand points, representing the sum total chilled water gpm flow demand for each building. Each building was simplified in to a single chilled water flow demand point, in order to avoid creating an overly complex and confusing network, which would otherwise be the case if all the down steam piping, pumps and individual coils were added to the model for each building. Each building flow demand point was given a nominal pressure drop of 5.0 psig at design flow rates, in order to represent the pressure drop of valves, fittings and other building entrance conditions. Automatic control valves were added in to the model for each building to provide for flow limiting and to allow for diversity to be adjusted.

Chilled Water Load Data Source

Available construction drawings for each building were pulled from the EWU drawing library and chilled water coil capacity and flow data was extracted from these plans. Cooling coil data provided in the 2009 Dumais-Romans *EWU Campus Chilled Water System Study* was also used in this report. Allowances for future building chilled water loads were provided by EWU based on pre-design information, or, in the case of the future cooling for the modernized residence halls, based on an estimate of 500 sq. ft. per ton.

Diversity

Utilizing only the sum of the total connected design peak chilled water demand for all facilities simultaneously, does not take into account the actual dynamics of building occupancy and weather variations, and results in an unrealistically high demand on the Central Campus Chiller Plant. For example, occupancy levels often don't reach 100% and can therefore reduce the demand for air conditioning. On a larger scale, peak demand in a given building is often balanced by a reduction in demand in other facilities as students migrate from the dorms to the classrooms, offices and gyms. This 'diversity' results in an overall demand reduction on the expected central chiller plant.

According to the EWU operations staff, the historical peak campus cooling load is somewhere between 3,500 tons (per Dumais & Romans in their 2009 *Campus Chilled Water System Study*) and 2,500 tons (per McKinstry in their *2012 Energy Efficiency & Sustainability Report*). In our interview with the EWU staff, they reported a historical peak cooling load of about 3,000 tons, which is the value that is used in our analysis.

Based on a total campus connected chilled water load of approximately 5,748 tons, the 3,000 tons represents a diversified load of 52% (of total campus load). Based on a chiller plant total capacity of 4,000 tons, this represents a 75% load of plant capacity.

For chilled water system flow modeling purposes, the diversified peak historic chilled water load was modeled at 50% of peak connected capacity.

COMPUTERIZED CHILLED WATER SYSTEM FLOW MODEL

Modeling Software

Pipe-Flow Professional, Version 12 (2014) by Engineered Software, Inc., was used to construct a computerized steady-state flow model of the steam distribution system. This software utilizes the Darcy-Weisbach formula with Bernoulli's theorem along with an extensive fluid and hardware properties database to solve complex networks including the effects of temperature, pressure, density, enthalpy, and steam quality. Its algorithms and equation solving techniques permit the program to automatically correct logical errors entered by the user (over-constrained system, reverse flow directions, inverted pressures, mismatched pipe sized, etc). Once the user defines the piping network within the software using actual pipe lengths, sizes, fittings, valves, and controls, the program solves the mass and energy balances and returns the solution along with all corresponding fluid properties.

Modeling Approach

Three (3) basic chilled water flow models (cases) were developed for the campus distribution analysis.

Case-1: Maximum Design - 100% Connected Loads

Basically this was an academic exercise to set-up the model for actual diversified loads, and it treated all connected buildings as having 100% chilled water flow load demand concurrently, with no system diversity. This model was used to validate that the sum of the connected building loads matched the expected values. The results of the flow are not really applicable to the actual chilled water system operation, which is highly diversified, but it is interesting to note the high resultant pipeline velocities near Rozell, where total flow is maximum, and the resultant high pumping flow rates and head pressures that would be theoretically necessary to satisfy this full flow system.

Case-2: Historic Peak - 50% Connected Loads

This model is basically the baseline expected peak chilled water flow demand for the actual existing campus system, based on the historic peak diversified demand of 50% of connected load (see above for diversity discussion).

Case-3: Future Peak - 50% Connected Loads

This model adds in the future chilled water loads, for the planned Gateway Athletic complex, the new Science I & II facility, as well as future cooling to the Residence halls, to the historic peak loads of Case-2. The same diversified load factor of 50% was used for this model.

CHILLED WATER SYSTEM FLOW MODEL RESULTS

See the graphic steam piping network drawings that are included with this report.

Case-1: Maximum Design - 100% Connected Loads

Not applicable. This was the model set-up. See discussion above.

Case-2: Historic Peak - 50% Connected Loads

Pipe Velocities:
Results of the chilled water system flow model for this case show that historic peak, diversified chilled flows and corresponding velocities in the existing piping network, do not exceed accepted values for good engineering practice. Velocities up to 10 fps maximum are generally accepted for good engineering practice for general water service piping (ASHRAE Fundamentals). Peak system velocities occur near Rozell where the combined chilled water flows are the greatest, with the west side main 12" at around 8.5 fps and east side main 16" branch at around 6.3 fps. The combined 16" plant main in to Rozell runs around 11.4 fps, which, although over the normal 10 fps maximum, is not really a concern for such a large diameter pipe, which can tolerate elevated velocities due to robust pipe wall thickness. This analysis indicates, and confirms, adequate pipe sizes for the actual existing historic peak loads for the campus.

System Pressure Drops:
Results of the chilled water flow model for this case indicate an overall total loop pressure drop to satisfy all remote flow demands, to be in the range of about 57 ft hd (25 psig) at the campus chilled water secondary pumps. Although this value is based on a simplified network analysis, with many variables that may not be fully understood, it does suggest that the existing campus secondary chilled water pumps may be somewhat under sized.

Case-3: Future Peak - 50% Connected Loads

Pipe Velocities:
With the addition of more chilled water load to the model to account for future buildings, the results of the flow model for this case show that anticipated future peak, diversified chilled water flows and corresponding velocities in the existing piping network, exceed the limits of good engineering practice in portions of the piping network. The existing west side 12" main line will experience considerably greater flow when the Gateway Athletic complex and future air conditioned Residence Halls come on line. Estimated peak flows of around 4,500 gpm in this section of piping will generate velocities around 12.8 fps. Not only is this higher velocity of concern for pipeline erosion issues, but the added flow resistance will create extra head pressure demands on the campus supply pumps. As such this section of 12" piping is a good candidate to be replaced to allow for future growth to this side of the campus loop.

At the same time the flow model shows that the larger 16" east side chilled water main will see flow rates that keep the peak velocities around 8.4 fps, well below the 10 fps maximum. However, the combined flows on the 16" main in to the Rozell plant show peak velocities over 16 fps, well above the usual 10 fps maximum. This analysis suggests that this section of piping should also be considered for replacement with larger piping to allow for future campus growth.

System Pressure Drops:
Results of the chilled water flow model for this future flow case indicate an overall total loop pressure drop to satisfy all remote diversified flow demands, to be in the range of about 175 ft hd (75 psig) at the campus chilled water secondary pumps, at a system flow rate of about 6,400 gpm. Because the existing campus secondary pumps only have a total flow capacity of about 5,000 gpm at 35 ft. hd., this indicates that these pumps will need to be replaced with larger capacity pumps to handle future campus chilled water demands.

Case-3A: Future Peak - 50% Connected Loads - Upsize 12" West Piping to 16"

Due to the results of Case-3 above that indicate that some of the existing chilled water piping will be too small to efficiently handle anticipated future chilled water flows, this model was run as a "what if" case with a larger pipe used on the west side loop, from Rozell to the HPE branch. This larger pipe accommodates the added expected future flow demands of the Gateway Complex and the air conditioned dorms.

Results of this case show pipe velocities in this section dropping below 7 fps and helping to reduce total system pump head pressure down to 85 ft. hd (37 psig).

CHILLED WATER SYSTEM FLOW MODEL CONCLUSIONS

Chilled Water Distribution Piping Capacity for Future Growth

In general, the existing chilled water system distribution piping is adequately sized to handle both the current chilled water flow demands plus anticipated future system growth. However, a portion of the existing west side main 12" piping, that runs from Rozell down Washington Street to the HPE complex, will be somewhat undersized for future growth allowance, and it is recommended that this section of piping be replaced with 16" size pipe.

Also, some of the existing 16" chilled water piping inside the Rozell Chiller Plant could experience excessive flow velocities due to future flow demands, and it is recommended that this piping be replaced or modified as the chiller plant grows to meet future loads (see below).

Chiller Plant Capacity for Future Growth

Due to the anticipated future growth of the campus as envisioned in the current Master Plan, the present 4,000 ton chiller plant will not have sufficient capacity to meet all the future cooling loads.

Based on the anticipated Master Plan campus growth for the New Science I & II projects, the new Gateway Athletic Project and the modernization of the legacy residence halls to include air conditioning, the expected addition of campus chilled water load is approximately 40%. Based on a peak historic capacity of 3,000 tons, a 40% increase would put the future campus load at over 4,200 tons, which is greater than the present total plant capacity of only 4,000 tons.

In order to meet the future cooling needs of the campus growth plan, it will be necessary to add cooling capacity, with sufficient redundancy to allow operational flexibility and to allow for break-downs. At minimum a 1000 ton chiller plant expansion should be planned for, although a larger, 2000 ton expansion would provide a higher degree of redundancy, future growth allowance and flexibility.

CAMPUS CHILLED WATER SYSTEM UPGRADE RECOMMENDATIONS

Overall the existing Central Campus Chiller Plant is in good condition, and has been very well maintained, similar to the steam plant equipment. The chiller plant underwent a major expansion in the mid 1990's and as a result the equipment is generally newer than much of the older steam plant equipment. An analysis of the chiller plant capacity and past load history indicates that, unlike the steam plant, the existing chiller plant will not have sufficient spare capacity to handle the anticipated new cooling loads for the 10 year Master Plan growth. As such, several projects have been identified below to provide added chiller plant cooling capacity, reliability and to increase system efficiencies.

Proposed Campus Chilled Water System Infrastructure Upgrade Projects:

Chilled Water System Recommended Project Summary List

Project No.	Title	Description	ROM Budget Price
CP	Chiller Plant		
CP-1	Add Chiller Plant Capacity, 2000 tons	New 2000 ton water-cooled centrifugal chiller with VFD drive. New induced draft, open cooling tower with VFD drive. New chiller and condenser water pumps with VFD drives. Controls. Rozell Plant expansion, electrical and ventilation.	$3,600,000
CP-2	Upgrade Campus Chilled Water Pumps	Replace three (3) existing secondary chilled water pumps (campus supply) with new VFD driven pumps, with flow and head capacity to handle future loads.	$300,000
CP-3	Install VFDs on Chiller Compressors & on Cooling Towers	Retrofit existing 1000 ton chillers and cooling towers with VFD drives and upgrade controls to improve plant efficiency.	$1,000,000
CP-4	Install 2 New Energy Efficient Cooling Towers	Replace (2) aging 500 ton cooling towers with new induced draft, open type towers with VFD drives, to improve plant efficiency.	$500,000
CD	Chilled Water Distribution		
CD-1	Replace/Upsize a Portion of the 12" West-Side Chilled Water Piping	Replace a portion of the existing 12" west side campus distribution piping with 16" pipe in order to handle future chilled water flow demand.	$1,000,000

Central Camps Chiller Plant (CP)

Overall the existing Central Campus Chiller Plant is in good condition, and has been very well maintained, similar to the steam plant equipment. The chiller plant underwent a major expansion in the mid 1990's and as a result the equipment is generally newer than much of the older steam plant equipment. An analysis of the steam plant capacity and past load history indicates that, unlike the steam plant, the existing chiller plant will not have sufficient spare capacity to handle the anticipated new cooling loads for the 10 year master plan growth. As such, several projects have been identified below to provide added chiller plant cooling capacity, reliability and to increase system efficiencies.

CP-1: Add Chiller Plant Capacity, 2000 tons

Description:

Install additional chiller plant capacity, 2000 tons.

(This recommendation is a concurrence of the chiller plant capacity upgrades "2.02-ROZ" as previously suggested by McKinstry in their *2012 Energy Efficiency & Sustainability Report*, as well as by the recommendations made in 2009 by Dumais & Romans in their *Campus Chilled Water System Study*)

The following elements would be installed or upgraded:

- New 2000 ton water-cooled centrifugal chiller with VFD drive.
- New 2000 ton induced-draft open cooling tower with VFD drive (2-1000 ton towers).
- New chiller (evaporator) pump.
- New condenser water (tower) pump.
- Upgrade/Replace Campus Loop chilled water pumps with new capacity pumps with VFDs.
- Controls.
- Rozell plant expansion, electrical work and ventilation.

Analysis/Justification:

The existing Central Campus Chiller Plant has a total capacity of 4,000 tons (3-1000 ton chillers & 2-500 ton chillers), which matching capacity cooling towers and pumps.

According to the EWU operations staff, the historical peak campus cooling load is somewhere between 3,500 tons (per Dumais & Romans in their 2009 *Campus Chilled Water System Study*) and 2,500 tons (per McKinstry in their *2012 Energy Efficiency & Sustainability Report*). In our interview with the EWU staff, they reported a historical peak cooling load of about 3,000 tons, which is the value that is used in our analysis.

