FIRE SUPPRESION, PLUMBING AND MECHANICAL NARRATIVE

DIVISION 21 – FIRE SUPPRESSION

I. STANDARDS, CODES AND GUIDELINES

A. State of Illinois

1. Illinois JCAR Administrative Code, Title 77: Public Health, Chapter 1: Department of Public Health, Subchapter c: Long-Term Care Facilities:

   a. Part 340 Illinois Veterans' Homes Code, Section 340.1010 Incorporated and Referenced Materials
   b. Part 340 Illinois Veterans' Homes Code, Section 340.2000 Maintenance
   c. Part 340 Illinois Veterans' Homes Code, Section 340.2010 Water Supply, Sewage Disposal and Plumbing
   d. Part 340 Illinois Veterans' Homes Code, Section 340.2050 Equipment and Supplies

2. Part 340 Illinois Veterans' Home Care, Section 340.1010 Incorporated and Referenced Materials

   a. The following regulations and standards are incorporated in the Part:

      1) Private and professional association standards:

         a) NFPA 99 Standard for Health Care Facilities (2012) Edition.

      2) Federal regulations:

         b) Physical Environment (38 CFR 51.200 effective February 7, 2012).

      3) The following federal and State statutes are referenced in this Part:

         c) Life Care Facilities Act (210 ILCS 40)
         d) Nursing Home Care Act (210 ILCS 45)
         e) Hospital Licensing Act (210 ILCS 85)
         f) Assisted Living and Shared Housing Act (210 ILCS 9)

3. Capital Development Board Design and Construction Manual (March 2009) DCM Supplement (November 2016)

B. Facilities seeking Federal Reimbursement

1. Federal Title 38 USC 8131-8137: Federal VA participation in up to 65% of cost of construction of new domiciliary or nursing home buildings and remodeling or alteration of existing domiciliary, nursing or adult day health care buildings, provided VA standards and regulations are met. IDVA has confirmed it will seek participation in this program. U.S. Department of Veterans Affairs, Office of Construction & Facilities Management publishes Design Manuals which are to be used as guidelines. At a minimum, the following Design Manuals are applicable:

a. Physical Security Design Manual for VA Life-Safety Protected Facilities, January 2015
b. Physical Security Design Manual for VA Mission Critical Facilities, January 2015
c. Fire Protection Design Manual, December 2015

GENERAL

Bridging Team Preliminary Work

We have produced schematic design level documents which depict most, but not all, the equipment and system components germane to our solution; these documents have been coordinated as best possible with the architectural work and engineering disciplines as appropriate for this limited stage of design. We will forward all design files (drawings, specifications, product selections and cut sheets, and engineering calculations) to the Design Build team as reference documents. These documents are not to be considered representative of the only solution for the Design-Build work, unless noted otherwise in the No Deviations list, nor are they to be considered fully complete or accurate, and representative of what is needed to design and construct the project; it is fully the responsibility of the Design-Build team to provide all engineering design phase services, inclusive of coordination amongst disciplines, and all construction phase services. The Bridging Documents architectural and engineering team will remain available for general consultation but all design responsibility and responsibility for design decisions is the responsibility of the Design-Build team.

SITE AND BUILDING FIRE PROTECTION WORK

The Nursing Home, Domiciliary building, tunnel connection from the Nursing Home to Nielson, the tunnel connection from the Nursing Home to the MultiTherapy Building, the tunnel connection from the Nursing Home to the Fifer Building, areas renovated in the Fifer Building as a result of the tunnel connection, and the renovated Nielson building will be fully sprinkled with a wet pipe system installed in accordance with NFPA 13. With known pressure issues on the campus and in the area, a fire pump will be required in each to meet flow and pressure demands of the system. The fire pump will be electric and be connected to emergency power. Size of the fire pump will be dependent on the final heights of the buildings and a flow test of the domestic water system. Each fire pump is located in the basement level in a dedicated room that has direct access to the exterior of the building via a fire-rated stairwell. All zone valves, jockey pumps, associated controls and appurtenances shall be provided and located in this room.

Presently, a combined domestic water and fire service water distribution system exists on campus. Under a separate CDB project, Number 040-010-114, currently in the early stages of design, a new domestic water distribution system will be constructed for the campus, providing service to the new Nursing Home, Domiciliary, and all existing buildings on campus which are to remain in service. CDB has contracted design services with Poepping Stone Bach and Associates, Quincy, IL for this project. When the new campus water system is installed, the existing combined domestic water and fire service water distribution system will be retained to provide fire service only. The Design Build Contractor shall provide a dedicated 8-inch fire water service for the Nursing Home and a dedicated 6-inch fire water service for the Domiciliary building; both services shall connect to the existing water distribution system being retained for fire service only. Coordination with the domestic water main replacement project shall be the responsibility of the Design Build Contractor. The Design Build Contractor shall provide a reduced pressure, backflow preventer before serving the building's sprinkler system; it is possible this may not be required if backflow prevention is addressed in the CDB 040-010-114 project.

All materials and sprinkler piping within the building shall be UL listed, FM-rated, and in compliance with the specifications.

A dry pipe sprinkler system is presently not required; final design decisions are the responsibility of the Design Build Contractor, pending exterior overhangs and canopies.

The Design Build Contractor shall provide a nitrogen generation system to serve the entire sprinkler system. The nitrogen system will provide protection against oxygen corrosion and Microbial Influenced Corrosion (MIC).

The Nursing Home and Domiciliary buildings are classified as Light Hazard using ordinary temperature heads. The following spaces will be classified as Ordinary Hazard, Group 1 and they will use intermediate temperature heads: mechanical rooms, storage rooms, and the kitchen. The following spaces will be classified as Ordinary Hazard, Group 1, and they will use ordinary temperature heads: electrical rooms. The elevator shafts will be sprinkled, ordinary temperature heads will be placed at the top and one at the bottom (2'-0" above the floor of the pit).

All sprinkler heads will be quick response. In areas with ceilings, heads will be concealed type and placed in the center of ceiling tiles. In areas without ceilings, heads will be upright with a brass finish. All heads that are subject to physical damage shall be provided with a protective wire cage.

Refer specification Section 21 10 00 – Water-Based Fire-Suppression Systems for design approach.

STAND PIPE SYSTEMS (NURSING HOME ONLY)

The Design Build Contractor shall provide standpipes in the egress stairwells, per NFPA 14 in the Nursing Home building. The standpipes shall have 2-1/2 inch hose valves at each intermediate landing of each egress stairwell, and as required by NFPA 14.

DIVISION 22 – PLUMBING

I. STANDARDS, CODES AND GUIDELINES

A. State of Illinois

1. Illinois JCAR Administrative Code, Title 77: Public Health, Chapter 1: Department of Public Health, Subchapter c: Long-Term Care Facilities:

   a. Part 340 Illinois Veterans' Homes Code, Section 340.1010 Incorporated and Referenced Materials
   b. Part 340 Illinois Veterans' Homes Code, Section 340.2000 Maintenance
   c. Part 340 Illinois Veterans' Homes Code, Section 340.2010 Water Supply, Sewage Disposal and Plumbing
   d. Part 340 Illinois Veterans' Homes Code, Section 340.2050 Equipment and Supplies

2. Part 340 Illinois Veterans' Home Care, Section 340.1010 Incorporated and Referenced Materials

   a. The following regulations and standards are incorporated in the Part:

      1) Private and professional association standards:

         a) NFPA 99 Standard for Health Care Facilities (2012) Edition.

      2) Federal regulations:

         a) Physical Environment (38 CFR 51.200 effective February 7, 2012).

      3) The following federal and State statutes are referenced in this Part:

         a) Life Care Facilities Act (210 ILCS 40)
         b) Nursing Home Care Act (210 ILCS 45)
         c) Hospital Licensing Act (210 ILCS 85)
         d) Assisted Living and Shared Housing Act (210 ILCS 9)

      4) The following State of Illinois rules are referenced:

         a) Department of Public Health, Illinois Plumbing Code (77 Ill. Admin. Code 890)
         b) Department of Public Health Drinking Water Systems Code (77 Ill. Admin. Code 900)

3. Capital Development Board Design and Construction Manual (March 2009)
   DCM Supplement (November 2016)
   Note: A life cycle cost analysis is required.

B. Facilities seeking Federal Reimbursement

1. Federal Title 38 USC 8131-8137: Federal VA participation in up to 65% of cost of construction of new domiciliary or nursing home buildings and remodeling or alteration of

existing domiciliary, nursing or adult day health care buildings, provided VA standards and regulations are met. IDVA has confirmed it will seek participation in this program. U.S. Department of Veterans Affairs, Office of Construction & Facilities Management publishes Design Manuals which are to be used as guidelines. At a minimum, the following Design Manuals are applicable:

a. Physical Security Design Manual for VA Life-Safety Protected Facilities, January 2015
b. Physical Security Design Manual for VA Mission Critical Facilities, January 2015
c. Sustainable Design Manual, May 6, 2014, Rev 1 August 18, 2017
d. Plumbing Design Manual, November 2014, Rev May 1, 2018
e. Fire Protection Design Manual, December 2015

2. Federal VA Form 10-0388-14 – Checklist of Major Requirements for State Home Construction and Acquisition Grants
3. Federal Department of Veterans Affairs 38 CFR 59.130 General Requirements for all State home facilities:

a. Facilities must meet all Federal, State, and local requirements. If the State or local requirements are different from the Federal requirements, compliance with the most stringent provisions is required.

