COMMONWEALTH of VIRGINIA
Office of the Governor

John Littel
Secretary of Health and Human Resources

January 13, 2023

The Honorable Janet D. Howell
Co-Chair, Senate Finance and Appropriations Committee

The Honorable George L. Barker
Co-Chair, Senate Finance and Appropriations Committee

The Honorable Barry D. Knight
Chair, House Appropriations Committee

Dear Senators Howell and Barker, and Delegate Knight:

On December 15, 2022, we submitted a partial Catawba Hospital Transformation Plan for your consideration and feedback. We are pleased to submit the final Catawba Hospital Transformation Plan, pursuant to Item 283 F. 2-3 of the 2022 Appropriations Act Amendments:

> F.2. Out of this appropriation, $750,000 from the general fund the first year shall be provided for the Secretary of Health and Human Resources to contract for a feasibility analysis to transform the Catawba Hospital Campus into a state-of-the-art campus at which a continuum of substance abuse treatment and recovery services, including long-term, short-term, acute, and outpatient services, is provided in addition to the array of behavioral health services currently provided to individuals in need of behavioral health care services. This analysis shall be completed for consideration of the workgroup in its recommendations on the structure and delivery of behavioral health and developmental disability services.
>
> 3. The workgroup shall report its findings and recommendations to the Governor and the Chairs of the House Appropriations and Senate Finance and Appropriations Committees by December 1, 2022."

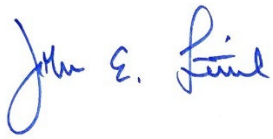
The Catawba Hospital Transformation Plan recommends the transformation of the Catawba Hospital Campus into a state-of-the-art substance abuse treatment and recovery services center capable of providing long-term, short-term, acute, and outpatient facilities to individuals in need of substance abuse disorder services.

This report provides the Catawba Hospital Transformation Plan including data analysis incorporating workforce, operational, administrative, capital requirements and considerations to

deliver substance abuse treatment and recovery services presented in various scenarios not provided in the preliminary report.

I look forward to discussing these with you and am available to answer any questions from you or your staff.

Warm regards,



John Littel
Secretary of Health and Human Resources

cc: Mike Tweedy, Senate Finance and Appropriations Committee
Susan Massart, House Appropriations Committee
Amy Cochran, House Appropriations Committee

Prepared for:
Secretary of Health and Human Resources in cooperation with the Department of Behavioral Health and Developmental Services

Feasibility Analysis

Catawba Hospital Campus Transformation

Roanoke, Virginia

January 11, 2023

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Executive Summary

More than 100,000 people in the United States died from drug overdoses in 2021; 2,656 of those were Virginians. The Roanoke Valley is one of the hardest hit regions of Virginia that is suffering from substance use disorder (SUD), the Commonwealth of Virginia is determined to fight this epidemic.

Item 283 of the 2022 Appropriations Act directed the Secretary of Health and Human Resources to "contract for a feasibility analysis to transform the Catawba Hospital Campus into a state-of-the-art campus at which a continuum of substance abuse treatment and recovery services, including long-term, short-term, acute and outpatient services, is provided in addition to the array of behavioral health services currently provided to the individuals in need of behavioral health care services."

The Secretary of Health and Human Resources, in coordination with the Department of Behavioral Health and Developmental Services (DBHDS) contracted with JLL to perform that feasibility analysis. To begin, JLL held a visioning session on November 17, 2022, with DBHDS, Catawba Hospital leadership, and stakeholders in the region. During the session, participants discussed perceived regional needs and guiding principles for further inquiry.

Inpatient Demand Estimates within the Catawba market obtained from IBM/Watson and DBHDS provided historical data were used to determine the need and the best location to provide continuum of substance use disorder treatment services given population size, location of facility vice population, and availability of workforce. Inpatient Demand DRG Estimates provides the total volume of annual acute care admissions and patient days. The current primary and secondary Catawba Hospital market areas were used as a baseline for inpatient bed projections for both behavioral health and substance use disorder diagnosis.

The transformed Catawba Hospital campus would support patients with dual diagnoses, a person who experiences both a mental health issue such as depression, and a substance use disorder concurrently, who significantly struggle with obtaining treatment in the private sector. Today we know that individuals who are dual diagnosed with disorders who have successful and long-lasting recovery must be treated for both conditions at the same time for recovery. The DBHDS data analysis showed that between 35% and 55% of all patients at the three hospitals (Western State Hospital, Catawba Hospital and Southwestern Mental Health Institute) had SUD and a mental health illness, and only 10% of the patients were diagnosed with SUD with no underlying mental illness. After fully analyzing the IBM/Watson data and the DBHDS historical data, it was determined that there is a need for approximately 100 – 150 Acute Behavioral Health Beds, 80-120 residential SUD treatment beds and 16 Detox Beds in the surrounding Catawba Hospital area through 2030.