Based on the anticipated master plan campus growth for the New Science I & II projects, the new Gateway Athletic Project and the

modernization of the legacy residence halls to include air conditioning, the expected addition of campus chilled water load is approximately 40%.
Based on a peak historic capacity of 3,000 tons, a 40% increase would put the future campus load at over 4,200 tons, which is greater than the present total plant capacity of only 4,000 tons.

In order to meet the future cooling needs of the campus growth plan, it will be necessary to add cooling capacity, with sufficient redundancy to allow operational flexibility and to allow for break-downs. At minimum a 1000 ton chiller plant expansion should be planned for, although a larger, 2000 ton expansion would provide a higher degree of redundancy, future growth allowance and flexibility.

Sequence / Category:
Capital Master Plan Project.

Cost:
CP-1: $3,600,000

CP-2: Upgrade Campus Chilled Water Pumps

Description:
Upgrade campus distribution loop chilled water pumps to increase system capacity and to provide VFD control for each pump.
(This recommendation is similar to the chilled water pump upgrades "2.01-ROZ" as previously suggested by McKinstry in their *2012 Energy Efficiency & Sustainability Report*)

The following elements would be installed or upgraded:

- Upgrade/Replace Campus Loop chilled water pumps CWP-2 & CWP-3 with new capacity pumps with VFDs. Existing CWP-1 is already controlled by a VFD.
- New Delta Controls.

Analysis/Justification:
Depending upon the priority and timing of the above proposed chiller plant expansion, the upgrade of the existing campus distribution pumps may not be necessary, as they are also included in the above scope.

However, until such time as the chiller plant capacity is increased, it would be beneficial to upgrade the existing campus distribution chilled water pumps for two reasons.

First of all, these existing pumps (CWP-2 & 3) are two-speed pumps, without VFD speed/capacity control. Two-speed pumps are not as efficient as pumps that are run with VFDS, and controllability is not as good for varying flow demands.

Secondly, based on the results of the chilled water system flow model that was prepared with this report, there are likely times when the existing campus chilled water distribution piping system is being "under pumped". In other words, it appears at times there may be a shortage of campus chilled water flow to some of the remote buildings. This is indicated by the results of the flow model that suggests that during times of peak historic campus cooling demand, that drop-off pressures (and therefore flows) to many of the buildings is greater than the capacity of the existing pumping plant (based on available flow and head pressures).

The present operational setpoint of 15 psig (35 ft head) pressure differential between the campus supply main and return main, does not seem to produce sufficiently strong flow conditions to necessarily satisfy all flow demands. This condition of possible under-pumping is also indicated by a reported high Delta T (nearly 20 deg. F) on the campus chilled water loop, compared to a design Delta T for most buildings of around 10 deg. F.

Further analysis of the chilled water distribution system is needed to better understand the dynamics suggested by the flow model and field observations, however, the recommendation to upgrade the existing chilled water distribution pumps (install VFDs and possibly increase capacity with larger pumps) is still valid.

Sequence / Category:
Capital Master Plan Project

Cost:
CP-2: $300,000

CP-3: Install VFDs on the Chiller Compressors and on the (3) 1,000 ton Cooling Towers

(This is recommendation " 2.00-ROZ:": per McKinstry in their *2012 Energy Efficiency & Sustainability Report)*

Description:

Upgrade the existing centrifugal chiller compressors to add new VFD drives. Replace the 2-speed fan motors on the (3) largest cooling towers with VFD duty motors and install new VFD drives. Update controls to map drives to building automation system.

Analysis/Justification:

Per McKinstry Analysis: Annual electrical energy savings due to more efficient part load operation of equipment. Better able to match equipment capacity with campus cooling loads.

Sequence / Category:
Improved Operational Efficiencies.

Cost:
CP-3: $1,000,000

CP-4: Install 2 New Energy Efficient Cooling Towers

(This recommendation" 2.40-ROZ:" per McKinstry in their *2012 Energy Efficiency & Sustainability Report)*

Description:

Replace the existing, aging and inefficient 500 ton cooling towers with new, energy efficient, open circuit, induced draft cooling towers, with VFDs on their fan motors.

Analysis/Justification:

Per McKinstry Analysis: The new cooling towers will be sized for supplying 75 deg F water to the chillers during peak load conditions, thereby improving chiller efficiency. Annual electrical energy savings are anticipated.

Priority/Sequence:
Improve Operational Efficiencies.

Cost:
CP-4: $500,000

Campus Chilled Water Distribution System (CD)

Similar to the steam system, the existing Campus Steam Distribution System is in good condition, and has been very well maintained; despite piping that is mostly over 40 years old. Assuming that the existing distribution system piping, valves, and insulation jacketing is maintained as well in the future, the system should have a life expectancy of at least 15 to 25 more years.

A computerized flow model of the campus chilled water distribution system, that was prepared as part of this analysis, indicates that most of the existing chilled water system piping is adequately sized to handle expected future campus growth and added chilled water production capacity. However, a portion of the existing 12" East-side (Washington street) loop piping will reach the limits of good engineering practice for peak flow/velocities, as the future Gateway and upgraded residence hall cooling projects come on line.

CD-1: Replace/Upsize a Portion of the 12" West-Side Chilled Water Piping

Description:

Replace the existing 12" chilled water piping that feeds the west-side (Washington Street) of the campus loop, with 16" size pipe, from the Rozell plant junction, up to the HPE branch, past the existing Science Building. This section of piping will see significantly increased flow demands when the future Gateway and residence hall cooling projects are completed.

Analysis/Justification:

Analysis of the future chilled water flow rates as developed by the computerized flow model, indicates a flow split of roughly 50-50 between the west-side (12") and east-side (16") chilled water loops when accounting for future flow conditions. Under this condition the 12" pipe branch will see a fluid velocity of roughly 50% greater than the 16" branch, and approaching the recommended peak design velocity of 10 feet per second.

Changing this section of piping from 12" to 16" size will reduce expected peak flow velocities to be within normal limits and reduce pumping head pressure requirements.

Sequence / Category:
Capital Master Plan Project.

Cost:
CD-1: $1,000,000

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

EWU - Campus Infrastructure Renewal
Proposed Mechanical Upgrades
Budgetary Level Cost Estimates
7/11/2014
MSI# 14-01
By: B. Snow

CHILLED WATER SYSTEM - INFRASTRUCTURE UPGRADE BUDGET SUMMARY

CHILLED WATER SYSTEMS	Budget Cost Estimate
Chiller Plant	
CP-1: Add Chiller Plant Capacity - 2000 tons	$3,600,000
CP-2: Upgrade (3) Campus Chilled Water Pumps	$300,000
CP-3: Install VFDs on (3) Chillers and Cooling Towers	$1,000,000
CP-4: Replace (2) Aging Cooling Towers with new Towers with VFD Drives	$500,000
CHILLER PLANT (CP) -	$5,400,000
Chilled Water Distribution	
CD-1: Replace Portion of 12" CW Loop Piping with 16" Piping	$1,000,000
CHILLED WATER DISTRIBUTION (CD) -	$1,000,000
CHILLED WATER SYSTEM TOTAL -	$6,400,000

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

EWU - Campus Infrastructure Renewal
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7/11/2014
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By: B. Snow

CHILLED WATER SYSTEM - INFRASTRUCTURE UPGRADE BUDGET SUMMARY

Chiller Plant (CP)

CP-1: Add Chiller Plant Capacity - 2000 tons

	Unit	Quantity	$/unit	Cost
2000 Ton Water-Cooled Cent. Chiller with VFD	ea	1	$750,000.00	$750,000
1000 Ton Induced Draft Cooling Tower with VFD	ea	2	$175,000.00	$350,000
4500 gpm chiller pump	ea	1	$30,000.00	$30,000
6000 gpm chiller pump	ea	1	$35,000.00	$35,000
VFD drives for pumps - X hp	ea	2	$20,000.00	$40,000
Chiller Loop Piping, Valves & Insulation	lot	1	$100,000.00	$100,000
Tower Loop Piping, Valves & Insulation	lot	1	$100,000.00	$100,000
Campus Loop Piping Tie-in & Modifications	lot	1	$75,000.00	$75,000
BAS Upgrades	lot	1	$75,000.00	$75,000
Water Treatment System	lot	1	$25,000.00	$25,000
Chiller Plant Addition HVAC & Ventilation	lot	1	$50,000.00	$50,000
Chiller Plant Addition Plumbing	lot	1	$25,000.00	$25,000
Test & Balance, Start-up & Commissioning	lot	1	$50,000.00	$50,000
Mis. Modifications	lot	1	$15,000.00	$15,000
Electrical Upgrades for Chiller Plant Addition	lot	1	$500,000.00	$500,000
4,000 Rozell Plant Addition Construction	sf	4,000	$165.00	$660,000
			Subtotal	$2,880,000
	%	15	Design Contigency	$432,000
	%	10	G.C. OH&P	$288,000
			CP-1 - TOTAL	**$3,600,000**

CP-2: Upgrade (3) Campus Chilled Water Pumps

	Unit	Quantity	$/unit	Cost
Demo Existing Pumps	ea	3	$1,000.00	$3,000
3000 gpm pumps - 100 hp	ea	3	$30,000.00	$90,000
VFD drives for pumps	ea	3	$15,000.00	$45,000
BAS Upgrade	lot	1	$25,000.00	$25,000
Piping, Valving & Insulation Modificaitons	ea	3	$10,000.00	$30,000
Test & Balance, Start-up & Commissioning	lot	1	$25,000.00	$25,000
Misc.	ea	1	$11,500.00	$11,500
Electrical Upgrades/Connections	ea	3	$3,500.00	$10,500
			Subtotal	$240,000
	%	15	Design Contigency	$36,000
	%	10	G.C. OH&P	$24,000
			CP- 2 - TOTAL	**$300,000**

CP-3: Install VFDs on (3) Chillers and Cooling Towers

	Unit	Quantity	$/unit	Cost
Retrofit Existing 1000 ton chillers with VFD drives	ea	3	$225,000.00	$675,000
Install VFDs on Existing Cooling Tower Fan Motors	ea	3	$15,000.00	$45,000
BAS Upgrades	lot	1	$25,000.00	$25,000
Test & Balance, Start-up & Commissioning	lot	1	$25,000.00	$25,000
Electrical Upgrades/Connections	ea	6	$5,000.00	$30,000
			Subtotal	$800,000
	%	15	Design Contigency	$120,000
	%	10	G.C. OH&P	$80,000
			CP-3 - TOTAL	**$1,000,000**

CP-4: Replace (2) Aging Cooling Towers with new Towers with VFD Drives

Demo Existing Cooling Towers	ea	2	$5,000.00	$10,000
Induced Draft Open Cooling Towers w/ VFDs - 500 tons	ea	2	$125,000.00	$250,000
Piping modifications & Connections	ea	2	$25,000.00	$50,000
Roof Structural Support Modifications	ea	1	$30,000.00	$30,000
Test & Balance, Start-up & Commissioning	lot	1	$25,000.00	$25,000
Misc.	ea	1	$25,000.00	$25,000
Electrical Upgrades/Connections	ea	2	$5,000.00	$10,000
			Subtotal	$400,000
	%	15	Design Contigency	$60,000
	%	10	G.C. OH&P	$40,000
			CP-4 - TOTAL	**$500,000**

CHILLED WATER SYSTEM - INFRASTRUCTURE UPGRADE BUDGET SUMMARY

Chilled Water Distribution (CD)

CD-1: Replace Portion of 12" CW Loop Piping with 16" Piping

	Unit	Quantity	$/unit	Cost
Demo Existing 12" CHS & CHR Piping	lf	1,500	$25.00	$37,500
New 16" Sched. 40 Welded Steel CHS & CHR Piping	lr	1,500	$315.00	$472,500
Fittings	%	25		$118,125
Valves - Butterfly 16"	ea	10	$5,000.00	$50,000
Pipe Insulation - 2" F.G. ASJ	lf	1,500	$25.00	$37,500
Insulation Jacket & Labels	lf	1,500	$5.00	$7,500
Expansion Joints	ea	12	$2,000.00	$24,000
Rollers & Guides	ea	100	$150.00	$15,000
Anchors	ea	10	$500.00	$5,000
Flush & Fill	lot	1	$5,000.00	$5,000
Misc.	ea	1	$27,875.00	$27,875
			Subtotal	$800,000
	%	15	Design Contigency	$120,000
	%	10	G.C. OH&P	$80,000
			CD-1 - TOTAL	**$1,000,000**

APPENDIX I2

Eastern Washington University

Chilled Water Capacity Upgrade

Project No. AE-1484

Pre-Design Report

Prepared by:

MSI Engineers

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

NAC Engineers
NAC Architecture
DCI Engineers

Prepared For:

EWU Facilities & Planning

MSI # 16.04

(Final) August 01, 2016

Eastern Washington University

Cheney, Washington

Chiller Plant Capacity Upgrade

Pre-Design Report

Project No. AE-1484

Planning Team

EWU Facilities & Planning — **Shawn King**, **Steve Schmedding, PE**

MSI ENGINEERS MEULINK STAUFFENBERG, INC. — **Bill Meulink, PE**, **Brad Snow, PE**

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DCI ENGINEERS — **David Giordano, PE**

Table of Contents

1.0 PURPOSE OF REPORT

A safe, reliable and efficient energy production and distribution utility system is critical to the fundamental mission of Eastern Washington University (EWU).