C. Other Requirements

1. Federal VHA Directive 1061
2. ANSI/ASHRAE Standard 188-2018, Legionellosis: Risk Management for Building Water Systems.

GENERAL

Bridging Team Preliminary Work

We have produced schematic design level drawings which depict most, but not all, the equipment and system components germane to our solution; these drawings have been coordinated as best possible with the architectural work and engineering disciplines as appropriate for this limited stage of design. We will forward all design files (drawings, specifications, product selections and cut sheets, and engineering calculations) to the Design Build team as reference documents. These documents are not to be considered representative of the only solution for the Design-Build work, unless noted otherwise in the No Deviations list, nor are they to be considered fully complete or accurate, and representative of what is needed to design and construct the project; it is fully the responsibility of the Design-Build team to provide all engineering design phase services, inclusive of coordination amongst disciplines, and all construction phase services. The Bridging Documents architectural and engineering team will remain available for general consultation but all design responsibility and responsibility for design decisions is the responsibility of the Design-Build team.

SITE PLUMBING WORK

The Design Build Contractor shall disconnect existing water, sanitary and storm sewer, and natural gas services to those buildings being demolished; preliminary approach has Kent, Markword, Fletcher, Elmore, Schapers, Northern Guest House, Vehicle Garage (Security Annex), and Truck Maintenance

(Ambulance Garage) as being demolished. Refer to SITE TUNNELS AND STEAM PIPING, POWER PLANT, AND MULTI-THERAPY CHILLER PLANT narrative for description of a preliminary Phasing Plan.

A separate CDB project, Number 040-010-114, has the main objective to replace the domestic water mains throughout the Veterans' Home campus. The water source, secondary treatment processes if any, and location of site distribution piping has yet to be determined. The Design Build Contractor shall coordinate selection of its materials, means and methods of installation, and means and methods of pipe joining, with the design of the Number 040-010-114 project.

NATURAL GAS DISTRIBUTION

The Design Build Contractor shall provide new natural gas service to the Nursing Home and the Domiciliary. The distribution pressure in each building shall be 2psig. Each piece of equipment will have a regulator to reduce the gas pressure from 2psig delivery to 7-11 inches w.c. utilization. All regulators within the building will be individually vented outside with copper piping. All gas valves will be rated for 125 lbs.

Gas shall serve the water heaters and boilers in the mechanical rooms, and extend over to serve the gas fired kitchen equipment in the Nursing Home building. Gas piping shall be provided to the Domiciliary mechanical room to serve the domestic water heaters and kitchen equipment. Natural gas piping shall be routed through the ceiling of the mechanical room and up onto the roof on both facilities. Additional small gas appliances shall be provided with gas service as required throughout both buildings, including a gas fireplace in the Domiciliary commons area.

See specifications for gas piping materials. Gas piping shall be primed and painted yellow where concealed within the building, painted to match the surroundings where exposed in the building, and painted to match the building materials were it rises up the side of the building. All piping on the roof will be painted yellow.

Gas service exists at the following buildings; the table also identifies the status of the gas services as design and construction are presently envisioned, pending direction taken by the Design Build Contractor.

Building	Gas Load (CFH)	Status
Schapers	300	Eventually Demolished
Andrew	240	Remains in Service
Elmore	400	Demolished
Fifer	400	Remains in Service
Northern Guest House	150	Demolished
Multi-Therapy	400	Remains in Service
Nielson Mess	1840	Remains in Service, but load reduced
Fletcher	400	Demolished
Markword	400	Demolished
Anderson	400	Remains in Service, but building is idled to be repurposed
Somerville	400	Remains in Service, but building is idled to be repurposed

II. BUILDING PLUMBING WORK

The following requirements pertain to the Nursing Home building, the Domiciliary building and to the renovated Nielson building. All systems shall be new, including new plumbing in the Nielson building, inclusive of replacement of existing sanitary and storm sewer piping under the floor slabs of Nielson.

NIELSON BUILDING

Remove all existing plumbing drain, waste and vent systems and all existing water piping. Provide all new drain, waste and vent piping and all new domestic water piping to accommodate new locker rooms and restrooms. Evaluate and reuse existing gas fired water heater if possible. Provide new water monitoring system, inclusive of new devices, and connect to existing campus system. Provide new building service entrance in-line filtration system.

PLUMBING FIXTURES

The Design Build Contractor shall provide new plumbing fixtures as scheduled and specified on the drawings for the Nursing Home, Domiciliary and Nielson buildings. Generally, the fixtures shall be commercial grade. Public flush valves shall be hardwired, sensor operated with manual override. Public lavatory and wash basin faucets shall be hardwired, sensor operated and have a built-in programming to allow the fixture to automatically flush water after a set period of non-usage. Exterior wall hydrants will be placed on 200' centers around the perimeter of the building. Provide exterior, freeze-proof hosebibs on roof as required to maintain rooftop equipment. Private water closets shall be manual, flush-tank style fixtures. Private sinks shall be under-counter-mounted with manual faucets. All faucets shall be fitted with non-aerating, laminar-flow outlets.

WASTE AND VENT PIPING

All below grade sanitary waste and vent piping shall be Schedule 40 PVC. Waste piping within the kitchen that will receive elevated temperature discharge shall be cast iron. Sanitary waste and vent piping within walls, vertical chases and return air plenums shall be cast iron no-hub. Grease laden waste shall be discharged through a grease interceptor located in the basement. Clearwater condensate resulting from the HVAC air conditioning shall be PVC where not in the plenum, and DWV weight copper when located in the plenum. Neighborhood kitchens shall each have an under-counter solids and grease interceptor to receive waste from the dish spray station. Preliminary foundation design for the Nursing Home and Domiciliary is grade beam and caisson construction; refer structural drawings and Geotechnical Investigation Report.

STORM DRAINS AND PIPING

All below grade storm sewer piping shall be Schedule 40 PVC. Storm piping within walls, vertical chases and within return air plenums shall be cast iron with no-hub connections. All storm piping above grade shall be insulated to protect against condensation dripping on finishes below. Building storm piping shall connect to site storm sewer system. Provide roof and overflow drains. Provide perimeter footing drainage system. Preliminary civil design shows roof drains leaving the Nursing Home on the north side of the building and the northeast side of the Domiciliary building; refer Civil drawing set. Preliminary foundation design for the Nursing Home and Domiciliary is grade beam and caisson construction; refer structural drawings and Geotechnical Investigation Report.

WATER HEATING

Water heating for the Nursing Home and Domiciliary will be accomplished by three high-efficiency, condensing, natural gas fired water heaters, located in the basement of each building. The water heaters will be connected to a hot water storage tank. Water will be heated and stored at a temperature requisite to deliver at 160°F at point of use. Kitchen outlets and service sinks will receive un-tempered hot water. All other outlets in the resident rooms and public areas shall have an ASSE 1070 rated thermostatic mixing valve to temper the water at the point-of-use. All hot awter recirculation water shall pass through the gas-fired heat-exchanger before entering any storage tank.

As herein before stated the Design Build Contractor shall evaluate and reuse existing gas-fired water heater in Nielson if possible. Water shall be heated, stored and delivered at 160°F. All outlets and public areas shall have an ASSE 1070 rated thermostatic mixing valve to temper the water at the point-of-use.

DOMESTIC WATER PIPING

The Design Build Contractor shall provide a 6 inch domestic water service for the Nursing Home facility, a 4 inch domestic water service for the Domiciliary, and a 3 inch domestic water service line to replace the existing service line feeding Nielson. All buildings shall be provided with a reduced pressure, backflow preventer before serving the building.

The Design Build Contractor shall provide a booster pump for the Nursing Home and the Domiciliary and confirm adequate pressure for Nielson. The anticipated peak load of the Nursing Home facility is 321 GPM, and the Domiciliary is 208 GPM, sized according to the Illinois Plumbing Code. The booster pumps shall be triplex, inline, skid-mounted unit with integral control panels and VFDs, with pressurized buffer tanks and all appurtenances.

As per specifications, all domestic water piping shall be copper with sweat fittings. Piping shall be properly insulated to maintain 25/50 ratings in the plenums. Insulation on water piping shall include cold water, hot water and hot water recirculation lines.

Piping branches to each fixture shall be made in such a manner as to eliminate dead-legs and seldom-used fixtures and branches. The hot water piping shall drop to within one foot of each mixing valve and continue on so the hot water is always recirculated and maintained above bacterial proliferation temperatures.

Resident room plumbing shall be piped in a manner such that the water closet in each room is the last fixture on the cold water run, increasing the probability that the water in the branches is turned over daily.

All appurtenances that require periodic maintenance shall have isolation valves located upstream and downstream to allow for minimal downtime. These locations are all balancing valves, y-strainers, pumps, tanks, water heaters and water treatment and monitoring equipment.