JLL considered whether Catawba Hospital was the right hospital location for this transformational model program with both Western State Hospital and Southwestern Mental Health Institute (SWVMHI) located in the valley; however, the expansive Catawba Hospital campus provides considerable space to grow. To assess the existing facility's capability to

support much needed SUD services, a multi-disciplinary group of architects and engineers assessed the condition of each building on the Catawba Hospital campus to ascertain the condition and suitability for reuse and repurposing to support this program. Concurrently with the building assessments, the architects identified the types and sizes of spaces necessary to provide the continuum of care services per best practices.

The functional and space programs were developed along three models – a mini-continuum of care, a base continuum of care, and an enhanced continuum of care. In all three models, the full range of services planned with each model providing for a different number of patients to be treated effectively through the full continuum of care. More details on each model are provided below:

Option A – Mini-Continuum of Care Model
This model is considered the minimum effort necessary to effectively deal with the increasing SUD cases in the area. To accomplish this, building 15 would have 1 ½ floors dedicated to residential treatment of SUD patients – providing 48 beds. One-half of a floor would become the detox unit for the facility which would provide 16 beds. The result would be to provide 64 beds dedicated to SUD patients.

Sixty-four behavioral health patient beds would be provided in a new building that will meet best practices and conform it into a state-of-the-art building that is desired by the Commonwealth. The existing treatment mall would be renovated and updated to current treatment standards. Forty-six beds of acute behavioral would remain in building 15.

A new 52,000 square foot three-story outpatient facility would be built adjacent to building 15 to provide outpatient services, additional administrative, clinical, educational and research space unique to SUD treatment.

Option B – Base Continuum of Care Model
To accomplish this model, building 15 would have 2½ floors dedicated to residential treatment of SUD patients – providing 80 beds. One-half of a floor would become the detox unit for the facility which would provide 16 beds. The result would be to provide 96 beds dedicated to SUD patients.

The 96 behavioral health patient beds would be provided in a new building that will meet best practices and conform it into a state-of-the-art building that is desired by the Commonwealth. The existing treatment mall would be renovated and updated to current treatment standards. Fourteen beds of acute behavioral remain in building 15 and Floor 1, Floor 2 and Floor 4 of building 15 could be utilized for future expansion of 80 residential treatment beds.

A new 52,000 square foot, three-story outpatient facility would be built adjacent to building 15 to provide outpatient services, additional administrative, clinical, educational and research space unique to SUD treatment.

This option will require significant upgrades to the wastewater treatment system as well as some upgrades to the water system.

Option C – Enhanced Continuum of Care Model
For this model, building 15 would have 4 floors dedicated to residential treatment of SUD patients – providing 128 beds. The 16-bed detox unit would be moved out of building 15 to the new behavioral health building.

The 128 behavioral health patient beds would be provided in a new behavioral health building that will meet best practices and conform it into a state-of-the-art building that is desired by the Commonwealth. The existing treatment mall would be renovated and updated to current treatment standards. The 16-bed detox unit formerly located in building 15 per Options A and B will now be in the new behavioral health building. No beds of acute behavioral beds remain in building 15 and Floor 1 and Floor 2 could be used for future expansion and provide 48 residential treatment beds.

A new 70,000 square foot four-story outpatient facility would be built adjacent to building 15 to provide outpatient services, additional administrative, clinical, educational and research space unique to SUD treatment. One story would be shell space for future growth.

This option will require significant upgrades to the water and wastewater treatment system.

Continuum of Care Summary

Continuum of Care Model	Residential Treatment Beds	Behavioral Health Beds	Outpatient Research Building (SF)	Project Cost (in Millions)**	Project Completion (after NTP)
Option A - Mini	80	64	52,000	$147	60
Option B Base	96	96	52,000	$192	68
Option C Enhanced	144	128	70,000*	$240	70

* Approximately 17,000 SF of shell space is included for future expansion
** Includes 25% Soft cost, 10% Design Contingency and Approximately 16.5% Escalation to Midpoint of Construction

The team considered the option of a full replacement facility for the noted services, but this option would have resulted in project costs nearly twice as high for the same level of services.

Workforce Development

The options identified above are primarily brick and mortar issues. To be successful, workforce development must also be addressed.

Staffing and Staff Development

Currently Catawba Hospital has sufficient staff to perform its mission. However, in all three option models, additional staff with potentially different expertise will be needed. The effects of the pandemic on the healthcare workforce and rising wages have resulted in a tight labor market across the country. Virginia is no different and is not immune to these effects. To recruit and retain the workforce at the transformed Catawba Hospital, the Commonwealth should considerer partnerships with education institutions that provide training and research opportunities for both the current and future staff. Further, the commonwealth and its partners should consider innovative programs and initiatives to increase the attractiveness of the Catawba Hospital campus for professionals to start and further careers in mental health and substance use disorder.