EWU Mission Statement:

Eastern Washington University is a student-centered, regionally based, comprehensive university. Its campus is located in Cheney, within the Spokane metropolitan area, with additional learning centers in the region and elsewhere in Washington State. Its mission is to prepare broadly educated, technologically proficient, and highly productive citizens to attain meaningful careers, to enjoy enriched lives, and to make contributions to a culturally diverse society.

In order to assure a reliable source of campus-wide chilled water production and delivery for well in to the future, this report sets out to answer the following two fundamental questions:

1. *How big does the chiller plant need to be?*

2. *What does the future chiller plant look like?*

The heart of the existing central campus chilled water plant, located at the Rozell Physical Plant facility, is starting to show its age a bit, most of the equipment is over twenty years old, and the ongoing growth of the campus is beginning to strain the plant's cooling capacity. Plans for near term campus growth, including the new Inter-disciplinary Science Center (ISC), as well as planned classroom building upgrades and residence hall replacements, will stretch the campus cooling loads beyond the plant's present capacity.

Rozell Central Plant

Constructed in 1967

Chiller Plant Upgraded in 1996

Therefore, the most immediate need of this report is to evaluate the cooling load growth trends for the near future, and then figure out what is the "right size" for the chiller plant capacity (i.e. answering how big it needs to be).

Figuring out how big the chiller plant needs to be is really the easy part, since future campus growth trends, and planned construction projects, are fairly predictable based on the *May 2014 Comprehensive Campus Master Plan (CCMP)* prepared by *mahlum*.

The more difficult part of this report is answering fundamental question #2; "What does the future chiller plant look like?"

Shawn King, EWU's Associate Vice President of Facilities and Planning, has challenged the design team to review a broad range of alternative chiller plant designs, technologies, configurations, and strategies to come up with ideas for optimizing the operations and efficiency of the future central chiller plant, in the most cost effective manner.

This is a big challenge, since, in addition to figuring out what a future conventional chiller plant should look like, it also involves looking at several unconventional or hybrid cooling systems, such as;

- Co-Generation opportunities, so called Combined Heat & Power systems (CHP).
- Steam powered cooling using the Rozell boilers as the energy source.
- Ground-source cooling and/or heat pumps, using the campus aquifer/wells as an energy source.
- Thermal Energy Storage (TES) systems (chilled water storage tanks).

Therefore, the primary goal of this report is to evaluate each of the above alternative cooling technologies, along with more conventional chiller plant approaches, to come up with the ideal future growth and configuration model for EWU's central chiller plant (i.e. answering what it looks like).

The ultimate result of this evaluation will be to determine the scope and budget, for the follow up design and construction work for the FY 2016-2017 *Chilled Water Capacity Upgrade project (AE-1484)*, which will implement the recommendations of this report.

2.0 EXECUTIVE SUMMARY

The results and recommendations of this Pre-Design Report, the goal of which is to determine the capacity ("How big should it be?") and configuration ("What should it look like?") of the future Rozell Central Campus Chiller Plant, are summarized as follows.

Chiller Plant Capacity

1,000 Ton Magnetic Bearing Chiller

After developing several likely versions of potential campus building/cooling load growth models, based primarily on the *2014 Campus Master Plan*, predictions for the next 10 year block of time, indicate the need to provide approximately **1,000 tons** of additional cooling capacity at the Rozell chiller plant.

Chiller Plant Configuration

In order to provide the recommended added cooling capacity at the Rozell chiller plant, three (3) alternative (options) configurations were studied. The three options studied are as follows:

- Option A – Upgrade Chillers In-Place ← CHOSEN OPTION
- Option B – Repurpose the Fab Shop
- ~~**Option C – New Chiller Plant Addition ☜ Recommended Option**~~

Of these three alternatives considered, it is the **recommendation of this ~~report that Option C – New Chiller Plant Addition~~**, be selected for implementation.

Option C –

New Chiller Plant Addition

Option C – New Chiller Plant Addition, provides a good balance between costs and enhancements/opportunities to improve the chiller plant's layout and operations. Because the existing layout of the chiller plant is fairly crowded, and the piping network is complex and confusing, plant operations are difficult to optimize or improve. There is just not enough space to simplify and consolidate the complex piping network. This results in unnecessary cross-over piping, multiple manual change-over valves, and other "old school" configurations, such as providing individual, dedicated pumps for each chiller, rather than being simplified with common, shared manifolded pumps. By implementing Option C, new plant space becomes available, not only to house the added new chiller equipment, but also sets up the space to provide for new common pumping manifolds, that can be eventually migrated to the older chillers as they are replaced over time as they wear out. In the end this would result in a better organized, less complex, and operationally friendlier chiller plant to understand and use.

Option A – Upgrade Chillers In-Place, has the lowest construction costs, and also provides a reasonable method to upgrade capacity inside the existing Rozell footprint, however, it does not really provide a good opportunity to improve/optimize the plant's layout and operations, and will, in the end, simply be newer version of the same old plant.

Option B – Repurpose the Fab Shop, although not as crowded as Option A, the end result would be a plant that is a bit chopped up and disconnected from a layout and operational standpoint. Even though this option does not require the Rozell building to grow, it does require a fairly costly new Fabrication Shop to be constructed off-site, in order to free up the space inside Rozell for the new chillers. In the end, this option would be not only more expensive than the preferred Option C, building a brand new plant addition, but the final layout and configuration would still be somewhat of a compromise and it would not provide the ideal set up for improving the long term layout and operational efficiency of the plant.

Chiller Plant Operations & Efficiencies

Because of the inherent nature of the existing Rozell central chiller plant's design, being that it is already utilizing fairly efficient, but older, water-cooled centrifugal chillers and open-type induced draft cooling towers, the operating energy efficiency is already fairly good compared to campuses that use either distributed chillers at each building, or alternative air-cooled type chiller plants. Chiller plant cost studies prepared previously by MSI Engineers, indicate an overall chiller plant operational efficiency of around 0.80 kW per ton. This is not too bad for an older plant, and is clearly superior to air-cooled plants that operate closer to 1.50 kW per ton. However, there is some room for improvement available with the implementation of the Chiller Capacity Upgrades recommended here.

With the proposed installation of newer, more efficient chillers with variable frequency drive (VFD) compressors, new campus chilled water distribution pumps with VFD motors, new cooling towers with VFD fans, and operational efficiency improvements possible using updated BAS controls and strategies, as well as using shared, manifolded pumping schemes, the overall chiller plant efficiency can be improved. As a point of reference, the campus chilled water systems at nearby WSU operate at around 0.60 kW per ton, using many of the optimization strategies and systems proposed here, including a chilled water system thermal storage tank (see below).

Alternative Cooling Plant Technology Options

As part of this Chiller Plant Capacity Upgrade study, several alternative chiller plant technologies were reviewed for feasibility and/or economic viability, including the following systems;

- Co-Generation Systems / Combined Heat & Power (CHP) Systems
- Steam Powered Cooling
- Ground Source Cooling
- Thermal Energy Storage (TES) Systems

Because of this region's relatively inexpensive electric and gas utility rates, the various possible alternative cooling technologies studied, do not have favorable economic outlooks in terms of return on investment or payback. Either the amount of potential energy savings is relatively small compared to the large capital investments (TES systems), or, in the case of both Co-Gen (CHP) and Steam Powered Cooling, the cost of using alternative fuels actually ends up being negative, meaning no savings at all, but huge capital costs.

Of the several alternative technologies studies, the only potentially viable candidate is the Thermal Energy Storage (TES) system, or, in other words, a large chilled water storage (buffer) tank. While the installation of a large chilled water thermal storage tank, probably in the 1.0 million gallon size range, only provides a small reduction in potential electric kW demand charges (not nearly enough to "pay for itself"), there are several operational benefits to the chiller plant that make the installation of a TES storage tank appealing.

In addition to operational benefits, the installation of a large chilled water system thermal storage tank has the effect of adding new "apparent" plant capacity, in the form of a "battery", that can be viewed the same as buying another chiller (and cooling tower and pumps), but without the added maintenance issues.

The decision to install a large TES thermal storage tank is probably as much a philosophical issue as it is a technological issue, since the real operational enhancements are somewhat subjective, and plant operator buy-in will be important to the success of the system, since a new way of doing things will be necessary. There is also a certain degree of being seen as more "Green" and/or "Sustainable" with the installation of a thermal storage tank, that may play in to the decision making process as it relates to Eastern's student body and faculty's perceptions.

1.0 Million Gallon Thermal Storage Tank Perspective View

It is the **recommendation of this report that the installation of a TES thermal storage tank be strongly considered for design and installation in the near future**, either as a substitute for replacing aging existing chillers, or as a supplement to increase the chiller plant's "apparent" capacity, without having to purchase new chillers and auxiliaries.

<u>Campus Chilled Water Piping Distribution Network</u>

A review of the existing EWU campus chilled water distribution piping network indicates that, for the most part, the existing size and capacity of the utility tunnel piping can readily support the planned building growth (added cooling flows) for the next 20 years.

As reported previously in MSI *Engineer's Chilled Water System Evaluation, July 2014*, the existing 12" chilled water lines that run from the Rozell plant, down Washington Street, to the HPE branch take-off, are marginally sized for the existing lateral flow rates, which will become even more challenged in the future as loads grow. As such, it is **the recommendation of this report that this section of 12" chilled water distribution piping be programmed for replacement with 16" piping in the near future**.

A review of the piping network within the Rozell chiller plant also indicates that as campus flow capacity is added over time, much of the existing main, combined supply and return lines will be undersized for the future flow, and will be candidates for replacement/upsizing under the several proposed plant upgrade options indicated above.

Campus Chilled Water Supply Pumps: Analysis of the campus chilled water distribution demands under diversified flow conditions, indicates that the existing campus chilled water pumps appear to already be a bit undersized for current "peak" flow demands, and will be definitely undersized in the near future as more campus cooling loads come on-line. In addition, since only one of these pumps has a variable frequency drive (VFD) for flow modulation and optimization, the present configuration is not optimized from an energy efficiency standpoint. Therefore, as part of the Chiller Plant Capacity Upgrade work, all three of these pumps should be replaced with larger capacity, energy efficient pumps with VFD motors.

Project Cost Analysis

For budget costing purposes, each of the above three (3) chiller plant upgrade options were split it to two additional sub-categories, in order to assist further with project fund allocation decisions. Each option was priced as either a 1,000 ton added capacity scheme (as recommended), or, as a somewhat larger, more conservative, 1,500 ton added capacity scheme.

Overall budget prices for the various options ranged from a low of $4.8 million to a high of $8.3 million.

The budget prices for the recommended Option C – New Plant Addition, range from $6.2 million to $7.1 million, depending upon type and chiller capacity finally selected and the amount of contingency to be allowed for.

EWU - ROZELL CHILLER PLANT UPGRADE OPTIONS

EWU - Chilled Water Capacity Upgrade A/E - 1484	OPTION - A1 Upgrade Chillers In Place (Add 1,000 Tons)	OPTION - A2 Upgrade Chillers In Place (Add 1,500 Tons)	OPTION - B1 Repurpose Fab Shop (Add 1,000 Tons)	OPTION - B2 Repurpose Fab Shop (Add 1,500 Tons)	OPTION - C1 New Chiller Plant Addition (Add 1,000 Tons)	OPTION - C2 New Chiller Plant Addition (Add 1,500 Tons)
Rozell Chiller Plant Upgrade:						
1) Chiller Plant Upgrade	$ 5,054,245	$ 5,451,027	$ 4,634,081	$ 5,217,029	$ 6,419,699	$ 6,886,548
2) New, Relocated Fabrication Shop	$ -	$ -	$ 2,768,946	$ 2,768,946	$ -	$ -
3) Total Project Cost	$ 5,054,245	$ 5,451,027	$ 7,403,027	$ 7,985,975	$ 6,419,699	$ 6,886,548
Probable Cost Range ($500K spread)	**$4.8M to $5.3M**	**$5.2M to $5.7M**	**$7.2M to $7.7M**	**$7.7M to $8.3M**	**$6.2M to $6.7M**	**$6.6M to $7.1M**

All costs include:
- 15% G.C. Profit
- 15% Design Contingency
- 9% Sales Tax
- 12% A/E Fees

Possible Project Enhancements/Alternates as Funds may Allow:

A. Upgrade Chiller Plant BAS System (from Delta to ATS/Alerton): $300K to $500K.
B. Install Improved Waterside Economizer on Chiller Plant: $750K to $950K.
C. Upsize Washington Street Chilled Water Line (12" to 16"): $1.2M to $1.5M.
D. 1.0 MG Thermal Storage Tank: $3.5M to $4.5M.