WATER TREATMENT AND MONITORING

A water monitoring system shall be provided, as an extension to the existing system installed in the campus resident facilities. As specified, it shall monitor the water quality at the service entrance in the basement and at sentinel locations on each floor. These sentinel locations are at minimum at the distal

locations on the top floor on each wing of the Long Term Care facility and each floor at each end of the Domiciliary. Suggested locations are indicated on the drawings. The water monitoring system shall contain all equipment, PLC, sensors, cables, programming, conduit and plumbing as specified. In addition, the system shall provide outputs to automatic flush valves to automatically flush water should the sensors indicate less than optimal water quality parameters.

The existing water monitoring system located at Fifer shall be modified and provided the ability to output to automatic flush valves to automatically flush water should the sensors indicate less than optimal water quality parameters at the existing distal monitoring locations. Work to accomplish this will include but not limited to additional hardware, water piping, drainage piping, and programming of output parameters.

The renovated Neilson facility shall receive a water monitoring system and point of entry filtration consistent with what is currently installed in the campus resident facilities.

Before being distributed in the Nursing Home and Domiciliary building, the domestic water service must pass through a set of 5-micron cartridge filters and then a self-regenerating, ultrafiltration system that will arrest any biological material from the city water supply and not allow it to seed the new systems. The explicit intent of this is to make certain that no unfiltered water will enter into new piping, during the course of construction or during commissioning and opening of the facilities.

At no point during the construction shall the domestic water system be allowed to have water stagnate for a period longer than 48 hours, once the system or portions thereof have been activated. The contractor will be responsible for flushing the domestic water system after the system is activated until such time that the building is turned over to the Owner. The using agency water management team will validate disinfectant residuals and bacteria levels. If these residuals and levels are not found to be within the limits set by the water management team, the contractor will be responsible for remedial action as determined by the water management team.

Prior to turning over to the Owner, the domestic water systems or parts of the systems shall be flushed and disinfected per the Illinois Administrative Code Part 890 (Illinois Plumbing Code) 1180.b) for non-chlorinated water supply. While the buildings will be supplied by chlorinated water, the commissioning of the domestic water system shall follow the procedure designated in the code for disinfection, contact time, flushing and bacteriological examination samples. This testing and sampling shall be done in coordination with the commissioning agent.

Additional measures for water treatment shall be implemented as specified, including a hard-piped injection point for the addition of chemical treatment bolus to the system should additional chemical treatment be necessary.

MEDICAL GAS SYSTEM (NURSING HOME ONLY)

A. General

1. Medical gas systems description:

a. The intent is to design complete, code complying and fully automated medical gas

systems to include the following gases with delivery pressures:

1) Oxygen 50-55 psig
2) Medical compressed air 50-55 psig
3) Medical vacuum 19" Hg

Each system will be independent of the other with no cross connections. All gas systems will be designed to meet the requirements of the authority having jurisdiction and the 2012 edition of NFPA 99 – Standard for Health Care Facilities (minimum Category 2 systems) and per IDPH. All work will be done in strict compliance with all local, county and state codes, applicable laws, rules and regulations governing the installation of medical gas systems. Each system will require third party testing and certification. System design will include isolation and zone valves, local and master alarms.

Note: All medical gas inlets/outlets, valves, zone valves, alarms, etc. will be supplied by a single manufacturer as coordinated with the Owner. All medical gas outlets (oxygen, medical air and vacuum) shall be 'Ohmeda' type to match existing Owner/Using Agency current equipment (confirm with Owner/Using Agency). Minimum NFPA 99 Category 2 should be reviewed with Owner/Using Agency and align with their Risk Assessment per NFPA 99 – Chapter 4.

b. Oxygen

Oxygen will be generated at the site by a Liquid Oxygen Tank bulk tank park (LOX) sized for an anticipated monthly usage of 125,000 cubic feet per month. The LOX consists of a liquid oxygen tank, emergency reserve cylinder manifold and vaporizer, with distribution to the facility. The LOX tank park shall be located on a fenced concrete pad, 50 ft. from any construction or in accordance with NFPA 55. The LOX tanks and related equipment such as a vaporizer will be furnished and installed by SJ Smith, the Owner/Using Agency contracted local gas supplier. Coordinate LOX tank equipment and installation with Owner/Using Agency and MJ Smith. LOX storage area and system will be designed and installed to meet NFPA 55 – Compressed Gas and Cryogenic Codes 2010 (for Bulk Oxygen). All interconnecting and final piping, tank fill connections and alarm, power, signal wiring, lighting, security fencing, concrete pad will be considered part of the project and not supplied by the LOX supplier.

Oxygen piping, distribution, alarms and outlets shall be designed and installed to comply with NFPA 99.

c. Medical Compressed Air

Medical compressed air will be provided by skid-mounted, packaged, single-stage duplex oil-free reciprocating compressors capable of delivering medical quality air. Each compressor will be 100% redundant and factory mounted on factory painted frame suitable for floor mounting. Package will be complete with a painted vertical ASME steel tank rated for 125 psig. General requirements for the packaged system will include factory assembled, wired, piped, tested, motor driven, air cooled continuous duty air compressors with receiver and refrigerated air dryers. The approximate flow rate for each

medical air compressor is 115 scfm pumps. Total skid dimensions when system is completely connected is approximately 110 inches by 150 inches by 83 inches tall.

Included will be vibration isolation, flex connections, motor overload protection devices, automatic control switches, traps, particulate filters, starting devices, instrumentation and alarm signal devices for building alarm and building management connections. Duplex refrigerated air dryers will be wall mounted units that exceed NFPA mandated dew point level.

d. Medical Vacuum

Medical vacuum will be generated by packaged unit duplex reciprocating vacuum pumps and receiver capable of delivering medical quality vacuum. Approximate flow rate of each vacuum pump will be 35 scfm. Each vacuum pump will be 100% redundant and factory mounted on a factory painted frame suitable for floor mounting. Package will be complete with a painted vertical ASME steel tank rated for 125 psig. General requirements for the packaged system will include factory assembled, wired, piped, tested, motor driven, air cooled continuous duty vacuum pumps with receiver and vibration isolation.

Included will be flex connections, motor overload protection devices, automatic control switches, starting devices, instrumentation and alarm signal devices for building alarm and building management connections.

2. Medical Gas System Materials

a. Medical Gas Piping and Valves

Medical gas piping systems will be seamless hard-drawn type “K” or “L” copper pipe with brazed joints and fittings conforming to *ASTM B8 19* cleaned and capped and bear either “acr/oxy” or “acr/med” markings.

Mainline, riser, in-line and zone type medical gas valves will be three-piece ¼ turn ball valve with full-port chrome-plated brass ball and extensions for brazing and having “open or closed” indicating handle.

Station inlets/outlets will be gas specific and have either threaded or quick-coupler connections to meet owner requirements. Inlets/outlets will comply with *NFPA 99* and *CGA V-5*. Emergency oxygen valve box will be provided and located so as to allow truck access/connection.

Pipe, fittings and valves shall be thoroughly cleaned and made suitable for oxygen service per *NFAP 99.*

b. Medical Gas System Alarms

Medical gas alarms will be provided in the engineer’s/maintenance office and within each resident/patient “household” where 24 hour monitoring is provided by nursing or care staff in accord with NFPA 99. Procedures for staff to follow should an alarm occur shall be permanently posted at the 24 hour monitored master alarm station.

Master Alarm panels shall monitor the local medical gas alarm panels and supply source pressure, volume and capacity monitoring as indicated in NFPA 99 for LOX storage, oxygen distribution, medical air compressor system, medical air distribution, vacuum pump system and vacuum distribution.

All medical gases will be monitored through each master alarm panel. Area alarms will sense pressures and signals to area alarms located at nurse/care stations.

DIVISION 23 – MECHANICAL

I. STANDARDS, CODES AND GUIDELINES

A. State of Illinois

1. Illinois JCAR Administrative Code, Title 77: Public Health, Chapter 1: Department of Public Health, Subchapter c: Long-Term Care Facilities:

   a. Part 340 Illinois Veterans' Homes Code, Section 340.1010 Incorporated and Referenced Materials
   b. Part 340 Illinois Veterans' Homes Code, Section 340.2000 Maintenance
   c. Part 340 Illinois Veterans' Homes Code, Section 340.2010 Water Supply, Sewage Disposal and Plumbing
   d. Part 340 Illinois Veterans' Homes Code, Section 340.2050 Equipment and Supplies

2. Part 340 Illinois Veterans' Home Care, Section 340.1010 Incorporated and Referenced Materials

   a. The following regulations and standards are incorporated in the Part:

      1) Private and professional association standards:

         a) NFPA 99 Standard for Health Care Facilities (2012) Edition.

      2) Federal regulations:

         a) Physical Environment (38 CFR 51.200 effective February 7, 2012).

      3) The following federal and State statutes are referenced in this Part:

         a) Life Care Facilities Act (210 ILCS 40)
         b) Nursing Home Care Act (210 ILCS 45)
         c) Hospital Licensing Act (210 ILCS 85)
         d) Assisted Living and Shared Housing Act (210 ILCS 9)

      4) The following State of Illinois rules are referenced:

         a) Department of Public Health, Illinois Plumbing Code (77 Ill. Admin. Code 890)
         b) Department of Public Health Drinking Water Systems Code (77 Ill. Admin. Code 900)

3. Capital Development Board Design and Construction Manual (March 2009)
   DCM Supplement (November 2016)
   Note: A life cycle cost analysis is required.