Transportation

The current lack of reliable public transportation is a significant barrier to transforming the Catawba Hospital campus into a best-in-class expanded facility. As part of this study, Valley Metro, the public transportation agency in the region, was contacted and discussed the possibility of extending bus service from Roanoke to Catawba Hospital. While such an extension would solve many of the hospital's current transportation issues, a decision to extend the service would require an agreement from the Valley Metro Board of Directors, Roanoke County, and other Valley Metro stakeholders. The extension may also require subsidization by the Commonwealth.

Public-Private Partnership

A public-private partnership (PPP) arrangement can facilitate the shared responsibility of providing access to the continuum of care in the region. Under a PPP, a partnered company could be responsible for managing the day-to-day operations of the new residential treatment program and outpatient facility. This would include the responsibilities of hiring and supervising staff, managing budgets, and providing clinical services to patients.

The Department of Behavioral Health and Developmental Services and Catawba Hospital may provide funding for the facility and set performance standards and quality benchmarks for the private company to meet. The partner company may be required to meet certain financial and performance targets set by DBHDS and Catawba Hospital such as reducing costs or improving the quality of care.

Private sector partners have expertise in managing and operating SUD facilities more efficiently, leading to cost savings, improved quality of care and utilization of new technologies, approaches, and practices that may not be possible without their participation.

Catawba Hospital already collaborates with a number of regional providers and educators, including the Virginia Tech School of Medicine, Radford University, the local Hospital Corporation of America (HCA), and Carilion Clinic.

Further use of PPPs should be explored for the Catawba Hospital transformation. The benefits of one or more partnerships with the private sector and academia can be the catalyst needed to

complete this continuum of care model at Catawba Hospital and replicate it to other regions of Virginia.

These models can be beneficial for the transformation of Catawba Hospital and some of these models may require legislative approval before they can be enacted or explored such as the model used for the Virginia Center for Behavioral Rehabilitation (§ 37.2-909(A)) which focused on patients with dual diagnoses of behavioral health and substance use disorders. By exploring different PPP models and partnerships, Catawba Hospital will identify the most effective ways to address the behavioral health continuum in their region and ensure that patients receive the care and support they need, by utilizing PPP models and partnerships.

Option 3, Rendering View Looking North

Introduction

In 1908, the Commonwealth of Virginia purchased the property that is the location of Catawba Hospital and appropriated $40,000 to establish the first tuberculosis sanatorium which was operated until the late 1960s when it began its transformation into a behavioral health facility. The last tuberculosis patient was admitted in 1972.

The Department of Behavioral Health and Developmental Services operates nine mental health facilities in the Commonwealth, three of which are major mental health hospitals and serve the Appalachian area of Virginia: Catawba Hospital, Western State Hospital, and Southwestern Virginia Mental Health Institute. Western State Hospital, the newest of the three was completed in 2013.

The rise in substance use disorder nationally and particularly in the Appalachian area of Virginia over the last 20 years has resulted in an increased need to treat individuals for substance use disorder and the mental health issues which often accompany the disease. Located at the epicenter of this growing crisis in the Commonwealth, Catawba Hospital is poised to become a state-of-the-art facility for substance use disorder treatment and recovery of individuals with this disease.

This study determines the feasibility of transforming Catawba Hospital into a facility at which a continuum of substance use disorder treatment and recovery services, including long-term, short-term, acute, and outpatient services, are provided. This is in addition to the array of behavioral health services currently provided at Catawba to adult and geriatric individuals in need of mental health care. The study provides a model that may be appropriate for the transformation of Commonwealth hospitals into facilities at which a continuum of care is provided in additional regions.

The creation of a substance use disorder treatment campus at Catawba Hospital has an underlying goal of reducing the Commonwealth's psychiatric hospital bed census by diverting or stepping down clients whose needs are better served by substance use disorder treatment.

In this study a new model of care, the "continuum of care" model, would be provided to substance use disorder patients. A continuum of care is a system that provides a comprehensive range of health services, so that care can evolve with the patient over time. With the understanding that a patient's health may be most vulnerable during gaps in care; the continuum of care exists to ensure those gaps are filled. The concept of continuum of care is not a universal feature of all health systems.

Three critical things are being created for bridging the gaps.

- On site behavioral health research and educational partners,
- New residential treatment transitional housing beds that do not exist in the state system today, and
- Outpatient services provided on the same campus where patients receive care.

One of these gaps is behavioral and SUD outpatient care some of the services that will be provided in the new building are: one on one counselling, group counseling, outpatient pharmacy and other typical clinical care. Access for patients to Medical assistive withdrawn and long-term counseling access is critical to the long-term success of the continuum of care. Medications can help people quit opioids, but fewer than 15% of patients who could benefit from those medications actually receive them.