Project Funding, Implementation and Schedule

Funding:

The Chiller Plant Capacity Upgrade recommendations contained in this Pre-Design Report, are intended to be implemented as an FY 2017 construction project, using the funds provided by the State Legislature under the *EWU Infrastructure Renewal I* project. The total appropriated funding amount was **$9,949,000**.

The funds provided under this appropriation are also earmarked to provide construction dollars for the following other EWU Campus Infrastructure Renewal projects, which will impact how much funding is left over for the chiller plant upgrade project recommended by this report.

- Chiller Plant Capacity Upgrade – Option C: $6.2M to $7.1M

- New Utility Tunnel Services – PUB to ISC: $1.2M to $1.5M
(Based on MSI Engineers *New ISC Building Energy Utility Services Study*, June 9. 2016)

- Electrical Capacity Upgrade Project (AE-1483): $ TBD
(Scope and Budget pricing being developed by NAC Engineers)

Construction Delivery Method:

It is anticipated that the Chiller Plant Capacity Upgrade project proposed by this report, will be implemented using the traditional Design – Bid – Build Format.

Construction Documents for competitive public bidding, will be prepared by MSI Engineers and their select consultants, as a follow-up to this study. Following the public bid period, the qualified low-bid contractor will be selected and a State of WA Construction Contract will be executed for this work.

Design and Construction Schedule:

Following EWU's review of this report and final project scope and budget determination, MSI Engineers anticipates immediately beginning formal development of the Construction Documents for a bid package.

The proposed design and construction schedule goal is to have the project ready for bidding by early spring of 2017, in order to allow the new construction to happen thru the summer and the fall of 2017. Then, during the winter of 2017-18, when the plant is off-line, all the new equipment tie-ins can occur, with new plant start-up & testing in the early spring, with the new plant fully operational by summer 2018.

Preliminary Design Schedule:
Duration Approx. 7 months - August 2016 to Feb. 2017

1. EWU review Report and determine scope & budget.
2. MSI & Consultants prepare design fees.
3. EWU Review fees and award design contract.
4. Prepare Preliminary (SD/DD) design & cost estimates.
5. Design review.
6. Prepare 50% design documents.
7. Design review.
8. Prepare 95% design documents.
9. Design review.
10. Prepare final Bid Documents.

Bidding & Award Period:
Duration: 1 month – March 2017

Preliminary Construction Schedule:
Duration Approx. 12 months – April 2017 to April 2018

1. Mobilization, submittals & procurement.
2. Construction.
3. Start-up & Commissioning.
4. Project Closeout.

New Chiller Plant on-line and fully operational for summer 2018.

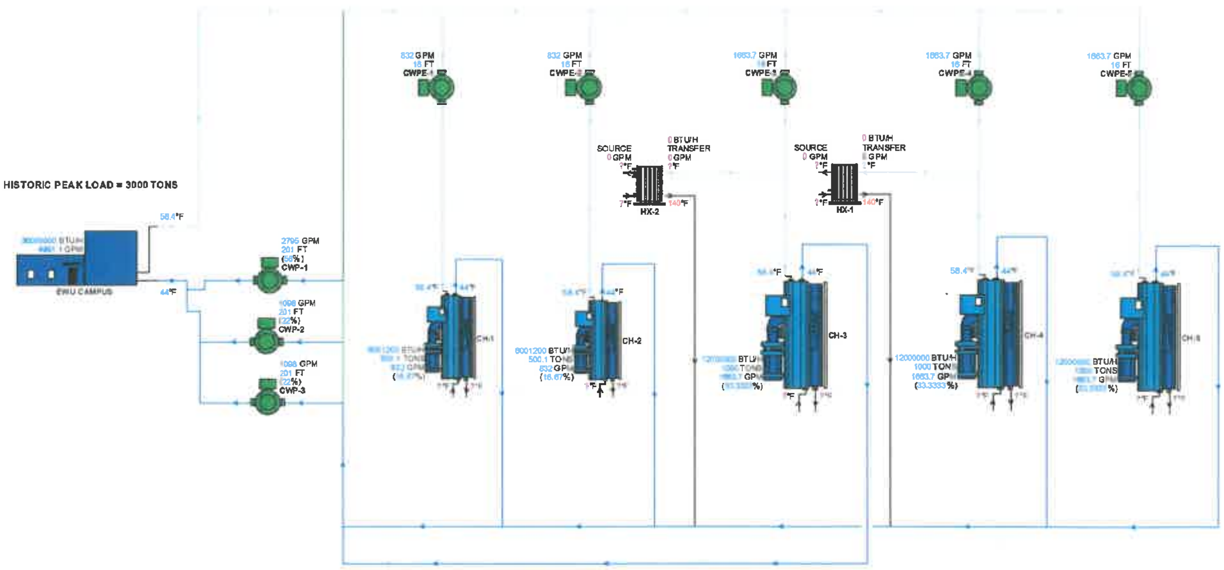
Next Steps

It is recommended that upon receipt and initial overview of this report, that EWU' facility staff and MSI's design team members, all sit down together in order to discuss and review the several aspects and recommendations, so that all the interested parties and stake holders have a clear understanding of the proposed options. This will be the quickest way to boil down the various involved technical aspects to a clearer picture, thereby allowing the decision makers to focus on selecting the final design and construction scope for this project moving forward.

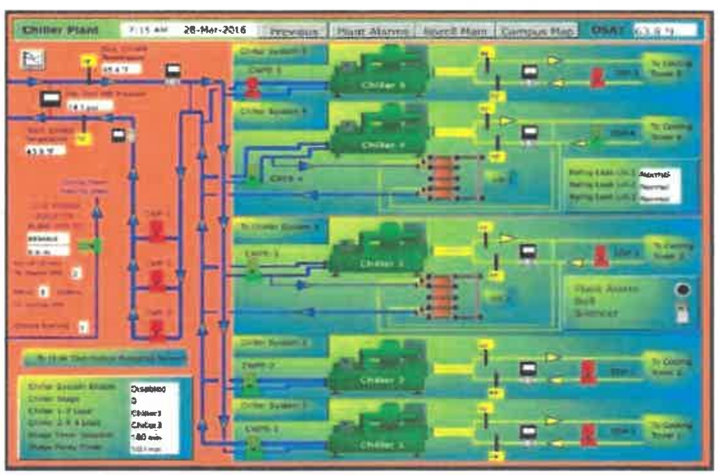
3.0 EVALUATION SCOPE & METHODOLOGY

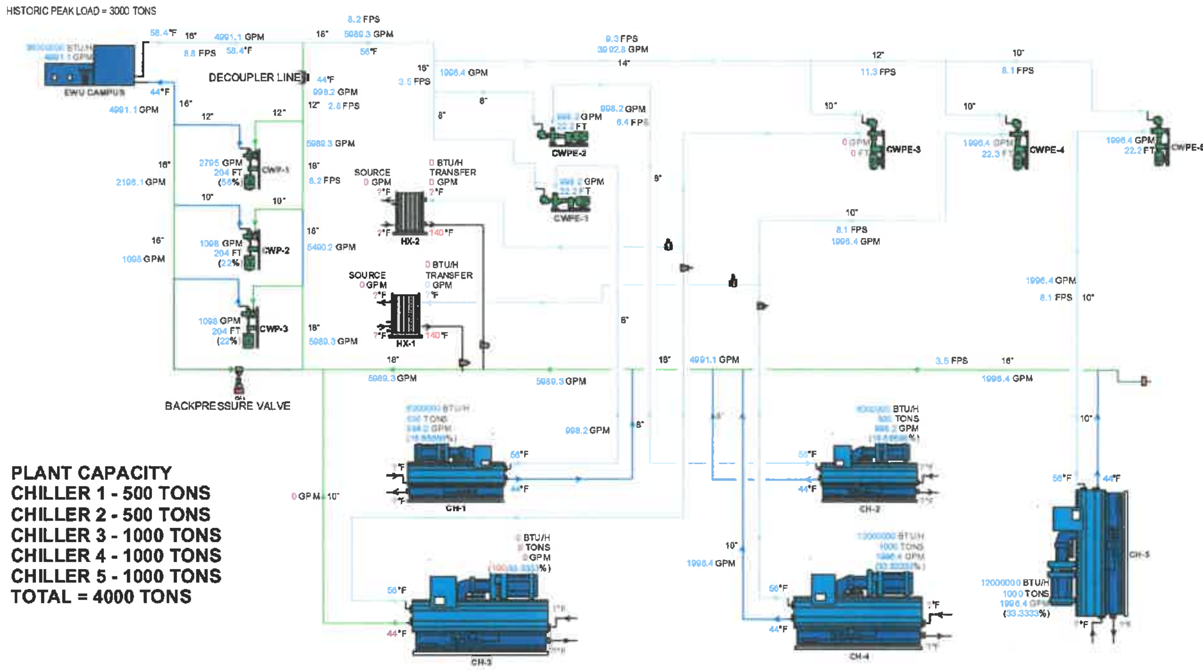
This evaluation of the existing central campus chiller plant involves the following primary subjects.

1) Existing Chiller Plant - Capacity, operation and performance of the existing chiller plant. Review of existing equipment condition, life expectancy, efficiency and opportunities for enhancements.
2) Cooling Load Growth Models - Campus cooling load growth prediction models and future chilled water production requirements.
3) Conventional Chiller Plant Capacity & Configuration - Recommendations for conventional chiller plant capacity upgrades and long term scenarios for replacing/modernizing aging plant equipment.
4) Rozell Physical Plant Space Evaluation - Review of the Rozell Physical Plant space requirements and availability for future chiller plant growth. This includes evaluations for relocating the existing Fabrication Shop to a separate (new) facility and repurposing this area for plant space, as well as options for constructing a new chiller plant addition to Rozell.
5) Campus Chilled Water Distribution Infrastructure Network - Review of the existing campus chilled water distribution piping infrastructure network to handle future campus cooling loads.
6) Alternative Cooling Plant Technologies – Analysis and economics of alternative unconventional cooling plant technologies and/or hybrid systems.
7) Electrical Power System Capacity Evaluation – Review the capacity and configuration of the existing Rozell electrical distribution system as is relates to the schemes for future plant growth.
8) Cost Estimates & Budgets – Develop budget level cost estimates for the various chiller plant upgrade alternatives, and forecast probably budget costs for recommended future chilled water system upgrades and replacement of aging equipment.
9) Implementation Requirements – Develop design and construction schedules for implementation of the proposed upgrade project for the 2017-18 timeline. Discuss project delivery considerations.

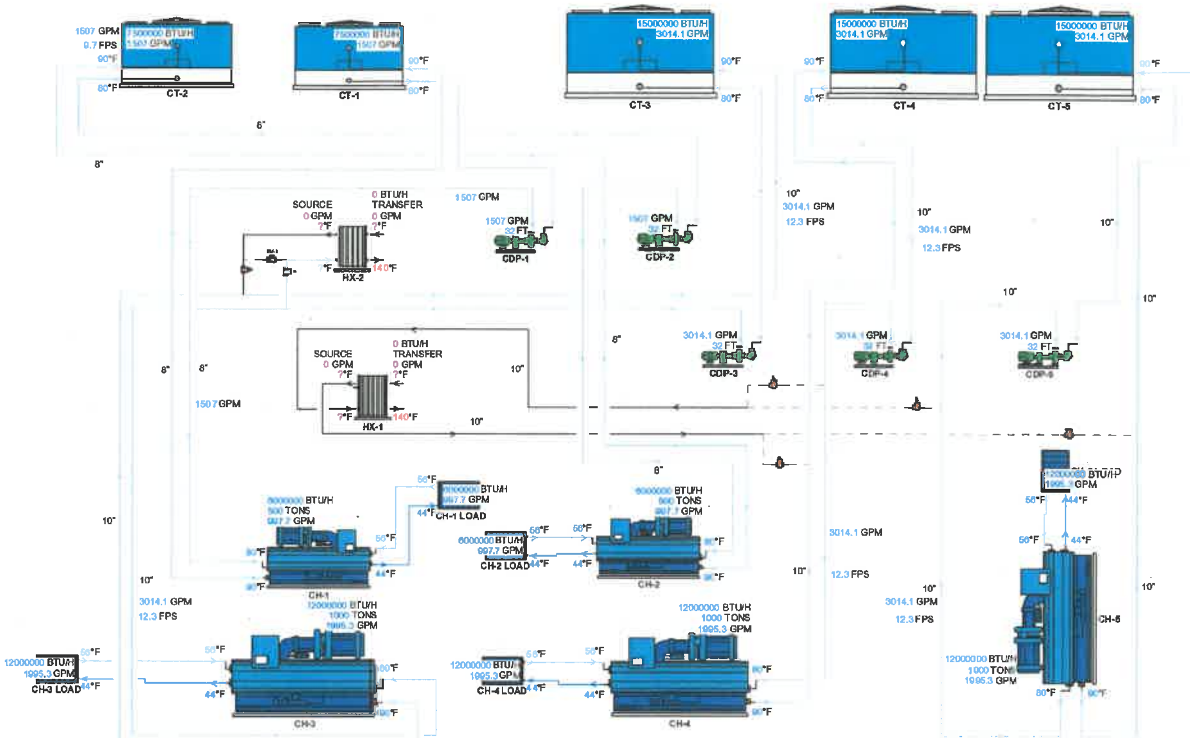


EWU - CHILLER PLANT - EXISTING CHILLED WATER FLOW DIAGRAM - SIMPLIFIED





EWU - CHILLER PLANT - EXISTING CHILLED WATER FLOW DIAGRAM



EWU - CHILLER PLANT - EXISTING CONDENSER WATER FLOW DIAGRAM

4.8 – Chiller Plant Layout and Configuration

The natural evolution of campus growth, modernization and additions to the Rozell Physical Plant have resulted in a chiller plant equipment layout and piping configuration that is frankly a bit complex, confusing and crowded. This is particularly true in the pump gallery area of the original basement, where ten (10) chiller duty pumps and three (3) campus distribution pumps compete for space with two (2) plate & frame free cooling heat exchangers, electrical gear, conduits, and a complex web of overhead piping.