B. Facilities seeking Federal Reimbursement

1. Federal Title 38 USC 8131-8137: Federal VA participation in up to 65% of cost of construction of new domiciliary or nursing home buildings and remodeling or alteration of

existing domiciliary, nursing or adult day health care buildings, provided VA standards and regulations are met. IDVA has confirmed it will seek participation in this program. U.S. Department of Veterans Affairs, Office of Construction & Facilities Management publishes Design Manuals which are to be used as guidelines. At a minimum, the following Design Manuals are applicable:

a. Physical Security Design Manual for VA Life-Safety Protected Facilities, January 2015
b. Physical Security Design Manual for VA Mission Critical Facilities, January 2015
c. Sustainable Design Manual, May 6, 2014, Rev 1 August 18, 2017
d. Steam, Heating Hot Water, and Outside Distribution Systems, Volume 2 WATER BOILERS (Hot Water Generating Systems), September 2016
e. Steam, Heating Hot Water, and Outside Distribution Systems, Volume 3 Outside Steam and Heating Hot Water DISTRIBUTION SYSTEMS, September 2016
f. Steam, Heating Hot Water, and Outside Distribution Systems, Volume 1 STEAM BOILERS (Steam Generating Systems), September 2016
g. HVAC Design Manual, November 1, 2017
h. Plumbing Design Manual, November 2014, Rev May 1, 2018
i. Fire Protection Design Manual, December 2015

2. Federal VA Form 10-0388-14 – Checklist of Major Requirements for State Home Construction and Acquisition Grants
3. Federal Department of Veterans Affairs 38 CFR 59.130 General Requirements for all State home facilities:

   a. Facilities must meet all Federal, State, and local requirements. If the State or local requirements are different from the Federal requirements, compliance with the most stringent provisions is required.
   b. State homes must meet the applicable provisions of NFPA 101, Life Safety Code (2012 Edition) and NFPA 99, Standard for Health Care Facilities (1999) Edition.

4. Federal Centers for Medicare & Medicaid Services, Department of Health and Human Services 42 CFR 483.90 – Physical Environment

   a. The facility must establish procedures to ensure that water is available to essential areas when there is a loss of normal water supply.

5. The U.S. Department of Veterans Affairs would classify the new building as a Community Living Center.

   a. The U.S. Department of Veterans Affairs Physical Security Design Manual for Life-Safety Protected Facilities, January 2015 states “Life-Safety Protected facilities are required to protect the life safety of the VA patients, staff and visitors in case of an emergency. Although indispensable to the mission of the VA, these facilities are not required to remain operational during a natural or manmade extreme event or a national emergency.”
   b. On Page 3 of the Physical Security Design Manual, Community Living Centers as listed as a Life-Safety Protected Facility Type, with Footnote 1 “with Mission Critical Level Utility/System Requirements”.

c. Footnote 1 states "Community Living Centers are designated as Life-Safety Protected with Mission Critical Level Utility and System Redundancy/Capacity. See Chapters 8 and 9 of the Physical Security Design Manual for Mission Critical Facilities. The default mission critical utility/system requirements is 4 days of full operation of the facility during or after an extreme event. It is acceptable to perform a risk assessment to determine if the level of the Mission Critical utility/system requirements can be reduced. VHA is the authority-having-jurisdiction enforcing this assessment. The minimum standby generator capacity shall not be less than the requirements of nursing homes in the state."
d. Other building types listed as Life-Safety Protected Facility types includes: Clinical Services Administration Offices, General Administrative Offices, Laundry, Maintenance Shops, all of which are expected to be within the Community Living Center.

C. Capital Development Board Requirements

1. 2018 International Mechanical Code
2. Illinois Energy Conservation Code, State Facilities

   a. 2018 International Energy Conservation Code
   b. Federal Energy Policy Act
   c. Green Building Act, LEED Silver

3. Illinois Environmental Protection Agency, Title 35, Environmental Protection, Air Pollution (Permit Revision)

D. Other Requirements

1. Federal VHA Directive 1061

GENERAL

A. The approach for the mechanical systems design for the new Nursing Home and Domiciliary and the renovated Nielson Building must be directed at choosing the most cost effective solution that is appropriate for each building type and the needs of the Illinois Department of Veterans' Affairs. Many factors should be considered in determining which heating, ventilating, and air-conditioning (HVAC) system type is the most suitable for this facility. The considerations below apply to the new Nursing Home and Domiciliary and the renovated Nielson Building.

1. Environment: Provide an effective and efficiently controlled atmosphere suitable for the unique environments while also taking into consideration the multitude of diverse spaces within each building. This involves selection of an HVAC system that will provide adequate ventilation, comfort, and a quiet environment.
   The Illinois Administrative Code, Part 340 Illinois Veterans' Home Code, Section 340.2000 Maintenance, requires that areas of a nursing home used by residents shall be air conditioned and heated by means of operable air-conditioning and heating equipment. The areas subject to this air-conditioning and heating requirement include, without limitation, bedrooms or common areas such as sitting rooms, activity rooms, living rooms, community rooms, and dining rooms. Further, the mechanical system shall be capable of maintaining a temperature of at least 75 degrees F., pursuant to disaster preparedness per Section 340.1320. The air-

conditioning system shall be capable of maintaining an ambient temperature of between 75 degrees F. and 80 degrees F. pursuant to disaster preparedness per Section 340.1320. Other than disaster preparedness, interior spaces shall be designed for 75 degrees F. in summer and 75 degrees F. in winter. Relative humidity shall be maintained between 30% (minimum) and 60% (maximum) within the space. Mechanical ventilation shall be provided as required by code and to maintain a slightly positive building pressure. Resident rooms within the Nursing Home and the Domiciliary shall be provided with ventilation supply and exhaust air to ensure that the rooms are exhausted to the outside and that the bathrooms maintain a negative pressure relative to adjacent spaces.

2. Maintenance: Design HVAC systems such that equipment is reasonably accessible and can be maintained.
3. Responsiveness: The building may be utilized in a variety of ways throughout the year, including activities occurring 24 hours/day, 365 days/year. The HVAC systems and their associated control systems should be able to respond in an efficient and effective manner. Control systems should be user-friendly to allow scheduling of HVAC systems to coincide appropriately with building activities.
4. Serviceability: Provide HVAC systems and associated temperature control systems that are familiar to chief engineer and the maintenance staff located at the facility and within the State Veterans' Affairs system. Systems should also be known regionally so that local service companies would be capable to service the equipment.
5. Flexibility: Where appropriate, provide HVAC systems that can be adapted to changing spatial configurations.
6. Energy Conservation: The HVAC systems shall be highly efficient and be able to respond to optimize energy consumption.
7. Appropriately Sized: HVAC systems should be selected to meet the peak heating and cooling loads of the various spaces. These systems also need to have the ability to modulate heating/cooling output to maintain space temperature as the heating/cooling load of the spaces and buildings changes throughout the day and throughout the year.
8. Redundancy: In the event of an equipment failure, being able to maintain heating and cooling within the Nursing Home and Domiciliary will be essential. Equipment will be supplied in a manner as to allow full or partial redundancy of each system.

B. Other Solutions

1. The Bridging Documents architectural and engineering team have viewed and analyzed existing conditions on campus and utilized knowledge gained through life cycle cost analysis when considering HVAC systems for the new buildings and renovation of the existing building. These deliberations, in consultation with the Using Agency and the Capital Development Board, and in view of economically viable energy reduction measures, have led to particular HVAC systems for the new and renovated buildings. We believe the consequent approach represents one viable and economically feasible approach to heating, cooling and ventilating the new and renovated buildings. However, we do not desire to limit the creativity and viability of economic argument that might present other viable options. We have produced schematic design level drawings which depict most, but not all, the equipment and system components germane to our solution; these drawings have been coordinated as best possible with the architectural work and engineering disciplines as appropriate for this limited stage of design. We will forward all design files (drawings, specifications, product selections and cut sheets, and engineering calculations) to the design build team as reference documents. These documents are not to be considered representative of the only solution for

the Design-Build work, nor are they to be considered fully complete or accurate, and representative of what is needed to design and construct the project; it is fully the responsibility of the Design-Build team to provide all engineering design phase services, inclusive of coordination amongst disciplines, and all construction phase services and coordination amongst design disciplines. The Bridging Documents architectural and engineering team will remain available for general consultation but all design responsibility and responsibility for design decisions is the responsibility of the Design-Build team.