Researchers based at Rhode Island Hospital tested one possible remedy - offering addiction treatment in local pharmacies. In an article by NPR News', Martha Bebinger "Offering addiction treatments in pharmacies could help combat the opioid crisis" January 11, 2023. The focus was on an innovative study by Genoa Health Care, a national pharmacy network. They studied patients' state of withdrawal related to their drug history and access to prescription on demand medication. During the initial visit, the pharmacist would call a physician or nurse who could write a prescription. Patients enrolled at these on demand pharmacies were 72% more likely to continue treatment for at least a month longer than patients who received treatment from more traditional treatment centers. The study's lead author, Traci Green, says the study shows pharmacies with on demand access to these medications are an effective way to expand addiction treatment.

Virginia code does not distinguish between clients who are in crisis due to their substance use from other mental health conditions. Even for clients whose crisis is clearly known to be substance-related, there are few alternatives to psychiatric hospitalization. The coronavirus pandemic continues to affect the Commonwealth's hospital systems and options for diversion. Understanding the needs of consumers with substance use issues can help guide what services will improve their care and reduce the burden on the Commonwealth's hospital systems.

Option 3, Rendering View Looking South

Acknowledgement

The management, programming, and planning team of JLL and HDR Architecture is grateful for the participation, inspiration, confidence, and enduring resolution of all that were key to this study, without their participation this effort could not have occurred we thank all those that have provided their valuable input.

Visioning and Guiding Principles

Visioning Session

An all-day visioning meeting was conducted to determine the vision and principles for this project. The Department of Behavioral Health and Developmental Services, healthcare providers, and community stakeholders (both public and private) met to review and further define the project principles that would define success for the project. Both near-term and long-term visions were determined as well as the development of metrics to determine the success of the program. The full details of the visioning session are provided in Appendix A. Appendix A-1 provides the full-size readable charts used in the visioning session.

Guiding Principles

Near Term Goals (Next 5 Years):
The groups articulated similar needs, issues, specific measurements of success, and gaps across the behavioral health service continuum. In all cases, participants articulated the need for a safe treatment environment that is flexible to therapeutic needs and has the ability to improve treatment using new biotechnology. The system of care and the service outlets within it recognized the need to recruit staff and retain them for long-term success. When all these elements are in place, participants noted metrics that would reflect their progress as:

- decreased length of stay,
- reduced readmissions,
- lower missed appointment rates,
- improved discharge planning,
- a safe treatment environment that flexes with the therapeutic needs,
- use of biotechnology to improve treatment, and
- recruitment and retention of staff.

Long Term Goals (Next 10 Years)
For many participants, near term goals resembled long-term goals. Defining the needed infrastructure and filling in service gaps is anticipated to be an ongoing process. The role of technology and data captured from it was a reoccurring theme in the framing of success over the long-term horizon. Participants noted the value of virtual-based care and apps designed to support treatment plans. Data capture and analysis has long been cited as impactful to the quality of care and participants seemed to recognize that as well.

Research and innovative biotechnologies will push forward substance use disorder treatment and Catawba Hospital should be leading the effort. Resources needed to improve outcomes may be supported both by data and by service infrastructure. Participants noted the need for advanced treatment standards, recovery housing, vocational rehab, and advances in the way methamphetamine and opioid disorders are treated. Some felt there was an opportunity for the partnership to serve as a national model for care. A few felt the 700-acre campus as a single

location for all continuum of care services was the path to achieve that goal. As within the five-year success conversation, the value of family and peer-supported care was central to patient treatment and prevention success. Long-term goals would include building upon the five-year goals and include:

- integrating treatment with a chronic disease model of care that supports and guides the patient from clinical management to more self-management of their disease.
- elements of support include advanced treatment standards incorporating technology,
- vocational training, and
- intermediate housing.

BARRIERS TO SUCCESS

Identifying what could limit the success of the imagined community partnership revealed a broad spectrum of uncertainty. Starting from the inside out, the Catawba campus itself generated concerns about how it could migrate away from historical misuse and misconceptions including the perception as a place where law enforcement could drop-off individuals without penalty. The Catawba facility's ability to function beyond its regulatory-mandated use was articulated as a federal, state, and local challenge.

Some participants noted changing regulatory and legal statutes could complicate how the hospital in the partnership could function and how they define themselves as a unified body. Still, the way the collaborative defines its mission could support advocacy and lobbying efforts potentially offsetting or softening regulatory and mandated use guidelines. Even addressing things like disclosure of admission justification and community support of service development via an advocacy platform could counter some of the potential challenges articulated by participants.