Good color coding, labels and flow arrows help make sense of all this piping spaghetti, and the plant operators use a clever system of red & green ribbon tape to help identify which valves are open and which valves are closed. The relatively low floor-to-floor heights (14 feet) in the Rozell plant make the complex stacking of piping inevitable, but not ideal.

The five (5) water-cooled chillers are located in the adjacent 1996 plant addition, and are organized with reasonable service clearances and good tube pull and cleaning areas. The overhead piping in this area is less complex than in the adjacent pump gallery.

Perhaps the biggest challenge to the chiller gallery is the lack of planning or access for future chiller removal and replacement/upgrades. There are no large overhead doors or windows available for such purpose. Although a 10 ft x 10 ft removable panel was originally installed in the outside wall during the 1996 expansion, this opening was located in a spot to allow only for the installation of Chiller #5, which now blocks access to this panel for every other unit in the plant. Phased replacement of chillers in the future will be complicated by this general lack of past foresight to provide such equipment removal access measures.

All five (5) cooling towers are situation in a row on the roof of the original Rozell plant office areas. This is a good location for the towers since they are easily accessible from the boiler plant access stairs, are somewhat visually screened by the higher adjacent boiler room gallery space, and are hydraulically in a good position being elevated well above the chiller condenser level. The degree to which the existing roof structure can handle more or larger cooling towers for the future is addressed later in this report.

4.9 – Equipment Age and Condition

The Rozell Central Chiller Plant underwent a major expansion and modernization in 1996. Therefore most of the major plant equipment, chillers, cooling towers, pumps, piping, valves, controls, etc. are around 20 years old. The notable exception being the original 500 ton cooling towers #1 & #2, which are approaching 50 years old, and cooling tower #3, which was replaced in 2003, making it only 13 years old.

Most of the chiller plant equipment is in fairly good shape and appears to have been well maintained over the years. Because the plant only operates about half the year, there is plenty of time and opportunity to do preventative maintenance and annual overhauls. That said, at 20 years old, most of the plant equipment is beginning to show its age a bit, and is starting to require more frequent and more costly upkeep.

The two (2) original chiller plant cooling towers (#1 & #2), while having been maintained in relatively good condition over the years, are basically at the end of their life expectancy and their capacity/efficiencies levels have been degraded by a certain degree.

The chilled plant piping, valves, insulation and auxiliary equipment are in good condition and show no signs of serious leaks or deterioration. Water treatment programs are being well kept, which helps maintain good plant operation and extends the life of the equipment.

4.10 – Plant Equipment Life Expectancy

Except for the two older original cooling towers, the existing chiller plant equipment, chillers, cooling towers, pumps, piping and auxiliaries are in good shape and should be reliable and reasonably efficient for another 5 to 10 years. The older, original cooling towers #1 and #2, are recommended for replacement and modernization as discussed later in this report.

That said, because most of the equipment was installed at about the same time in 1996, it is reasonable to expect that they will all begin to wear out at more or less the same time. If this were to happen, not only would it have a major negative impact to the operation and capacity of the chiller plant in the future, the sudden and extreme cost to modernize most of the chiller plant at one time would be painful and expensive. To avoid the probability of such a chaotic event from happening in the future, this report recommends that a phased replacement and modernization of the existing chiller plant equipment be budgeted for and implemented, starting within the next few years. This will be discussed future later in this report where chiller plant growth options are discussed.

4.11 Existing Chiller Plant Efficiency

The configuration of the existing Rozell central chiller plant makes it already inherently energy efficient from a cooling plant standpoint. This is because the use of multiple large tonnage water-cooler chillers, combined with open type draw-thru cooling towers, generally provides the lowest (best) kW per Ton energy consumption profile, especially when compared against alternative large air-cooled type chillers or distributed small capacity chillers spread throughout the campus. Also, the use of variable speed drives (VFDs) and 2-speed motors on many of the plants pumps provides for additional operational energy efficiency.

According to available utility billing data and chiller run-log data that was compiled for the 2014 cooling season, the overall Rozell central chiller plant average seasonal production efficiency worked out to about 0.80 kW per Ton. This compares favorably against conventional air-cooled chiller plants, which operate in the 1.20 to 1.50 kW per Ton range. By point of comparison, the central chilled water plant(s) at WSU in Pullman reported an overall average efficiency of about 0.60 kW per Ton for 2013, which makes sense, because they have spent a lot of time over the years optimizing their plants performance with high efficiency chillers, VFDs and the use of a large thermal energy storage (TES) tank.

That said, based on an approximate overall plant efficiency of 0.80 kW per Ton, and realizing that the most of the equipment is about 20 years old and does not possess the most current technology, such as VFD drives or magnetic bearings, there are clearly opportunities for improvement in the plant's operating efficiency.

5.6 – Summary & Recommendations - EWU Chiller Plant Cooling Load Predictions & Capacity Requirements

As can be seen from the several cooling load growth prediction charts above, the "right size" for the future chiller plant capacity more or less boils down to how conservative of a value should be used for the campus-wide cooling load diversity; 55% as historical data suggests, or a more conservative value of 65% (less campus load diversity)?

Based on the above campus growth projections, the amount of chiller plant capacity required in the near term, between now and 10 years in to the future, is in the range of 1,000 tons to 1,500 tons, while still maintaining the plant's N+1 reserve capacity.

Simply from an added capacity standpoint, it is obvious that installing more capacity now, 1,500 tons (based on 65% diversity) rather than 1,000 tons (based on 55% diversity), provides more growth potential for a longer time in to the future, and also allows for the natural difficulties in accurately predicting actual campus growth rates, as well as trying to determine true system turn-down diversity. Installing 1,500 tons of added cooling capacity is the more conservative approach and covers the various unknowns inherent to predicting the future.

However, that said, the presumed need to install enough cooling capacity to handle the few rarely occurring "design days", when cooling loads are at their annual peak, and still allowing for full N+1 spare (1,000 tons) plant capacity, may, in fact, be unnecessarily too conservative of an approach, as discussed below.

- Known Growth vs. Peak Load:

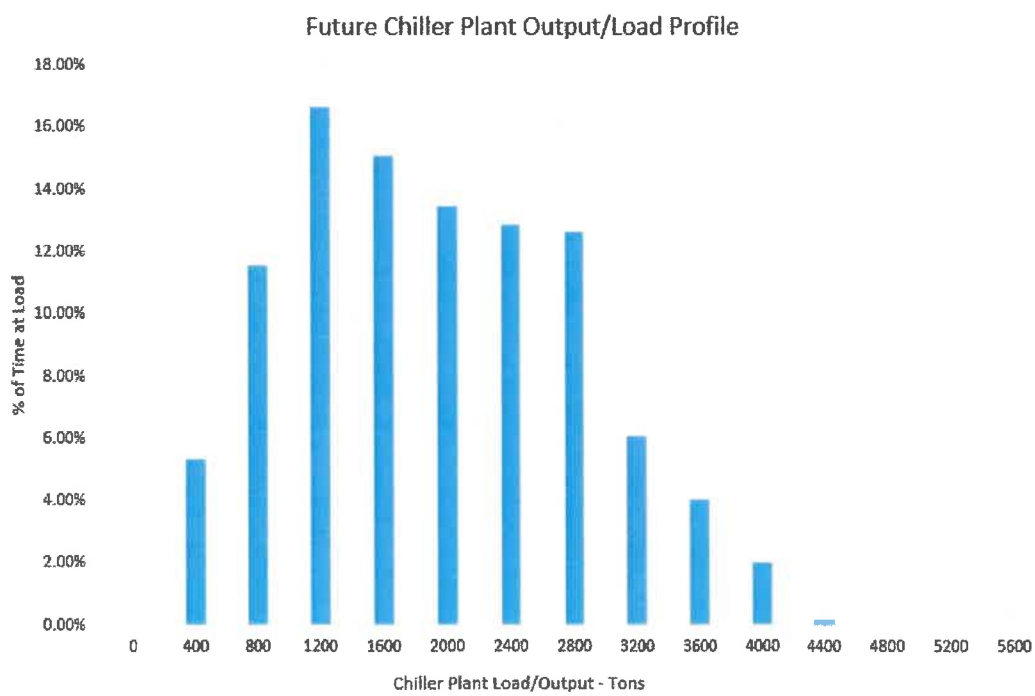
The near term (next several years) likely campus cooling load increase is primarily to due to the planned new ISC building. The anticipated load for this building is about 500 tons. Adding this predicted load to the historic campus peak cooling load of about 3,000 tons, totals 3,500 tons. With a proposed upgraded plant capacity of 1,000 more tons, the new plant capacity would be 5,000 total tons, or 4,000 available tons, with N+1 maintained. In this case, there would still be a comfortable 500 tons of "spare" new capacity for additional campus growth (new dorms, CEB addition, etc.) for the foreseeable future. By this view, a 1,000 ton new chiller should be more than adequate, compared to the more conservative forecast methods that suggest 1,500 tons growth.

- N+1 Chiller Capacity Buffer:

All of the above growth prediction models are predicated on the idea of an N+1 plant capacity, allowing for one 1,000 ton chiller to be off-line for maintenance, and hence unavailable for cooling duty. However, in practice, this is not necessarily the case, and as long as the stand-by N+1 chiller is healthy, it can be pressed in to service for those rare peak cooling days. So, in reality, most of the time the chiller plant will always have an extra 1,000 ton capacity in reserve, above and beyond what is being allowed for in planning purposes.

- Peak Load Rarity:

Based on long term historic weather data for Cheney, the frequency and duration of peak design day temperature conditions is extremely rare, occurring less than 0.5% of the time. Even when applying the more conservative growth predictions to historic weather data trends, the vast majority of the time, around 97% of the cooling season, the future plant cooling load will be less than 3,600 tons, which is 400 tons below the "available" 4,000 ton capacity (with 1,000 tons at N+1 standby).



- Impact to Campus Air Conditioning Fairly Limited:

Even in the event of an unusually long hot spell, with extreme temperature spikes, it is normal practice, and good economics, not to oversize systems for those very rare occurrences. Although in these instances it might happen that internal space temperatures in some of the campus buildings might begin to rise, as system cooling capacity is tapped out, it would certainly not be unexpected to the occupants, or unusual if a heat wave was occurring, and some amount of occupant discomfort/complaints would be naturally anticipated in these events. The degree to which such a rare occurrence would become a real problem, rather than simply a passing transient to be tolerated, is difficult to predict and clearly a subjective issue beyond the judgment of this report.

However, as a matter of perspective, such a transient heat wave event, with the cooling plant capacity maxed out, might create conditions similar to those times that already happen when unexpected warm spells occur in the spring or fall, when the central cooling plant is completely shut-down, and the entire campus is without cooling for some uncomfortable amount of time.

- Future Plant Capacity Increase Opportunity:

In the event that the campus cooling load growth trajectory proves to be greater than predicted, or the amount of load diversity is less than expected, more central plant cooling capacity will obviously be required at some point, sooner rather than later. Perhaps the simplest way to add more capacity to the chiller plant is to replace one, or both, of the existing, aging, 500 ton chillers, with larger chillers, probably in the 1,000 ton range each. This solution to adding capacity in-place, achieves a twofer: it replaces older equipment with new and provides more capacity at the same time. Replacing both 500 ton chillers with 1,000 ton chillers each would net an extra 1,000 tons new capacity to the plant. Obviously the auxiliaries such as the pumps and cooling towers would also have to be replaced/upsized at the same time.