C. Preliminary thermal resistance values:

Wall: U = 0.05 (Domiciliary), U=0.033 (Nursing Home)
Roof: U = 0.02
Window: U = .26, Shading Coefficient = 0.46

NURSING HOME & DOMICILIARY

A. Schematic Design level system consists of the following:

1. Four-pipe chilled and heating water system serving space cooling and heating needs in the Patient Rooms, utilizing ceiling mounted fan coil units. Basis of Design for fan-coil units is Trane Horizontal Concealed (Model C), front and back duct collar, with piping package and pressure independent control valve. The Design Build Contractor is advised that federal guidelines indicate a need for supplemental perimeter heating if room heat loss exceeds 180 BTUH per lineal foot of exposed wall in patient bedrooms and if room heat loss exceeds 210 BTUH per lineal foot in all other occupied spaces. Preliminary analysis utilizing envelope thermal resistance values noted above indicates no need for perimeter heating in the patient rooms of the Nursing Home nor the resident rooms of the Domiciliary. The drawings note perimeter heating in other select areas of the building with high glass concentration. The fan coil mounting and access panels associated with the four-pipe system shall be included in the room mock-ups for approval. See architectural for further patient room mockup requirements.
2. Three, 250 ton nominal, 194.3 tons refrigeration capacity, air cooled chillers, helical rotary design. Basis of Design is Trane RTUD 250 HE, high efficiency, low ambient capability, two refrigeration circuits and two condensers per machine, 134a refrigerant. These three chillers will provide chilled water for the fan coil units in the new Nursing Home and the new Domiciliary. Chiller design is N+1 capacity. Conduct ASHRAE 15 and 34 refrigeration analysis. Primary pumps are shown to circulate water through the chillers. Building pumps, operating via variable speed drives, are shown to provide chilled water to the Nursing Home and the Domiciliary. Provide noise attenuation of chillers and mechanical equipment room considering all equipment within the room.
3. Three, 3,500 MBH maximum input and 175 MBH minimum input, Lochinvar Crest High-Efficiency, Condensing Boilers (Basis of Design). These three boilers will provide heating water for the fan coil units in the new Nursing Home, the fan coil units in the new Domiciliary, and the VAV reheat coils in both buildings. Boiler design is N+1 capacity. Primary pumps are shown to circulate water through the boilers. Building pumps, operating via variable speed drives, are shown to provide heating water to the Nursing Home and the Domiciliary.
4. Due to the exhaust requirements of the patient and resident rooms, high levels of fresh air will be required. Energy recovery ventilators are used to recover energy from the exhaust airstream. Four, dedicated outdoor air units serve the Nursing Home and two, dedicated

outdoor air units serve the Domiciliary; sizes are scheduled. Basis of Design is Daikin Model MPS040F, gas heat, hot gas reheat, energy recovery via wheel, 100% variable volume outside air. IDPH has confirmed that it is acceptable to not include ventilation loads on the emergency generator; coordinate work with appropriate member of the Design Build team.

5. In the basement of the Nursing Home, two, four-pipe air handling units are located in mechanical equipment rooms; AHU-D is shown serving the Laundry and Pharmacy and AHU-E is shown serving the Kitchen and adjacent spaces. Each is sized for approximately 27 tons of cooling. Kitchen chilled water coil capacity included takeoff of sensible and latent heat release from preliminary kitchen equipment product data; the Design Build Contractor shall confirm loads. Basis of Design is Trane Performance Climate Changer, Unit Size 25.
6. Two, packaged industrial variable air volume rooftop units serve the common areas of the Nursing Home, identified as RTU CD and RTU EF; the variable air volume boxes have hot water reheat coils. Basis of Design is Trane Packaged Industrial Rooftop, Model SLHJ, with DX cooling, gas heat, hot gas reheat, and energy recovery. Sizes are scheduled on drawings.
7. One, packaged commercial variable air volume rooftop unit to serve the common areas of the Domiciliary, identified as RTU A ; the variable air volume boxes have hot water reheat coils. Basis of Design is Trane Packaged Unitary Gas/Electric Rooftop, Model YHD240, with nominal 20 ton DX cooling, gas heat, hot gas reheat, and energy recovery. Size is scheduled on drawings.
8. Modular packaged exhaust and makeup air units for the main kitchen hoods in the basement of the Nursing Home and floor-by-floor kitchens in the Nursing Home; shown are DX cooled and gas fired makeup air units. Modules shown include downturn plenum, DX cooling module, blower module, heating module and condenser modules. All hoods are furnished by the Kitchen Equipment Subcontractor, installed by the Design Build Contractor. The Kitchen Equipment Consultant informs that preliminary hood requirements are as follows:

    a. Central Production Kitchen in the Nursing Home: two hoods, each is 66” by 366”, each is a Type 1 hood with ceiling supply plenum, total exhaust air flowrate is 14,154 CFM at a pressure drop of 1.6” w.c. each, total makeup air flowrate is 16,418 CFM, with Melink Intelli-Hood control system; refer kitchen equipment product data. Design and construction of the duct system connecting the hood to the modular packaged exhaust and makeup air units and the modular packaged exhaust and makeup air units is the responsibility of the Design Build Contractor. Preliminary sizes of ducts and modular packaged exhaust and makeup air units, duct routing and roof locations are shown on the drawings. Preliminary selection of modular exhaust and makeup air system is: CaptiveAire MPU Series, Model D1500, 13,000 CFM maximum, 10 ton DX maximum cooling, 1,375 MBH maximum gas heating; identified as LEF/LMAU -1 and 2 on the drawings.
    b. Central Production Kitchen in the Nursing Home: bake oven hood, 1,000 CFM exhaust at 1.6” w.c.; refer kitchen equipment product data. Design and construction of the duct system connecting the hood to a roof mounted exhaust fan and the exhaust fan is the responsibility of the Design Build Contractor. Preliminary size of exhaust duct, its routing, and roof mounted exhaust fan are shown on the drawings. Makeup air is shown coming from one of the dedicated outdoor air supply units, with duct extended into the basement.
    c. Central Production Kitchen in the Nursing Home Dishmachine: exhaust connection is a direct connection to the machine, there is no hood. Exhaust requirement is 600 CFM. Design and construction of the duct system connecting the dishmachine to a roof mounted exhaust fan and the exhaust fan is the responsibility of the Design Build

Contractor. Preliminary size of exhaust duct, its routing, and roof mounted exhaust fan are shown on the drawings. Makeup air is shown coming from one of the dedicated outdoor air supply units, with duct extended into the basement.

d. Household Kitchens in the Nursing Home: one hood per kitchen (14 total); each is a Type 1 hood, exhaust air flowrate of each is 613 CFM at a pressure drop of 1.3" each; refer kitchen equipment product data. Design and construction of the duct system connecting the hood to the modular packaged exhaust and makeup air units, and the modular packaged exhaust and makeup air units is the responsibility of the Design Build Contractor. Preliminary sizes of ducts and modular packaged exhaust and makeup air units, duct routing and roof locations are shown on the drawings. Preliminary selection of modular exhaust and makeup air system is: CaptiveAire MPU Series, Model D500, 3,000 CFM maximum, 5 ton DX maximum cooling, 550 MBH maximum gas heating; identified as LEF/LMAU-3 through 16.
e. Pub Hood: one Type 1 hood, 60" by 120", UL 710 listed, 2,625 CFM exhaust at 1.6" w.c., with Melink Intelli-Hood control system; refer kitchen equipment product data. Design and construction of the duct system connecting the hood to a roof mounted exhaust fan and the exhaust fan is the responsibility of the Design Build Contractor. Preliminary size of exhaust duct, its routing, and roof mounted exhaust fan are shown on the drawings. Makeup air is planned to come from positive pressure in the building.
f. Pub Dishmachine: exhaust connection is a direct connection to the machine, there is no hood. Exhaust requirement is 600 CFM. Design and construction of the duct system connecting the dishmachine to a roof mounted exhaust fan and the exhaust fan is the responsibility of the Design Build Contractor. Preliminary size of exhaust duct, its routing, and roof mounted exhaust fan are shown on the drawings. Makeup air is shown coming from one of the dedicated outdoor air supply units or outdoor air from the common area rooftop unit.
g. Domiciliary Dishmachine: exhaust connection is a direct connection to the machine, there is no hood. Exhaust requirement is 600 CFM. Design and construction of the duct system connecting the dishmachine to a roof mounted exhaust fan and the exhaust fan is the responsibility of the Design Build Contractor. Preliminary size of exhaust duct, its routing, and roof mounted exhaust fan are shown on the drawings. Makeup air is shown coming from one of the dedicated outdoor air supply units or outdoor air from the common area rooftop unit.

9. In the Laundry room of the Nursing Home, the Laundry Equipment Subcontractor shall furnish and install a lint filter system; refer product data and installation manual for lint filter. The Design Build Contractor shall install a small duct between each dryer and the lint filter, a large exhaust duct at the discharge of the lint filter, and appropriate discharge fitting. Preliminary product data indicates a booster fan is to be furnished with the lint filter; coordinate discharge route and congruent pressure drop through the duct system with the Laundry Equipment Subcontractor, and verify the size of the booster fan needed for the application. Total exhaust flow rate is 20,000 CFM with all dryers operating. Lint filter will be provided with an air compressor and variable speed drive for the booster fan. A dedicated outdoor air supply unit, identified as DOAS H, located on the roof with duct extended to the Laundry room, is shown to provide makeup air for the filter box. DOAS H shall have DX cooling, natural gas heat, and a variable speed driven fan with control coupled with the lint filter booster fan drive controller. The location of the exhaust discharge from the lint filter shall be located away from air intakes of other equipment to avoid lint being drawn into

equipment. Also, provide exhaust duct and fan for residential laundry equipment in the Nursing Home and Domiciliary.