Outpatient and community-based services were heavily noted in both the measurements of success and barrier conversations. These services were emphasized as a need, but how to develop them emerged as a concern. Finding an operator to establish services like recovery venues, transportation services and other needed resources might require a strong business case for new market entrants or with the expansion of services should they exist. Staffing for these services and others across the care continuum is a threat not just for this group but across the nation. Technology is viewed as a release valve to staffing pressures but whether patients and caregivers have broadband access to tap into technology-based solutions presents its own challenge. Cross-training of staff was suggested as a means for bridging labor gaps and for those areas where technology cannot help. Ultimately, developing a financially viable community-wide system of services free of stigma was the hope of many.

Data Gathering and Analysis

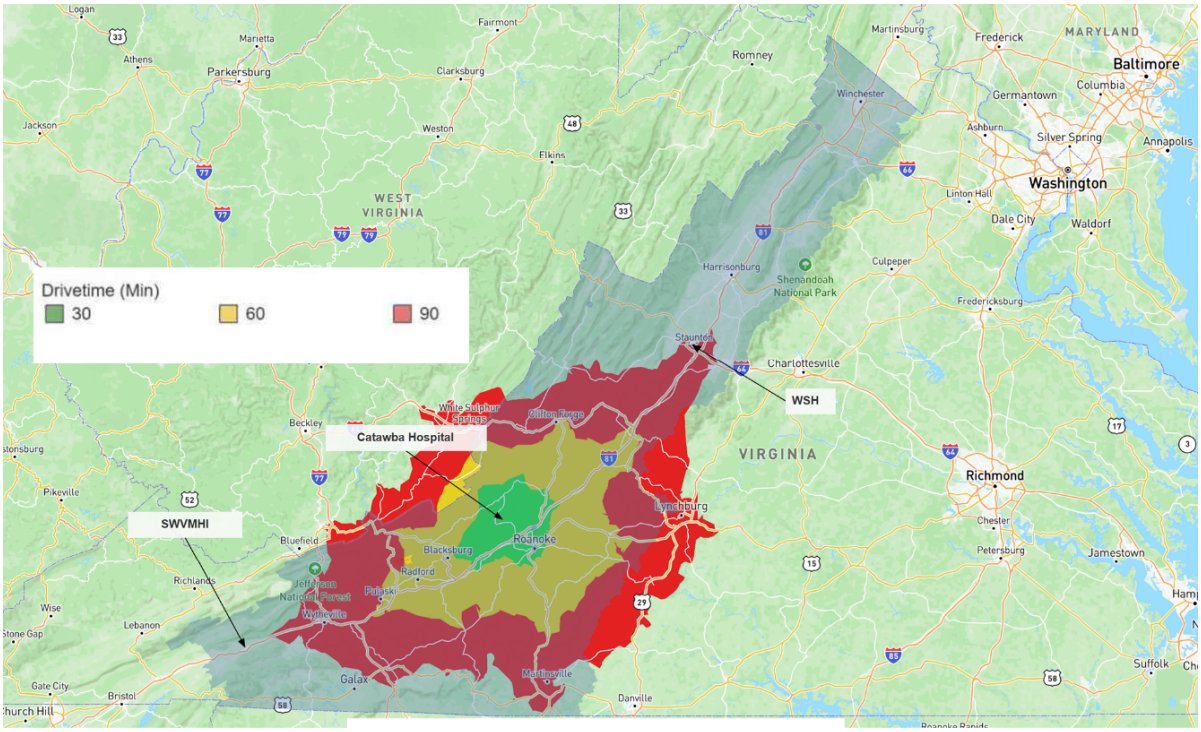
The IBM Market Expert® Inpatient Demand Estimates module, and appropriate data supplied by DBHDS for current and future demand estimates as it relates to behavioral health and substance use disorders were used for this study. The data was used to determine the prior, current, and future patient diagnosis code and the regional and state population projections. The full data and resulting outputs are included in Appendix B.

According to the US Surgeon General US Department of Health and Human Services, Addiction and Substance Misuse Reports and Publications, April 8, 2022, alcohol and drug misuse and related disorders are major public health challenges that are taking an enormous toll on our society.

- The annual economic impact of substance misuse in the US is estimated to be $249 billion for alcohol misuse and $193 billion for illicit drug use; this equates to $8 billion of impact for the Commonwealth of Virginia.
- Nationally, over 23.5 million people suffer from a substance use disorder right now; 500,000 of whom reside in the Commonwealth of Virginia right

Alcohol and other drugs cost society roughly $442 billion every year in health care, lost productivity and criminal justice involvement. By comparison, diabetes impact is approximately half that amount.