<u>Chiller Plant Capacity Increase Recommendation:</u>

In view of the above analysis and considerations, it is the recommendation of this evaluation that ***the "right size" for the chiller plant capacity upgrade is <u>1,000 tons</u>.***

KEY :

(N)=NEW

INDICATES INITIAL CHILLER PLANT UPGRADE ELEMENTS

(F)=FUTURE

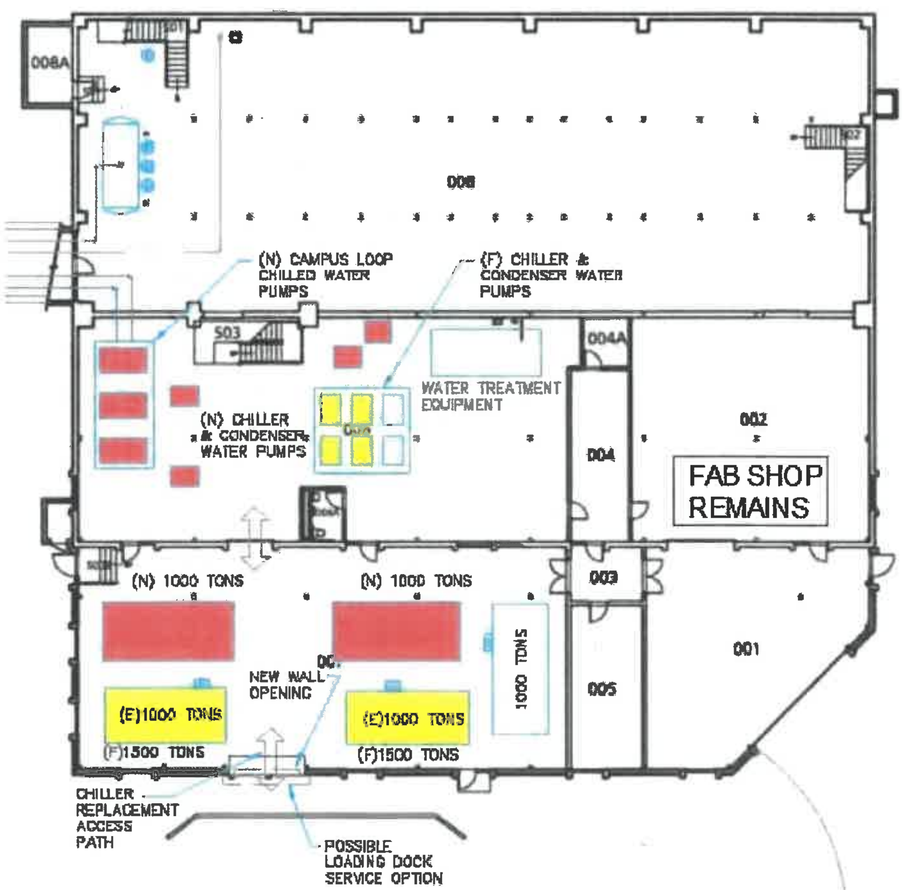
INDICATES FUTURE CHILLER PLANT UPGRADE ELEMENTS

6.1 - Option A – Upgrade Chillers In-Place:

In order to avoid the added expense of a new chiller plant addition, or the disruption and cost to expand into, and relocate, the Fabrication Shop, this option was considered as the logical starting point for upgrading the existing chiller plant capacity.

The main idea with this option is to replace the two (2) existing 500 ton chillers with two (2) new, larger tonnage chillers, giving the plant a net increase of 1,000 to 1,500 tons added capacity.

Because the design of modern chillers is more compact for the same, or even larger, tonnages than older chillers, it is feasible to install more capacity in the same footprint as the existing, smaller capacity chillers. This, therefore, allows for the opportunity to replace the plant's two (2) aging 500 ton chillers, with larger, 1,000 or 1,500 ton chillers.



Option A – Upgrade Chillers In-Place – Implementation Requirements:

- Installation of new access opening/overhead door, in wall of existing chiller plant to allow removal/replacement of equipment.
- Removal of two (2) existing 500 ton chillers.
- Removal of two (2) existing 500 ton cooling towers.
- Removal of associated four (4) existing chiller and tower pumps.
- Removal of existing three (3) campus distribution pumps.
- Option A-1: Installation of two (2) new 1,000 ton chillers. Net new plant capacity increase will be 1,000 tons.
- Option A-2: Installation of one (1) new 1,000 ton chiller and one (1) new 1,500 ton chiller. Net new plant capacity increase will be 1,500 tons.
- Upgrade of roof supports for new cooling towers.
- Option A-1: Installation of two (2) new 1,000 ton cooling towers.
- Option A-2: Installation of one (1) new 1,000 ton cooling tower and one (1) new 1,500 ton cooling tower.
- Installation of four (4) new chiller and tower pumps with VFDs for new chillers.
- Installation of three (3) new campus distribution pumps with VFDs.
- Upgrade of chiller plant Building Automations System controls for new equipment.
- Upgrade/installation of electrical power to feed the new chiller plant equipment.

The final configuration of the upgraded chiller plant would be very similar to the existing plant from an operational standpoint, but with additional cooling capacity available. Each chiller and cooling tower pair will be provided with dedicated pumps, identical to the present configuration. Because of the added capacity and increased system flow rates involved, much of the existing plant piping will need to be replaced/upsized.

Future Plant Upgrades to Achieve Full 20 Year Capacity:

Under Option A, it is envisioned that over the next several years, that most, or all, of the remaining existing 1,000 ton chillers and their auxiliaries (cooling towers, pumps, etc.) would be removed and replaced with larger, 1,500 ton capacity units. By replacing this older equipment in a phased manner over time, the plant will not only grow in total capacity, but will be modernized with new equipment to carry it well in to the future.

Option A – Upgrade Chiller In-Place:

Pros

- Does not require costly new plant addition.
- Preserves Fabrication Shop Location/Function.
- Begins process to replace and modernize aging equipment.
- Retains current plant operation configuration and methodology.
- Lowest construction cost option.

Cons

- Does not "modernize" existing complex plant piping arrangement.
- Retains "old school" pumping approach, i.e. dedicated pumps per chiller/tower. See Option C for description of recommended manifolded pumping concept.
- Growth within existing plant footprint will increase overhead pipe crowding due to larger pipe sizes required.
- Provides less equipment redundancy than other options that are proposing to add more chillers.
- Installation work will create significant disruption to the existing plant.

Option A – Upgrade Chiller In-Place - Budget Price Range:

A-1 (Add 1,000 tons):	$4.8M to $5.3M
A-2 (Add 1,500 tons):	$5.0M to $5.5M

6.4 – Chiller Plant Equipment Options:

The proposed size range for the chiller plant expansion provides a limited variety of equipment that is worth of consideration for this project.

- Chillers:

Daikin Single Compressor Centrifugal Chiller

Daikin Dual Compressor Centrifugal Chiller

York Single Compressor Centrifugal Chiller

York Magnetic Bearing Chiller

For conventional water-cooled chillers in the 1,000 to 1,500 ton size range, the choice for chiller types is primarily limited to traditional centrifugal compressor type chillers, similar to what is presently being used at EWU. Alternative compressor types, such as scroll or screw chillers, do not really fit this size range.

Within the category of centrifugal chillers there a several variations to consider, including:

- Single compressor type, with VFD drives.
  - Lowest 1st cost.
  - Good overall performance & efficiency.
  - Conventional design.
- Dual compressor type, with VFD drives.
  - Good part load efficiency with ability to turn off one compressor, but use full size evap. & condensers.
  - Compressor redundancy.
- Single compressor type, with magnetic bearings & VFD drives.
  - Best performance and efficiency.
  - Oil free (improves thermal efficiency).
  - Low maintenance – no oil systems, no compressor bearing wear & tear.
  - Minimal vibration.

All of the above listed chiller types have excellent full load efficiencies in the 0.57 to 0.53 kW per ton range, and IPLV efficiencies in the 0.43 to 0.31 kW per ton range.

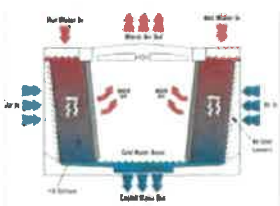
- Chiller Manufacturers:

There are a number of available area manufacturer's agents that represent the major chiller manufacturers, however, based on past experience and reputation for responsive follow-up, local service and trouble-shooting, this report recommends limiting the choice for possible chiller considerations to the following manufacturers:

1) Daikin (formerly McQuay) – Agent: Air Reps.*
2) York/JCI – Agent: CMS.

Pricing and performance for several sizes and types of the above manufacturer's chillers were used in this report and can be found in the appendix.

* - Note: Air Reps formerly represented Carrier Corp. chillers. Carrier is now represented in Eastern Washington by Airefco, which is not considered very experienced with large tonnage chillers.



<u>- Cooling Towers:</u>

For open cooling tower types there are several possible choices for the size range in question, but the most efficient style designs are basically the same as what is currently being utilized, namely the induced draft, draw-thru cross-flow, propeller fan type. Where space allows, these type of cooling towers provide the best efficiency with the lowest horsepower fans. For this project, the cooling tower fans would be provided with VFD drives for capacity control and part-load energy efficiency.

- Cooling Tower Manufacturers:

Similar to the suggestion above for chillers, there is a limited number of qualified local area manufacturers/agents that are recommended for consideration for a project of this magnitude:

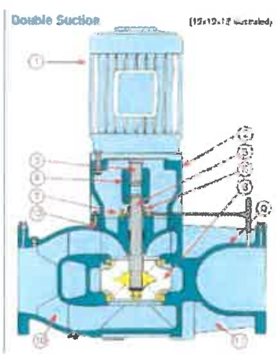
1) Baltimore Air Coil (BAC) – Agent: Air Reps.
2) Marley – Agent: CMS.

Pricing and performance for several sizes of the above manufacturer's cooling towers were used in this report and can be found in the appendix.

- Pumps:

There will be a fair number of new circulating pumps required for the chiller plant upgrade; for campus chilled water distribution, chiller circulation within the plant and cooling tower/condenser water flow. Because of the large tonnages involved, especially if shared, manifolded pumping arrangements are utilized, the expected flow rates will be significant, in the several thousand GPM range. This will result is substantial size motor horsepower ranges as well, so it will be important to select the pump performances carefully, to help with overall chiller plant efficiencies.

For this project, it is recommended that the presently utilized, conventional base-mounted style pumps, be replaced (where necessary) with newer style vertical in-line style pumps. These style of pumps provide a number of advantages over traditional base-mounted type pumps:



- Space saving footprint.
- Simplified installation.
- Inherently self-balancing and aligning.
- Reduced maintenance. No pump bearings to service.
- Minimal vibration.

As an added enhancement to the vertical in-line style pumps, it is also recommended that each pump be provided with an integral, unit mounted, variable frequency drive (VFD), with self-sensing technology. What this means is that each pump's performance, flow and head, can be automatically monitored and displayed locally on the VFD controllers, with built-in control algorithms for various modes, such as constant flow, constant head, variable flow, soft-start, etc.

- Pump Manufacturers:

There are several reliable area pump manufacturer agents that can be considered for this project;

- Armstrong Fluid Tech. – Agent: Mechanical Sales.
- Taco – Agent: Suntoya.
- Bell & Gossett – Agent: Columbia Hydronics

6.5 – Other Chiller Plant Upgrade Considerations:

- **HVAC/Ventilation:**

- Option A, Replace Chillers In-Place;

The existing chiller plant HVAC and ventilation systems will be reused.

- Option B, Repurpose Fab Shop;

The existing Fab Shop HVAC and ventilation systems will be mostly removed. A new refrigeration equipment room ventilation system, consisting of a HVAC unit with 100% outside air capability, and a purge exhaust fan, would be provided for both space conditioning and refrigerant leak evacuation purposes.

- Option C, New Chiller Plant Addition;

An entirely new HVAC and ventilation system would be provided. Similar to the repurposed Fab Shop system, which would consist of a HVAC unit with 100% outside air capability, and a purge exhaust fan, to provide for both space conditioning and refrigerant leak evacuation purposes.

- BAS Controls/Upgrades:

- Chiller Plant Expansion Controls:

The new Building Automation System (BAS) for the expanded chiller plant, would probably end up being a bit of a hybrid between the older, existing Delta based controls presently used to run the chiller plant (as well as the rest of the Rozell HVAC systems), and a newer, ATS/Alerton based control system. The ATS/Alerton based system would be a continued migration towards converting most of the campus from the old legacy Steafa and Delta platforms, to a more modern and consistent ATS/Alerton based network.