10. The preliminary cooling load for electrical closets and IT closets totals 34.0 tons. The bridging approach contemplates packaged DX cooling units in each closet with a water cooled condenser and an auxiliary cooling coil piped to a pumped closed-loop glycol-water based cooling loop, connected to a dry cooler on the roof. Each packaged DX cooling unit and entire closed-loop glycol-water based cooling system must be on the emergency generator. Coordinate work with the appropriate member of the Design Build team.
11. The preliminary approach for removing rejected heat from kitchen freezers and coolers is to connect it to the building chilled water system; the preliminary rejected load to the chilled water system is 169,248 BTUH; refer kitchen equipment data. Note that minimum incoming water temperature is 45 degrees F. and maximum incoming water temperature is 85 degrees F.
12. Smoke compartments are identified on the Life Safety Plans; provide appropriate dampers as required. Duct risers may require shaft enclosures; provide appropriate dampers as required.
13. Each thermal zone would receive a VAV box with a hot water coil.
14. Air handling units will provide 55 °F air to the VAV boxes.
15. When heating is required the hot water coil in the VAV box will provide the necessary heat to the space. In some cases, perimeter finned tube elements are shown.
16. Preliminary structural system in the Nursing Home and Domiciliary is two-way flat concrete plate slab systems with shear walls. Openings should be avoided near columns and in column strips where possible (5 foot wide strip between columns).
17. At central kitchen in nursing home ,provide underslab heating at freezer and cooler areas. These should be designed to reduce probability of floor heave due to frost.

NIELSON BUILDING

The extent of renovation found in Nielson is minor; refer architectural drawings. The work for the Design Build Contractor includes disconnection and removal of existing kitchen equipment, construction of ancillary space, inclusive of men's and women's restrooms, and cleaning of existing duct systems and associated air handling units. It is permissible to reuse existing HVAC systems, including steam sourcing from the Power Plant; evaluate existing systems and reconfigure existing systems and controls to accommodate new spaces.

BUILDING AUTOMATION SYSTEM (BAS)

A direct digital control (DDC) system shall be provided to control the HVAC systems in the Nursing Home, Domiciliary, Nielson and to connect the new small boiler in the Power Plant.

SITE TUNNELS AND STEAM PIPING, POWER PLANT, AND MULTI-THERAPY CHILLER PLANT

General Description: Design-Build Contractor shall provide:

A. Analysis of decreasing steam loads due to demolition of buildings currently connected to the steam system.

B. Modifications to Power Plant and site steam distribution system.

C. Reconfiguration of chilled water system emanating from the Multi-Therapy building.

The new Nursing Home and Domiciliary buildings will house residents and staff currently occupying several buildings on campus which are served from the steam production system in the central Power Plant. As residents and staff are moved into the new building(s), the steam load on the Power Plant will decrease. Site evaluation of the existing steam tunnel and steam piping system has demonstrated that a very significant future investment will be required to upgrade the tunnel and piping system; the state of Illinois will not make this investment, therefore there is a need to plan for a decreasing steam load in the Power Plant.

The following analysis was conducted on a preliminary basis to evaluate the need for a small boiler in the Power Plant and the timing of its construction. The Design/Build Contractor shall conduct its own analysis predicated upon its approach to phasing construction and its determination of steam consumption within buildings which remain in service.

There are three coal-fired boilers in the Power Plant; all boilers are identical, rated as follows: Wickes, 50,000 lbs. /hr. capacity, 300 maximum allowing working pressure, operating pressure is 250 psig, built in 1950.

Power Plant steam is consumed by parasitic loads in the Power Plant, by process loads in the kitchen and laundry, by building heating systems, by building cooling systems via an absorption chiller plant located in Multi-Therapy, and by two turbine driven electrical generators located in the Power Plant which provide back-up power in the event of an extended utility power outage. With the demolition of Schapers, the absorption chiller will eventually be phased out of operation and the electrical generators will no longer be needed since a new campus emergency generator is included within the electrical portion of this project. During construction, the Using Agency may decide to operate the steam turbines to produce back-up electrical power but the Using Agency only operates one of these generators because additional electrical emergency generators have previously been installed on campus therefore there is no need to consider operating both turbine generators. Only one coal fired boiler is required to operate the steam generator plus meet maximum steam heating and process demand. Therefore, operation of the steam powered generators will not be impacted by placement of a small boiler.

In order to construct the proposed Nursing Home, demolition of the following buildings is required: Kent Building, Northern Guest House, Ambulance Garage, Security Annex, Elmore Building and Fletcher Building. The steam tunnel directly northwest of Kent is physically connected to the basement of Kent; when Kent is demolished, the steam and condensate piping systems in this tunnel are vulnerable. Building demolition will also impact other areas of the tunnel and steam piping system. Refer Sheet SM101 EXISTING STEAM DISTRIBUTION SYSTEM SCHEMATIC DIAGRAM; tunnels, steam and condensate piping systems located in the tunnels, and direct buried piping systems impacted by construction of the proposed Nursing Home and Domiciliary are shown.

In the tunnel section between Multi-Therapy and Smith Hall, moving alongside Kent, there is a 5”, 90 psig high pressure steam pipe, a 5”, 7 psig low pressure steam pipe and a 4” condensate/vacuum return pipe; pipe sizes are taken from best available information, the Design Build Contractor must confirm. The 90 psig high pressure steam pipe provides redundant steam service to Andrews, Schapers and Reig buildings and also steam service to Nielson. Schapers will ultimately be demolished when its residents move to the new Nursing Home but Andrews and Reig will remain in service and the kitchen function in Nielson must remain operable until the new kitchen in the Nursing Home is commissioned and operable. In order to continue redundant steam service, a new 90 psig high pressure steam and condensate service is

needed; the preliminary solution presented herein is to route a new pipe system through the Central Tunnel, beginning with a new connection to the existing 90 psig steam header in the Power Plant, and terminating with a reconnection to the 90 psig steam service near Smith Hall; refer keyed notes on Sheet SM101 EXISTING STEAM DISTRIBUTION SYSTEM SCHEMATIC DIAGRAM; pictures follow on Sheet SM102. This will keep 90 psig steam service to Nielson intact. The Using Agency would also like to retain redundancy of the 7 psig steam service routed in the north tunnel to serve Fogg and Multi-Therapy. Possible solutions include extending steam service from Nielson to the North Tunnel via direct buried piping; it is permissible to reuse the steam pipe serving the Multi-Therapy absorption chiller plant, pending construction phasing.

A preliminary Phasing Plan is included in the Bridging Documents; major steps in the plan follow:

A. Markword building residents move to Hammond building. (No work for Design-Build Contractor)

B. Elmore building residents move into Markword building. (No work for Design-Build Contractor)

C. Construct new boiler plant in basement of Fifer building. There is an existing steam to heating water heat exchanger located in the basement which must stay in service until the new Fifer boiler plant is constructed. Once constructed, isolate and remove the steam service from the basement, remove the PRV station, and remove the heat exchanger. Disconnect the condensate receiver and turn over to the Using Agency. Coordinate timing of construction with Using Agency. Provide end-of-line drip trap assembly on remaining steam service as required pending timing of demolition of tunnel. Coordinate natural gas service requirements for new boiler with appropriate member of the Design Build team. Steam is only presently consumed in Fifer for building heating; there is no humidification or infection control.

D. Construct new low pressure steam boiler plant in Medical Staff building and connect to existing building steam heating system. Assuming summer construction, once the boiler plant is constructed, isolate and remove the existing steam service from the basement, patch the basement wall, and remove the PRV station. Disconnect the condensate receiver and turn over to the Using Agency. Coordinate timing of construction with Using Agency. Provide end-of-line drip trap assembly on remaining steam service as required pending demolition of direct buried piping. Coordinate natural gas service requirements for new boiler with appropriate member of the Design Build team.

E. Construct new takeoff from existing 90 psig header in Boiler House, extend it through Central Tunnel, and reconnect feed to Nielson and South Tunnel. Provide expansion compensation and drip legs as required.

F. Remove 90 psig and 7 psig steam and condensate pipe in tunnel adjacent to Kent building; other piping in this tunnel to be removed is abandoned domestic water. Remove 90 psig steam line in north tunnel from Kent back to Power Plant and cap in Power Plant. Abatement of hazardous materials will be provided by the Hazardous Materials Design Build Contractor.

G. Remove steam and condensate pipe in tunnel feeding Northern Guest House, Elmore and Fifer; provide caps and drip leg as required. Remove direct buried steam and condensate piping serving Ambulance Garage, Security Annex and Medical Staff Office building. Abatement of hazardous materials will be provided by the Hazardous Materials Design Build Contractor.

H. Remove steam and condensate pipe serving Fletcher; provide cap and drip leg as required. Abatement of hazardous materials will be provided by the Hazardous Materials Design Build Contractor.

I. The Design-Build Contractor will demolish the following buildings: Kent, Fletcher, Northern Guest House, Elmore, Ambulance Garage, and Security Annex. Abatement of hazardous materials will be provided by the Hazardous Materials Design Build Contractor.