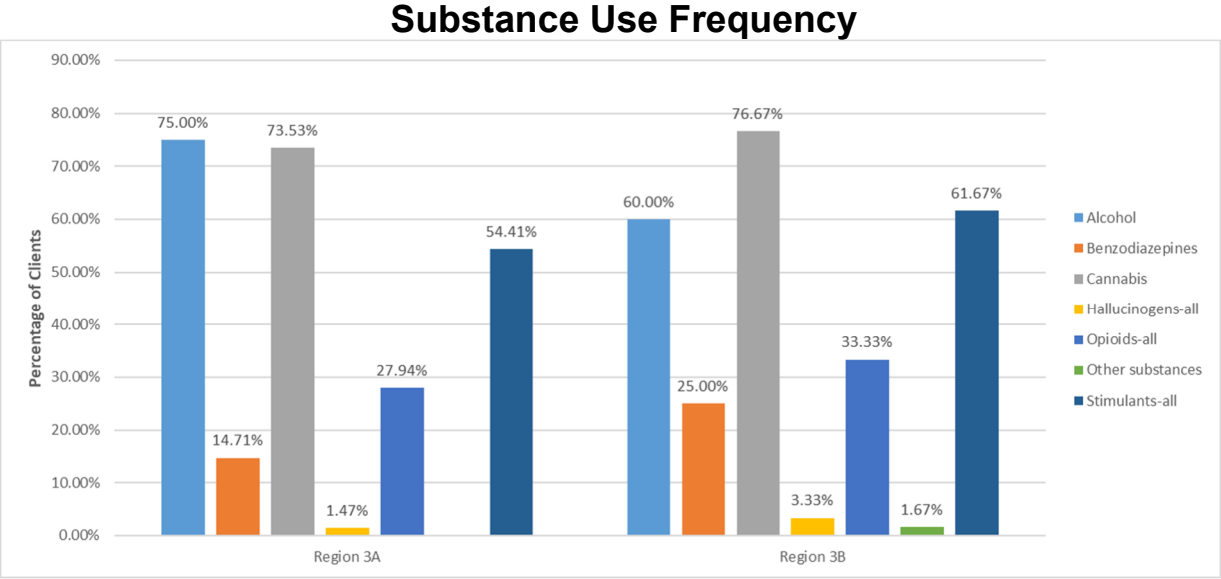
The Appalachian region of Virginia, shown in the market services areas studied for this report, is expected to see a 37% increase for cases of substance use disorders, while during that same period the general population of the Commonwealth will only grow by 3%.



Service Area Drive Time

Opioids are of grave concern due to the record-breaking number of fatal overdoses in 2020. Fatalities were up 47.5% from 2019 according to Virginia Department of Health's statistics.

The three most common substances used by people receiving care at Catawba Hospital, Western State Hospital and Southwestern Virginia Mental Health Institute are cannabis, stimulants, and alcohol. These are the most treatable of the substance use disorders. Over 50% of their average daily patient census is for patients that have a substance use disorder. Therefore, approximately 400 beds are dedicated to substance use disorder treatment in the same facility as patients receiving treatment solely for mental illnesses.



It should be noted that every dollar spent on increasing access to care for substance use disorders results in a savings of $11 *($4 in health care costs and $7 in criminal justice costs).*

Team members used the IBM Watson system, which uses many proprietary and public claims streams, to forecast Inpatient Demand Estimates within the Catawba market. This information is used in the inpatient setting to anticipate future scenarios.

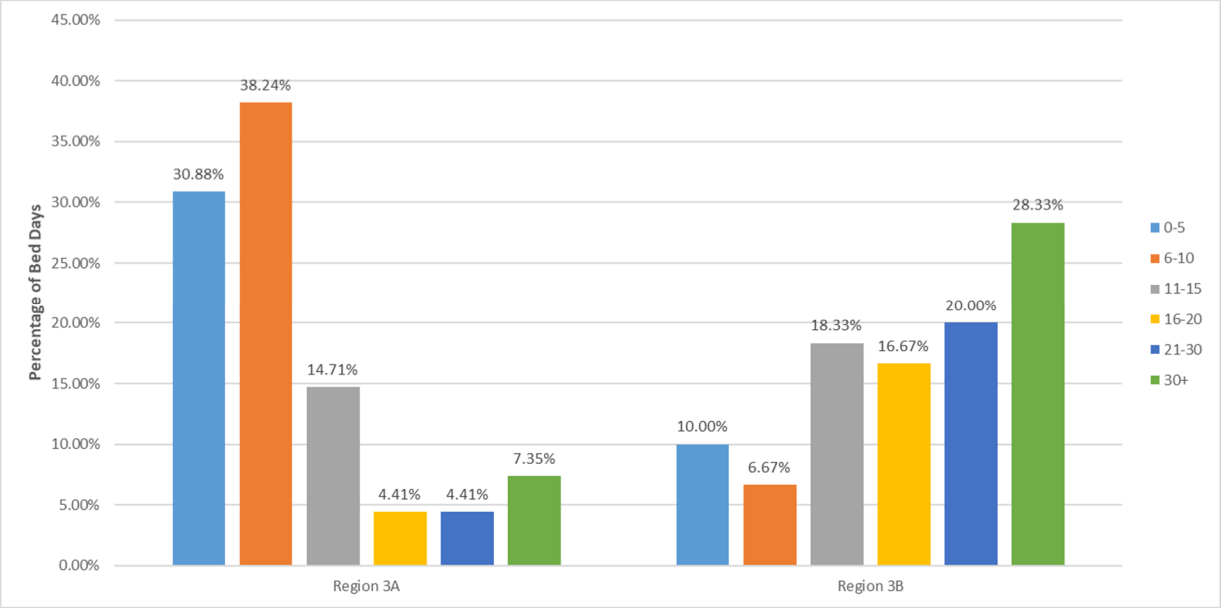
The Inpatient Demand Estimates module consists of two datasets–Diagnosis Related Group (DRG) estimates and International Classification of Diseases (ICD) estimates. Inpatient Demand DRG Estimates provides the total volume of annual acute care admissions and patient days by ZIP Code, age group, sex, payor, and DRG for every market in the United States. As with the DRG Estimates, IBM used all-payor state discharge data for 21 states and Medicare (MEDPAR) data. These rates were applied to demographic projections by ZIP Code to estimate inpatient utilization for 2020 through 2030.