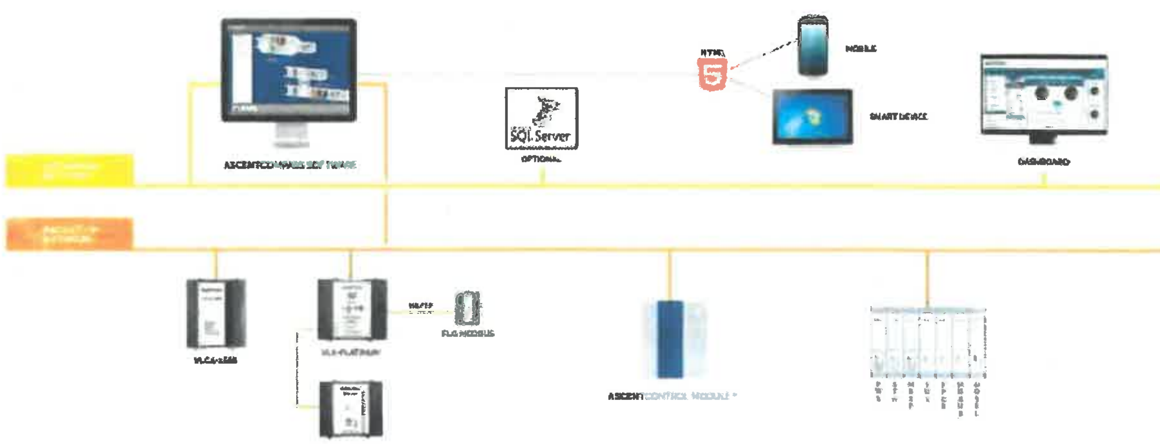
Having two different automation platforms in place for the chiller plant would end up being a bit of a hassle for the operators, since there would be two separate system "protocols" and "looks" to the operator input graphics. While the actual plant operation can be integrated and automated between the two platforms using BACnet and other translation techniques, it would be beneficial in the long term, to convert the old legacy Delta system to the newer ATS/Alerton system. Having

the entire chiller plant operation under a single consolidated BAS system provided by ATS/Alerton, would also allow for the chiller plant equipment and operations to be integrated in to the campus-wide Energy Monitoring and Dashboard System that is presently being rolled out at EWU.

- Upgrade Existing Chiller Plant Delta Controls Option:

Such a recommended upgrade and migration from the Delta based system to the ATS/Alerton based system, could be considered for the chiller plant expansion project, either as a Base Bid item if funds allow, or, perhaps, be priced as an Alternate Bid Item, if adequate funding is questionable, preserving the option to implement the BAS upgrade/migration at a later date.

Based on preliminary estimates of the amount and complexity of chiller plant's existing Delta control points that would need to be migrated over to a new Alerton system, the rough order of magnitude price range is $300K to $500K.



2018 Chiller Plant Upgrades

Efficiency Study & Cost Savings

PREPARED BY: KELLY HARKINS PE
KJH ENGINEERING PLLC 610 EAST 3RD STREET MOSCOW, IDAHO 83843
6-22-20

EASTERN WASHINGTON UNIVERSITY ROZELL CHILLED WATER PLANT UPGRADE EFFICIENCY STUDY

TABLE OF CONTENTS

PART 1 EXECUTIVE SUMMARY

KJH Engineering was contacted by EWU Construction and Planning Services in April of 2020 and asked to furnish an analysis of the overall effect of the operational efficiency of the Rozell chilled water plant attributed to the recent upgrade of chillers, pumps and cooling towers. EWU completed a project during the summer of 2018 involving the demolition of (2) 500-ton constant speed centrifugal Carrier chillers, (2) associated cooling towers, (15) constant speed equipment and campus distribution pumps and all associated piping, electrical service, water treatment and controls. This equipment was replaced with (2) 1500 Ton York YK variable speed centrifugal chillers, (2) Baltimore Air Coil Model S3E-1424-13R induced draft cross flow variable speed cooling towers, (9) parallel piped Armstrong variable speed chiller/cooling tower equipment pumps and campus chilled water distribution pumps, associated piping, electrical service, controls and water treatment. This upgrade raised the plants overall chilled water generation and distribution capacity from 4000 to 6000 Tons.

An alternate bid was accepted and implemented involving the installation of a Dry-Cooler system allowing the plant to generate 210 Tons of chilled water cooling during periods of outside air temperatures less than 32 F to provide a cooling source for any connected campus cooling loads during the winter time. At this time there are no winter time cooling loads but anticipated future example loads: water cooled condensing units, environmental chamber water source cooling, lab instrument cooling and IT computing room cooling.

EWU is in the process of improving their chiller plant pump efficiencies by controlling the (6) equipment pump speeds based upon flow-rate requirements and the (3) campus chilled water distribution pumps based upon the heat transfer requirements of each operating chiller. These new efficiencies cannot be reported here as the improvements will be implemented this summer.

PART 2 MSI ENGINEERS BASELINE EFFICIENCY STUDY

MSI Engineers, a Spokane based mechanical consulting business, performed a chiller plant capacity upgrade pre-design report that included a study of the pre-upgrade efficiency of the previous chilled water plant. Central chilled water plants are typically rated by the kWH consumed per ton of cooling or kWH/TON-Hour or simply kW/Ton. MSI used historical metered electrical data (2014) to compile the total kWH consumed for the cooling season (4,010,086). This kWH data set represents the sum of all operating equipment (chillers, equipment pumps, distribution pumps and cooling tower fans). MSI used chilled water ton hours generated data (2013) to compile the total Ton-Hours campus load for the season at 4,985,555. This leaves the previous plant baseline chilled water efficiency at 0.8 kW/Ton.

PART 3 KJH ENGINEERING PLANT UPGRADE EFFICIENCY STUDY

KJH coordinated with ATS controls (project control contractor) to create a database that calculates and stores the sum total kWH of all applicable operating equipment (chillers, pumps and cooling tower fans). This database also calculates and stores the Ton-Hours of chilled water generated and performs the final kW/Ton efficiency performance objective. KJH collected chiller plant performance data from May 2020 to use for this study. This data set shows the efficiency (kW/Ton) during the hours of operation of the plant for this month (figure 1). The average plant efficiency for the month is 0.61 kW/Ton.

The following shows the overall effect of the chiller plant upgrade towards improving efficiency and actual dollars saved.

- Assuming a 15% increase in campus Ton-Hour load from the MSI 2013 load calculation reflects a current campus annual cooling load of 5,733,388 Ton-Hours.
- The increase in overall plant efficiency is shown by the following:
    - ((0.8 - 0.61) / .8) X 100 = 23.75% increase in efficiency.

- Current electrical utility rate is \$0.041/kWH
- Previous annual plant cost at current utility rate:
    - 5,733,388 Ton-Hours X 0.8 kW/Ton X \$0.041/kWH = \$188,055.00 Annual cost.
- Current Plant cost:
    - 5,733,388 Ton-Hours X 0.61 kW/Ton X \$0.041/kWH = \$143,392.00 Annual cost.
- Annual savings: \$44,663.00

PART 4 Conclusion

The savings shown account for a reduction in kWH alone and do not account for any savings due to a reduction in electrical demand charges. This calculation is outside of the scope of this current study. Further improvement in the overall efficiency is expected once the operational improvements to the equipment and distribution pumps mentioned above are fully implemented.

Kelly J. Harkins PE

EWU CHILLER PLANT MAY 2020 KW/TON EFFICIENCY (91 HOURS OF OPERATING DATA)	
Time Stamp	Total kW per ton - Chiller Tons
2020-05-05T12:00:00	0.57
2020-05-05T13:00:00	0.59
2020-05-05T14:00:00	0.57
2020-05-05T15:00:00	0.58
2020-05-05T16:00:00	0.60
2020-05-08T12:00:00	0.58
2020-05-08T13:00:00	0.59
2020-05-08T14:00:00	0.56
2020-05-08T15:00:00	0.57
2020-05-08T16:00:00	0.69
2020-05-09T15:00:00	0.46
2020-05-09T16:00:00	0.53
2020-05-09T17:00:00	0.70
2020-05-10T10:00:00	0.88
2020-05-10T13:00:00	0.84
2020-05-10T14:00:00	0.73
2020-05-10T15:00:00	0.63
2020-05-10T16:00:00	0.66
2020-05-10T17:00:00	0.69
2020-05-10T18:00:00	0.74
2020-05-11T12:00:00	0.56
2020-05-11T13:00:00	0.58
2020-05-11T14:00:00	0.56
2020-05-11T15:00:00	0.56
2020-05-11T16:00:00	0.59
2020-05-12T13:00:00	0.57
2020-05-12T14:00:00	0.57
2020-05-12T15:00:00	0.60
2020-05-13T13:00:00	0.57
2020-05-13T14:00:00	0.56
2020-05-13T15:00:00	0.60
2020-05-14T14:00:00	0.60
2020-05-14T15:00:00	0.64
2020-05-15T15:00:00	0.60
2020-05-15T16:00:00	0.60
2020-05-16T21:00:00	0.64
2020-05-16T22:00:00	0.58
2020-05-17T15:00:00	0.64
2020-05-19T19:00:00	0.61
2020-05-19T20:00:00	0.69
2020-05-27T14:00:00	0.57
2020-05-27T15:00:00	0.57
2020-05-27T16:00:00	0.56
2020-05-27T17:00:00	0.57
2020-05-27T18:00:00	0.59
2020-05-27T19:00:00	0.61
2020-05-27T20:00:00	0.63
2020-05-28T08:00:00	0.70
2020-05-28T09:00:00	0.59
2020-05-28T10:00:00	0.58
2020-05-28T11:00:00	0.58
2020-05-28T12:00:00	0.60
2020-05-28T13:00:00	0.61
2020-05-28T14:00:00	0.62
Time Stamp	Total kW per ton - Chiller Tons
2020-05-28T15:00:00	0.61
2020-05-28T16:00:00	0.59
2020-05-28T17:00:00	0.57
2020-05-28T18:00:00	0.57
2020-05-28T19:00:00	0.58
2020-05-28T20:00:00	0.59
2020-05-28T21:00:00	0.61
2020-05-28T22:00:00	0.62
2020-05-28T23:00:00	0.64
2020-05-29T15:00:00	0.57
2020-05-29T16:00:00	0.59
2020-05-29T17:00:00	0.69
2020-05-29T18:00:00	0.70
2020-05-29T19:00:00	0.60
2020-05-29T20:00:00	0.65
2020-05-29T21:00:00	0.59
2020-05-29T22:00:00	0.59
2020-05-29T23:00:00	0.59
2020-05-30T00:00:00	0.60
2020-05-30T01:00:00	0.61
2020-05-30T02:00:00	0.65
2020-05-30T03:00:00	0.65
2020-05-30T04:00:00	0.71
2020-05-30T05:00:00	0.64
2020-05-30T08:00:00	0.58
2020-05-30T09:00:00	0.57
2020-05-30T10:00:00	0.59
2020-05-30T11:00:00	0.58
2020-05-30T12:00:00	0.59
2020-05-30T13:00:00	0.59
2020-05-30T14:00:00	0.58
2020-05-30T15:00:00	0.58
2020-05-30T16:00:00	0.60
2020-05-30T17:00:00	0.61
2020-05-30T18:00:00	0.61
2020-05-30T19:00:00	0.58
2020-05-30T20:00:00	0.58
2020-05-30T21:00:00	0.62
Average KW/Ton	0.61

Appendix J – C 100

C-100(2022)

Updated June 2022

Quick Start Guide

GENERAL INFORMATION

1) The intended use of the C-100(2022) is to enable project managers to communicate their project cost estimates to budget officers in the standard format required for capital project budget requests/submittals to OFM.

2) This workbook is protected so that the worksheets within it cannot be moved or deleted in the usual manner. This protection is necessary to ensure that the cost estimate details and formulas align with the estimating application in the Capital Budgeting System.

3) The estimating format to develop the maximum allowable construction cost (MACC) is presented in Uniformat II.
4) Form-calculated costs such as A/E Basic Design Service fees and Agency Project Management costs are dependent on other estimated project costs such as MACC, equipment, etc.
5) Project estimates generated with this tool are not sufficient for budget request submittals to OFM. Use the Capital Budgeting System to submit capital project budget requests and attach the C-100 form.
6) Contact your assigned OFM Capital Budget Analyst with questions.
OFM Capital Budget Analyst

INSTRUCTIONS

1) Only green cells are available for data entry.
2) Fill in all known cells in the 'Summary' tab prior to moving on to the cost entry tabs A-G.
3) It is recommended, but not required, to fill out cost entry tabs in the following order:
A. Acquisition, C. Construction Contracts, D. Equipment, G. Other Costs, B. Consultant Services, F. Project Management, then E. Artwork.

4) If additional rows are inserted to capture additional project costs, a description must be provided in the Notes column or within Tab H. Additional Notes. Be particularly detailed for additional costs estimated for contingencies and project management.