J. The Design-Build Contractor will demolish tunnels supporting Kent, Northern Guest House, Elmore, and Fifer buildings, and the portion of the branch tunnel feeding Fletcher. The steam feed to Lippincott must stay intact with the proposed approach. Coordinate piping to remain with the final design and construction of the foundation of the building connection to the new Domiciliary.

K. Construct new Domiciliary building and Nursing Home building.

L. Move residents from Anderson and Somerville to Domiciliary. Move residents from Markword and Schapers to new Nursing Home. (No work for Design-Build Contractor)

M. Commission kitchen in new Nursing Home.

N. Retain steam and condensate pipe serving Nielson; provide cap and drip leg as required. Abatement of hazardous materials will be provided by the Hazardous Materials Design Build Contractor.

O. Commission laundry in new Nursing Home.

P. Decommission laundry function in Ehle Laundry building; Design-Build Contractor shall remove 250 psig steam service at Power Plant and cap. Steam piping passes through Equipment Storage Building; this pipe may be abandoned in place. When replacing direct buried steam service to Ehle, replace with 90 psig direct buried service and connect to 90 psig steam service in south tunnel. Set new PRV in Ehle for building heating systems only; existing building heating systems to be reused. Coordinate timing of construction with Using Agency.

Q. If construction of new pedestrian tunnel to Fifer as proposed is included in the Design Build scope of work, depending upon the sequence of work, it's possible the existing underground chilled water services to Schapers will be disrupted. If this is the case, provide a temporary chiller at Schapers and connect new piping to existing building chilled water piping system; data taken from a previous project indicates the flowrate is 200 GPM and the delta T is 10 degrees. The CDB 040-010-093 absorption chiller project makes no mention of glycol; confirm with the Using Agency. Coordinate the electrical work with the appropriate Design Build team member. Confirm building cooling requirements.

R. Provide a permanent air-cooled chiller for Multi-Therapy building and connect new piping to existing building chilled water piping system; data taken from a previous project indicates the flowrate is 120 GPM and the delta T is 10 degrees. The CDB 040-010-093 absorption chiller project makes no mention of glycol; confirm with the Using Agency. Coordinate the electrical work with the appropriate Design Build team member. Confirm building cooling requirements. In the Power Plant, close isolation valve on 125 psig steam feed to absorbers in basement of Multi-Therapy building; ensure proper drip leg; steam pipe in tunnel may be abandoned in place.

S. For Schapers, isolate and remove the steam service from the basement of Andrews, remove the PRV station, and remove the heat exchanger. Disconnect the condensate receiver and turn over to the Using Agency. Coordinate timing of construction with Using Agency. Provide end-of-line drip trap assembly on remaining steam service in Andrews as required. Abatement of hazardous materials will be provided by the Hazardous Materials Design Build Contractor.

T. In Markword, isolate and remove the steam service from the tunnel. Provide end-of-line drip trap assembly on remaining steam service in tunnel as required. Abatement of hazardous materials will be provided by the Hazardous Materials Design Build Contractor.

U. The Design-Build Contractor will demolish Markword and Schapers after new Nursing Home and Domiciliary are constructed. Abatement of hazardous materials will be provided by the Hazardous Materials Design Build Contractor.

V. Renovate Nielson, anticipating it will stay on the Power Plant steam distribution system.

Refer Drawing S-ASD100 OVERALL CAMPUS DEMOLITION SITE PLAN for demolition plan and those buildings for which there is no work in this contract.

The Design Build Contractor shall structurally close existing tunnel walls where demolition leaves an opening.

When the absorption chiller plant in Multi-Therapy is decommissioned, the Design Build Contractor shall remove the water cooling tower outside of the building and all associated exterior piping, and patch the building wall.

Relative to buildings remaining on the central Power Plant steam system, renovation of some buildings may occur at some point in the future (i.e., not included in this contract). Although the mechanical systems in most buildings which remain are aged, the opportunity to right size existing mechanical systems during renovation and improve the building envelope when the building function is truly known outweighs the benefit of replacing main mechanical equipment in these buildings. Other buildings not being renovated will retain their current function. Consequently, those buildings to be renovated in the future and those buildings whose function will not change, will remain on the Power Plant steam production and distribution system.

A steam flow meter exists at the discharge of each steam boiler in the Power Plant; no other steam meters exist on campus.

There are significant sections of uninsulated and weakened insulation on steam piping in the tunnel system, therefore, there is considerable heat loss in the tunnels, consuming steam energy.

The Design/Build Contractor can assume Somerville and Anderson Buildings will have residents and staff relocated to the new building(s) but will remain intact and can be heated to 50 degrees F. The laundry functions within the Ehle Laundry Building will be relocated to the new Nursing Home; the Design/Build Contractor can assume staff will also relocate to the new building, therefore, the Ehle Laundry Building will remain intact but it also can be heated to 50 degrees F. Although the kitchen functions within Nielson will relocate to the new Nursing Home, Nielson will be repurposed for occupancy and therefore need to be heated to appropriate space temperature.

Power Plant boiler operator reported maximum known steam demand is 26,000 lbs. /hr.; this occurs in the winter. The summer load is small in comparison, relegated to two absorption chillers in the basement of Multi-Therapy, perhaps some reheat, and parasitic loads in the Power Plant. The Power Plant experiences a high makeup water rate, reportedly due in large part to failed condensate pumps in many buildings. The resulting high rate of makeup water taxes the water treatment system. Water treatment limitations limit maximum steam production to 26,000 lb. /hr. however, Power Plant personnel report that there are no known deficiencies in adequately heating the buildings on campus at this steam flow rate. The U.S. Department of Veterans Affairs, Office of Construction and Facilities Management, Steam, Heating Hot Water, and Outside Distribution Systems, Volume 1, Steam Boilers Design Manual, requires N+1 boiler plant design, where N is the number of boilers in operation to meet total heating demand and +1 is the installed standby boiler which shall match the capacity of the largest installed boiler.

Parasitic Power Plant loads, such as a steam turbine driven feedwater pump and a deaerator, are more constant loads, consuming steam whenever a boiler is operating. Make-up water rate is reported at 63%; at 40 degree F. entering water temperature and 180 degree F. condensate return water temperature, mixed water temperature in the deaerator is about 90 degrees F.; at 7 psig, steam consumption is about 5,710 lbs./hr. at full load, considering tank heat loss. At partial load associated with shoulder seasons, estimated steam demand is 7,000 lb./hr., coincident deaerator steam demand is 1,550 lb./hr. There are two turbine driven feedwater pumps; one is base-load and consumes about 1,500 lbs. /hr. according to Power Plant personnel; the steam driven pump is used in winter coinciding with the higher steam demand; an electric pump, operated via frequency drive, is utilized during shoulder and summer seasons. There is a swimming pool in the Multi-Therapy Building, heated with steam; figuring a 10 degree F. temperature rise, we estimate about 2,700 lbs./hr. steam consumption utilizing 7 psig steam on 31,000 gallons of water (20’ width by 40’ length by 5’ deep). The foundation of the pool is located in the basement of the Multi-Therapy Building; we draw the conclusion that heat loss from the pool is fairly consistent and minor relative to an earthen foundation setting. Other steam consumers are intermittent and therefore not included (e.g. soot blowers and ash handling).

In 2015, under CDB Project Number 040-010-105, BRiC authored a short study to analyze the impact of decommissioning the steam to domestic hot water heat exchangers located in the Power Plant in deference to gas fired water heaters located in the buildings. The report states “The institution has advised that the minimum steam load is 4,000 lbs. per hour; they do not know when that occurs.” During the course of preparing the Master Plan, personnel from the Power Plant indicated the minimum steam load is 7,000 lbs. per hour. Further discussion with Power Plant personnel and IDVA-Q Chief Engineer reveal that what is really meant by minimum steam load is a boiler has been able to turn down to 4,800 lb. /hr., remain on line, but at this low fire rate, the flue gas moving past the cyclone centrifugal-type collector contains sufficient particles of un-combusted carbon in the fly ash that opacity limits are exceeded; of equal concern, particulate adheres to the breech duct and stack walls. Consequently, Power Plant personnel report about 7,000 lbs. /hr. steam production is the lowest fire rate that can be maintained, meeting emission limits and not causing other problems. In 2016 BRiC determined that removal of the steam fired central station water heaters was estimated to remove 475 lbs. per hour from the steam demand. Taking into account removal of the water heating load reveals a minimum load of 6,525 lbs. per hour. Certainly, boilers in the Power Plant have been performing satisfactorily since removal of the central station water heaters. Plant personnel will occasionally blow steam to meet low steam demand. For the purposes of the following discussion, the Bridging Team assumed an acceptable minimum boiler operating point of 6,525 lb. per hour.

The Bridging Team further assumes that in the shoulder seasons, Power Plant personnel operate the

electric feedwater pump on a VFD therefore the only parasitic load is the DA tank, now operating at a diminished makeup water rate and feedwater rate requiring a steam demand of 1,550 lbs./hr.
Finally, the Bridging Team assumed the shoulder seasons, late spring and early fall, presented a steam demand of about 20% of the total minimum building related demand of 16,090 lbs./hr.