Clinical Classifications Software Refined is one in a family of databases and software tools developed as part of the Healthcare Cost and Utilization Project (HCUP), a Federal-State-Industry partnership sponsored by the Agency for Healthcare Research and Quality (AHRQ). HCUP databases, tools, and software inform decision making at the national, state, and community levels. Inpatient Demand CCSR Estimates provides the total volume of annual acute care admissions and patient days by ZIP Code, age group, sex, payor, and CCSR diagnosis code for every market in the United States. To construct population-based use rates, IBM used

all-payor state discharge data for 21 states and Medicare (MEDPAR). These rates were applied to demographic projections by ZIP Code to estimate inpatient utilization for 2020 through 2030. In addition, IBM Watson data provided the last two years of patient data, grouped in similar groups. This data was provided for all three regional hospitals, Catawba Hospital, Southwestern Mental Health Institute and Western State Hospital.

The current primary and secondary Catawba Hospital market areas were used as a baseline for inpatient bed projections for both behavioral health and substance use disorder. The 2020 inpatient bed demand for both behavioral health and substance use disorder in the market was 229 beds. This includes all beds in the market both private and public. There are approximately 120 private beds in the market and 110 beds located at Catawba Hospital. The 2030 inpatient demand model shows only slightly increases to 232 beds. The current census at Catawba Hospital frequently exceeds the recommended 80% occupancy threshold. Average length of stay for these acute beds is approximately 6 days in 2020 and is projected to remain at 6 days in 2030. This length of stay is shown in both the IBM Watson data and data provided by DBHDS.

Hospital Length of Stay



The creation of the longer stay resident treatment unit beds for Substance abuse will lower the need for Acute care Substance abuse beds over time and reduce readmissions and costs. Approximately 25% of substance use disorder patients are due to readmissions.

The bed model is created by determining the Average Daily Census (ADC) by totaling the number of patient days that occur and dividing that by 365 days. Then, we divide that number by the targeted utilization rate to calculate the bed need. Based on this information, the need in the market is 229 to 232 both behavioral health and Substance abuse beds thru 2030. Private sector beds provide approximately 129 beds and Catawba is providing 110 beds.