FORM-CALCULATED COSTS (FEE CALCULATIONS)

1) A/E Basic Design Services: AE Fee % (x) (MACC + Contingency)
2) Design Services Contingency: Contingency % (x) Consultant Services Subtotal
3) Construction Contingency: Contingency % (x) MACC
4) Artwork: 0.5% (x) Total Project Cost
5) Agency Project Management (Greater than $1million): (AE Fee % - 3%) (x) (Acquisition Total + Consultant Services Total + MACC + Construction Contingency + Other Costs)

State of Washington
AGENCY / INSTITUTION PROJECT COST SUMMARY
Updated June 2022

Agency	EASTERN WASHINGTON UNIVERSITY
Project Name	Infrastructure Renewal IV
OFM Project Number	40000114

Contact Information

Name	Shawn King
Phone Number	509-359-6878
Email	sking@ewu.edu

Statistics

Gross Square Feet		MACC per Gross Square Foot	
Usable Square Feet		Escalated MACC per Gross Square Foot	
Alt Gross Unit of Measure			
Space Efficiency		A/E Fee Class	A
Construction Type	Heating and power plant	A/E Fee Percentage	12.57%
Remodel	Yes	Projected Life of Asset (Years)	30

Additional Project Details

Procurement Approach	GCCM	Art Requirement Applies	No
Inflation Rate	4.90%	Higher Ed Institution	Yes
Sales Tax Rate %	8.90%	Location Used for Tax Rate	Cheney, WA
Contingency Rate	10%		
Base Month (Estimate Date)	June-22	OFM UFI# (from FPMT, if available)	
Project Administered By	Agency		

Schedule

Predesign Start	October-22	Predesign End	December-22
Design Start	January-23	Design End	June-24
Construction Start	August-23	Construction End	June-25
Construction Duration	22 Months		

Green cells must be filled in by user

Project Cost Estimate

Total Project	**$14,695,970**	Total Project Escalated	**$15,799,964**
		Rounded Escalated Total	**$15,800,000**

Cost Estimate Summary

Acquisition

Acquisition Subtotal	**$0**	**Acquisition Subtotal Escalated**	**$0**

Consultant Services			
Predesign Services	$0		
Design Phase Services	$757,869		
Extra Services	$278,750		
Other Services	$324,767		
Design Services Contingency	$136,139		
Consultant Services Subtotal	**$1,497,525**	**Consultant Services Subtotal Escalated**	**$1,612,600**

Construction			
Maximum Allowable Construction Cost (MACC)	$7,576,746	Maximum Allowable Construction Cost (MACC) Escalated	$8,013,167
GCCM Risk Contingencies	$1,782,689		$1,970,763
GCCM Management	$1,337,325		$1,478,413
Owner Construction Contingency	$757,675		$837,610
Non-Taxable Items	$0		$0
Sales Tax	$1,019,445	Sales Tax Escalated	$1,094,696
Construction Subtotal	**$12,473,879**	**Construction Subtotal Escalated**	**$13,394,649**

Equipment			
Equipment	$0		
Sales Tax	$0		
Non-Taxable Items	$0		
Equipment Subtotal	**$0**	**Equipment Subtotal Escalated**	**$0**

Artwork			
Artwork Subtotal	**$78,607**	**Artwork Subtotal Escalated**	**$78,607**

Agency Project Administration			
Agency Project Administration Subtotal	$645,959		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$645,959**	**Project Administration Subtotal Escalated**	**$714,108**

Other Costs			
Other Costs Subtotal	**$0**	**Other Costs Subtotal Escalated**	**$0**

Project Cost Estimate			
Total Project	**$14,695,970**	Total Project Escalated	**$15,799,964**
		Rounded Escalated Total	**$15,800,000**

Funding Summary

	Project Cost (Escalated)	Funded in Prior Biennia	New Approp Request 2023-2025	2025-2027	Out Years
Acquisition					
Acquisition Subtotal	$0				**$0**
Consultant Services					
Consultant Services Subtotal	$1,612,600				**$1,612,600**
Construction					
Construction Subtotal	$13,394,649				**$13,394,649**
Equipment					
Equipment Subtotal	$0				**$0**
Artwork					
Artwork Subtotal	$78,607				**$78,607**
Agency Project Administration					
Project Administration Subtotal	$714,108				**$714,108**
Other Costs					
Other Costs Subtotal	$0				**$0**

Project Cost Estimate

Total Project	**$15,799,964**	**$0**	**$0**	**$0**	**$15,799,964**
	$15,800,000	**$0**	**$0**	**$0**	**$15,800,000**
Percentage requested as a new appropriation			**0%**		

What is planned for the requested new appropriation? (*Ex. Acquisition and design, phase 1 construction, etc.*)

Insert Row Here

What has been completed or is underway with a previous appropriation?

Insert Row Here

What is planned with a future appropriation?

Insert Row Here

Cost Estimate Details

Acquisition Costs					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Purchase/Lease					
Appraisal and Closing					
Right of Way					
Demolition					
Pre-Site Development					
Other					
Insert Row Here					
ACQUISITION TOTAL	**$0**		**NA**	**$0**	

Green cells must be filled in by user

Cost Estimate Details

Consultant Services					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
1) Pre-Schematic Design Services					
Programming/Site Analysis					
Environmental Analysis					
Predesign Study					
Other					
Insert Row Here					
Sub TOTAL	**$0**		**1.0286**	**$0**	Escalated to Design Start
2) Construction Documents					
A/E Basic Design Services	$722,869				69% of A/E Basic Services
Other	$35,000				
Insert Row Here					
Sub TOTAL	**$757,869**		**1.0641**	**$806,449**	Escalated to Mid-Design
3) Extra Services					
Civil Design (Above Basic Svcs)	$12,500				
Geotechnical Investigation					
Commissioning	$177,250				
Site Survey					
Testing	$89,000				
LEED Services					
Voice/Data Consultant					
Value Engineering					
Constructability Review					
Environmental Mitigation (EIS)					
Landscape Consultant					
Other					
Insert Row Here					
Sub TOTAL	**$278,750**		**1.0641**	**$296,618**	Escalated to Mid-Design
4) Other Services					
Bid/Construction/Closeout	$324,767				31% of A/E Basic Services
HVAC Balancing					
Staffing					
Other					
Insert Row Here					
Sub TOTAL	**$324,767**		**1.1055**	**$359,031**	Escalated to Mid-Const.
5) Design Services Contingency					
Design Services Contingency	$136,139				
Other					
Insert Row Here					
Sub TOTAL	**$136,139**		**1.1055**	**$150,502**	Escalated to Mid-Const.

CONSULTANT SERVICES TOTAL	**$1,497,525**		**$1,612,600**	

Green cells must be filled in by user

Cost Estimate Details

Construction Contracts					
Item	Base Amount		Escalation Factor	Escalated Cost	Notes
1) Site Work					
G10 - Site Preparation					
G20 - Site Improvements	$1,739,280				
G30 - Site Mechanical Utilities	$3,274,456				
G40 - Site Electrical Utilities	$2,563,010				
G60 - Other Site Construction					
Other					
Insert Row Here					
Sub TOTAL	**$7,576,746**		**1.0576**	**$8,013,167**	
2) Related Project Costs					
Offsite Improvements					
City Utilities Relocation					
Parking Mitigation					
Stormwater Retention/Detention					
Other					
Insert Row Here					
Sub TOTAL	**$0**		**1.0576**	**$0**	
3) Facility Construction					
A10 - Foundations					
A20 - Basement Construction					
B10 - Superstructure					
B20 - Exterior Closure					
B30 - Roofing					
C10 - Interior Construction					
C20 - Stairs					
C30 - Interior Finishes					
D10 - Conveying					
D20 - Plumbing Systems					
D30 - HVAC Systems					
D40 - Fire Protection Systems					
D50 - Electrical Systems					
F10 - Special Construction					
F20 - Selective Demolition					
General Conditions					
Other Direct Cost					
Insert Row Here					
Sub TOTAL	**$0**		**1.1055**	**$0**	
4) Maximum Allowable Construction Cost					
MACC Sub TOTAL	**$7,576,746**			**$8,013,167**	
	NA			*NA per 0*	

5) GCCM Risk Contingency				
GCCM Risk Contingency	$1,782,689			
Other				
Insert Row Here				
Sub TOTAL	**$1,782,689**	**1.1055**	**$1,970,763**	
6) GCCM or Design Build Costs				
GCCM Fee	$1,337,325			
Bid General Conditions				
GCCM Preconstruction Services				
Other				
Insert Row Here				
Sub TOTAL	**$1,337,325**	**1.1055**	**$1,478,413**	
7) Owner Construction Contingency				
Allowance for Change Orders	$757,675			
Other				
Insert Row Here				
Sub TOTAL	**$757,675**	**1.1055**	**$837,610**	
8) Non-Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.1055**	**$0**	
9) Sales Tax				
Sub TOTAL	**$1,019,445**		**$1,094,696**	
CONSTRUCTION CONTRACTS TOTAL	**$12,473,879**		**$13,394,649**	

Green cells must be filled in by user

Cost Estimate Details

Equipment					
Item	Base Amount		Escalation Factor	Escalated Cost	Notes
1) Equipment					
E10 - Equipment					
E20 - Furnishings					
F10 - Special Construction					
Other					
Insert Row Here					
Sub TOTAL	**$0**		**1.1055**	**$0**	
2) Non Taxable Items					
Other					
Insert Row Here					
Sub TOTAL	**$0**		**1.1055**	**$0**	
3) Sales Tax					
Sub TOTAL	**$0**			**$0**	
EQUIPMENT TOTAL	**$0**			**$0**	

Green cells must be filled in by user

Cost Estimate Details

Artwork					
Item	Base Amount		Escalation Factor	Escalated Cost	Notes
1) Artwork					
Project Artwork	$0				0.5% of total project cost for new construction
Higher Ed Artwork	$78,607				0.5% of total project cost for new and renewal construction
Other					
Insert Row Here					
ARTWORK TOTAL	**$78,607**		**NA**	**$78,607**	

Green cells must be filled in by user

Cost Estimate Details

Project Management					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
1) Agency Project Management					
Agency Project Management	$645,959				
Additional Services					
Other					
Insert Row Here					
Subtotal of Other	*$0*				
PROJECT MANAGEMENT TOTAL	**$645,959**		**1.1055**	**$714,108**	

Green cells must be filled in by user

Cost Estimate Details

Other Costs					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Mitigation Costs					
Hazardous Material Remediation/Removal					
Historic and Archeological Mitigation					
Other					
Insert Row Here					
OTHER COSTS TOTAL	**$0**		**1.0576**	**$0**	

Green cells must be filled in by user

C-100(2022)
Additional Notes

Tab A. Acquisition
Insert Row Here

Tab B. Consultant Services
Insert Row Here

Tab C. Construction Contracts
Insert Row Here

Tab D. Equipment
Insert Row Here

Tab E. Artwork
Insert Row Here

Tab F. Project Management
Insert Row Here

Tab G. Other Costs
Insert Row Here

Appendix K – Greenhouse Gas Reduction Policy

EASTERN
WASHINGTON UNIVERSITY

Eastern Washington University Greenhouse Gas Reduction Policy
March 1, 2020

Purpose: The purpose of the policy is to set forth EWU's commitment to reducing greenhouse gas within the area of campus operations and guide the university towards a collective goal of Washington State government agencies achieving carbon neutrality in 2050. This policy sets the greenhouse gas reduction standards for managing greenhouse gas emissions at Eastern Washington University and brings EWU in line with Washington State Legislation under RCW 70.235.

History: EWU is committed to reducing greenhouse gas emissions and reducing our impact on climate change. EWU is a signatory of the American College and University Presidents Climate Commitment, developed its first campus Sustainability Plan in 2012, and created the Office of Sustainability with the hiring of our first Sustainability Coordinator in 2016. EWU seeks to further these efforts by developing Sustainability focused polices that decrease our carbon footprint and other environmental impacts. In 2020 the Washington State Legislature passed HB 2311 that amends RCW 70.235 and strengthens the State's commitment to reducing greenhouse gas emissions with the goal to become carbon neutral by 2050. This policy is intended to align EWU's commitment to carbon emission reductions with Washington State policy and provide guidance as EWU progresses towards near carbon neutrality.

I. **Policy** – As part of its role as a State agency, EWU will work to meet the statewide greenhouse gas emission limits established in RCW 70.235.020:
   - **i.** Year 2030 – Reduce greenhouse gas emissions by 45 % below 2005 levels
   - **ii.** Year 2040 – Reduce greenhouse gas emissions by 70 % below 2005 levels
   - **iii.** Year 2050 – Reduce greenhouse gas emissions by 95 % below 2005 levels; and support the collective goal of achieving net zero greenhouse gas emissions by the Washington State government agencies as a whole.

II. **Policy Review** – This policy will be reviewed annually and updated to reflect changes in Washington State Legislation as well as Eastern Washington University policies. The EWU Office of Sustainability will be tasked with the annual review and proposing updates to the policy as necessary.

III. **Greenhouse gas monitoring and reporting** – The Office of Sustainability is tasked with tracking greenhouse gas emissions and providing biannual reports to the State Efficiency and Environmental Performance Office at the Department of Commerce. As defined in RCW 70.235.050, these biannual reports will document steps taken in the previous biennium as well as actions planned for the next two biennia and long-term strategies to meet emission reduction targets. Reports will be submitted every two years, beginning in 2022, on June 1st of even numbered years to the Department of Commerce. Additionally, the Office of Sustainability will provide annual greenhouse gas reduction reports to the EWU VP of Business and Finance.