BUILDING (SF) LOAD	AREA BUILDING	UNIT DEMAND (7PSIG) (BTU/SF)	TOTAL (MBH)	SYSTEM (LB/HR) (@ 957 BTU/LB)
FOGG	4395	10	43.9	46
MULTI-THERAPY	41100	30	1233.0	1288
KENT	58850	10	588.5	615
N. GUESTHOUSE	6949	10	69.5	73
ELMORE	34126	35	1194.4	1248
SMITH	18286	20	365.7	382
NIELSON	40929	45	1841.8	1925
SCHAPERS	35716	40	1428.6	1493
STONE	17115	15	256.7	268
CHAPEL	5357	15	80.4	84
LIPPINCOTT	19324	20	386.5	404
FIFER	43077	35	1507.7	1575
ANDERSON	38680	35	1353.8	1415
SOMERVILLE	38680	35	1353.8	1415
MARKWORD	27504	35	962.6	1005
FLETCHER	32922	10	329.7	344
ANDREW	20188	30	605.6	633
REIG	20188	30	605.6	633
EQUIPMENT STORAGE	24229	5	121.2	127
ROLAND	5625	10	56.3	59
LIBRARY	5910	25	147.8	154
SUPERINT. HOUSE	9203	10	92.0	96
CARPENTER'S SHOP	7104	10	71.0	74
MEDICAL STAFF	3464	30	103.9	109
EHLE LAUNDRY	9120	145	1322.4	1382
TRADESMAN	3805	15	57.1	60
ENGINEERING	2625	30	78.8	83
AMB. GAR. & S.A.	924	10	9.2	10
				17000
				WITHIN 5%

DERIVATION OF BUILDING STEAM CONSUMPTION

An individual building unit load value (BTU/SF) encompasses consideration for the expected composition of its envelope R-value, inclusion of process loads, expected degree of ventilation required,

humidification, expected utilization, and inclusion of process loads, such as the laundry equipment in Ehle and kitchen equipment in Nielson.

Subtracting Power Plant parasitic loads from the total steam demand of 26,000 lbs. /hr., renders a net of 16,090 lbs. /hr. (26,000 lbs. /hr. less a full DA tank load of 5,710 lbs. /hr., less turbine feedwater pump of 1,500 lbs. /hr., less the therapy pool load of 2,700 lbs. /hr.). Spreading 16,090 lbs. /hr. over the buildings consuming steam renders some low to very low unit values. The Bridging Team did not feel comfortable further diminishing the net of 16,090 lbs. /hr. to further account for tunnel loss so we added 2,000 lbs. /hr. to the net load, rationalizing the approach not fully but to some degree, by acknowledging the tolerance of the steam meter and possible effects of calibration.

The Bridging Team assumed the steam load attributable to kitchen process loads in Nielson to be 40% of the total Nielson steam demand, equivalent to 770 lbs. /hr., and the steam load attributable to laundry process loads in Ehle Building to be 65% of the total Ehle steam demand, equivalent to 900 lbs. /hr., for a total process load of 1,670.0 lbs. /hr.

BEFORE CONSTRUCTION IS FINISHED

	Steam in Pounds per Hour
Total Building Related Steam Load	16,090
Before demolition, disconnect Fifer from steam system & install boiler	(1575)
Before demolition, disconnect Medical Office from steam system & install boiler	(109)
Less Roland (demolished)	(59)
Less Demolition (Kent, N. Guest House, AG & SA, Elmore, Fletcher) 615 73 10 1248 344	(2290)
Subtotal	12057
@ 20% Shoulder Season	2412
Add back	
Kitchen & Laundry Process Loads	1670
Tunnel Loss	2000
Boiler House Parasitic Loads	1550
Total	7632 lbs. /hr.
	7632>6525 (OK)

AFTER CONSTRUCTION IS FINISHED

	Steam in Pounds per Hour
Total Building Related Steam Load	16,090
Less Roland	(59)
Less demolition	(2290)
Less Fifer conversion to boiler	(1575)
Less Medical Office conversion to boiler	(109)
Less decommission of	
Somerville	(710)
Anderson	(710)
Less cooking process load	(770)
Less demolition of	
Markword	(1005)
Schapers	(1493)
Subtotal	7369
@ 20% Shoulder Season	1474 (less than 6525)

Conclusion: a small boiler needs to be constructed in the same timeframe as construction of the new building occurs; preferably during the summer when loads are least. Since the Power Plant achieves N+1 redundancy with two boilers, it's possible to begin demolition during the first summer of new building construction. A short period of downtime will be needed to seal the breech opening and install double block steam valves. The preliminary size of the summer boiler is 10,000 lbs. /hr. steam production, at 120 psig operating pressure, with a minimum 10:1 turndown, natural gas fired, water tube type. Coordinate gas service requirements with appropriate member of the Design Build team.

On a preliminary basis, with reference to the International Existing Building Code, work in the Power Plant is classified as a Level 1 Alteration; the Design Build Contractor shall verify the appropriate code analysis and execute accordingly.

Provide analysis of need for additional steam traps in the tunnel system since larger steam pipes will be flowing less steam volume per hour.

Provide analysis of PRV stations in Power Plant and execute accordingly.

If pressure reduction from operating pressure of 250 psig is contemplated, consult appropriate ASME Boiler and Pressure Vessel Code. A "best practices technical brief" is available from the U.S. Department of Energy, Energy Efficiency and Renewable Energy, "Steam Pressure Reduction: Opportunities and Issues".

Relative to the new boilers required in Fifer and the Medical Office Building, there is no design data or drawings available for the Medical Office Building. Fifer was constructed in 2000 under CDB Project No. 040-010-081. A steam to heating water heat exchanger was installed in 2000; mechanical design data available from the Heating Drawing Set reveal the following:

Heat Exchanger HX-1: Bell & Gossett SUIO 4-2: 215 GM, 140 degree F. EWT, 160 degree F. LWT, steam flow of 2,101.2 lbs. /hr. of 2.0 psig steam, 1,942,000 BTUH. All terminal heating devices (i.e., finned tube, unit heaters, and fan coils units) were selected based on 40% ethylene glycol solution. Two heating water pumps are indicated, one is standby.

Additional information is available from CDB Project No. 040-010-081 construction documents.

Additionally, provide the following work:

A. Replace direct buried steam and condensate service lines to the following buildings: Tradesman Building, All Faiths Chapel, Library, Chief Engineer, Carpenter's Shop, and the Superintendent's House. Map these buildings into new campus geospatial position system.
B. The Using Agency has determined that they prefer the new small boiler in the Power Plant to be located in the space currently occupied by coal fired Boiler No. 3 (this boiler is the farthest to the right if standing in front of the boilers, facing the boilers). Boiler No. 3 has a relatively new Laclede chain grate stoker; Boiler No. 1 has an old stoker; work shall include removing the chain grate for No. 1 Boiler and No. 3 Boiler and installing the chain grate for No. 3 Boiler in No. 1 Boiler.
C. Replace condensate pumps in Nielson when renovating the mechanical systems. Replace condensate pump in the Administration Building. Replace transfer condensate pump in the Deer Park Pump House.

MULTI-THERAPY ABSORPTION CHILLER PLANT

Two York absorption chillers were installed in the basement of the Multi-Therapy Building; construction was completed in 2012, under CDB Project Number 040-010-093. At the time of this work, these chillers replaced 35-year old absorption chillers, one each located in the basement of Elmore, Schapers and Kent (3 total); absorbers and related cooling towers were decommissioned and removed from the premises. An underground primary piping system was installed to flow water from Multi-Therapy to Elmore, Schapers and Kent. Using the 10 degree F. spread between the temperature of water entering the absorber and leaving the absorber as denoted in the 2012 design documents and the chilled water flow rates for pumps located in each of Elmore (240 GPM), Schapers (200 GPM) and Kent (585 GPM) buildings, we calculate a cooling load of 100 tons for Elmore, 85 tons for Schapers, and 245 tons for Kent. The sum of calculated cooling loads for Multi-Therapy, obtained from design drawings, is 50 tons, 38 tons when the pool is covered. The sum of all cooling loads connected to the absorber is 480 tons, therefore the two 600 ton machines make sense. Data extracted online from York Installation, Operations and Maintenance manual for the installed absorber indicate minimum load position is 20% per machine. The campus steamfitter reports that he has not seen the steam valve on one of the absorbers open beyond 54% on the hottest day of the year. Refer Sheet SM103 for approximate location of existing underground chilled water piping system.

Based on the proposed project approach (refer Item 17 in listing above), the absorption chilled water plant is plant is viable until Schapers is decommissioned at which time, a chilled water arrangement will need to be made to accommodate Multi-Therapy, as hereinbefore mentioned.

With the proposed Nursing Home, the building footprint will not impede upon the existing underground 8" and 6" pipe loop from Multi-Therapy to Schapers; required work will include disconnecting Kent and Elmore from the system prior to demolition. The Design-Build Contractor shall verify that its footprint

will not require relocation of the existing underground chilled water line to Schapers; under the present phasing plan, Schapers is demolished after its residents are moved into the new Nursing Home.

Refer Sheet SM103 for plan view of underground chilled water piping emanating from the absorption plant in the Multi-Therapy Building and terminating at Schapers, branching to buildings in between these two buildings. Additional reference information is available from construction documents pertaining to CDB Project Number 040-010-093.