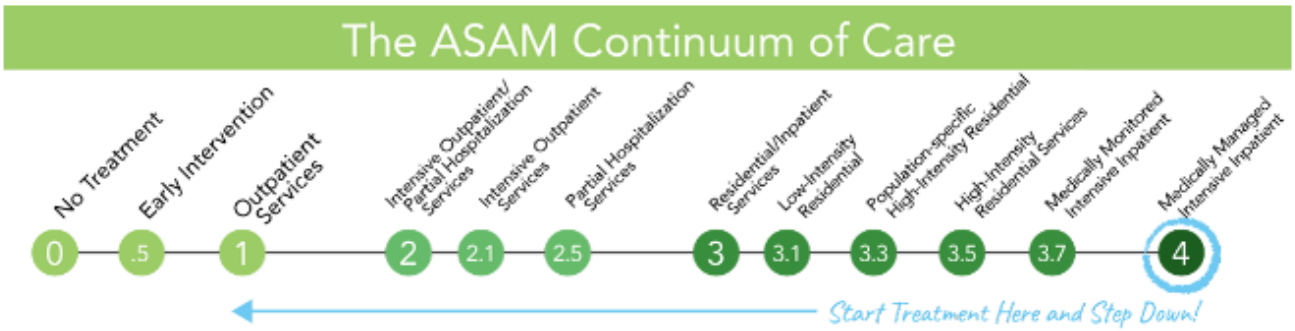
Adults & Geriatrics - Catawba Market

	Discharges		ALOS		Bed Need	
	2020	2030	2020	2030	2020	2030
Grand Total	11,213	11,417	6.0	5.9	229.7	232.5
ACUTE ADJUSTMENT REA..	310	336	3.9	3.7	4.1	4.2
BEHAVIORAL AND DEVELO..	6	3	4.6	4.4	0.1	0.1
DEPRESSIVE NEUROSES	570	614	4.5	4.5	8.9	9.4
DISORDERS OF PERSONA..	49	58	5.7	6.2	1.0	1.2
NEUROSES EXCEPT DEPR..	578	628	4.6	4.7	9.2	10.0
ORGANIC DISTURBANCES ..	247	133	8.8	9.3	7.5	4.2
OTHER MENTAL DISORDE..	6	5	6.1	6.8	0.1	0.1
PSYCHOSES	6,703	6,877	6.7	6.6	154.6	155.1
SUBSTANCE ABUSE	2,744	2,762	4.7	5.1	44.3	48.1

The detox unit created for each of the 3 options is sized at 16 beds for all options. Detox units are costly to run whether you have 1 bed or 30. However, because there are so many fixed costs in opening the doors to a detox unit, it is best to make it as efficient as possible. The detox unit should only have the beds it can realistically fill. You need 24/7 RN care, an administrative assistant, a CNA/TMA, and a part-time doctor or provider to oversee the assessment and care and withdrawal to run a detox unit. Ideally, you would have 12 to 16 detox beds and 80 to 120 or more residential beds to support the detox unit and continuum of substance abuse treatment services envisioned. This is predicated on an average length of stay of 3 weeks for the residential treatment and 4-6 detox admissions a day with a 1-3 day stay. The shorter stay for the detox admissions compared to a typical detox unit is due to the availability of the residential beds.

The American Society for Addiction Medicine Levels of Care for Addiction

The American Society for Addiction Medicine (ASAM) established codes for each step of the continuum to standardize the way addiction treatment is viewed. Rehabilitation facilities address clients in the different ways, ASAM's definitions make it easier to put services in two different facilities in the same context. This makes billing easier for insurers and provides guidance to the addiction treatment community on the most effective ways to assess and treat patients at each level. The scale ranges from 0-4, with 0 signifying no treatment at all, and 4 being the highest level of care in the industry.



Level 1: Outpatient Services

In Level 1 care, patients participate in outpatient services. Outpatient services are popular options for individuals who are further along in their recovery and want to integrate back into the real world. Outpatient treatment is also a good first step for people who need addiction treatment but can't miss out on obligations like work or school and are healthy enough to be unsupervised throughout the day.

Patients can continue maintaining their daily routines and live at home while attending outpatient appointments. They can schedule outpatient appointments at any point in the day to best fit their schedule. Outpatient treatment consists of regularly meeting with a physician or medical professional during the week, having access to various therapies, clinical services, and receiving medications.

This level of care is lowest on the treatment scale because patients still live at their residence during treatment and are interacting with loved ones, co-workers and peers like usual. According to ASAM criteria, outpatient services consist of treatments and therapies administered to patients with addiction who are not residents of a facility. For care to be considered outpatient at level 1, patients must spend less than 9 hours at the treatment facility during a given week.

Level 2: Intensive Outpatient (IOP) or Partial Hospitalization (PHP) Programs

Level 2 involves services where patients are not residents of a facility but still spend a significant amount of time in a location receiving therapies and treatment that support recovery. Individuals who need more care for their substance use disorder can receive intensive outpatient treatment or partial hospitalization services. These treatment programs are beneficial for people with more complex substance use disorders. This can mean a high severity of addiction or the presence of co-occurring disorders that require more attention and supervision.

Intensive outpatient and partial hospitalization services provide more resources for patients than traditional outpatient treatment. Here are further details about both treatment programs:

Level 2.1 is IOP, which is more than 9 hours of intervention. Many of these are programs take place before or after work or school so that patients can receive treatment while remaining integrated in society. Level 2.5 is PHP, which involves 20 or more hours of care per week without the around-the-clock attention of residential care.

Level 3: Residential/Inpatient Services

Level 3 includes a scale of inpatient treatment that progresses from minimum engagement to fully supervised, intensive care. Patients who need around-the-clock supervision require a higher level of care to progress through recovery. Residential and inpatient services are best for patients who will benefit most from having access to medical staff and mental health professionals while they reside at the treatment facility. These patients may struggle if they continue with treatment while living at their homes — residential treatment can provide the care they need.

Treatment centers can provide various versions of residential treatment to accommodate multiple types of patients and ensure they have the right resources to provide the best inpatient care.

Levels 3.1, 3.3, and 3.5 describe different intensities of clinically managed residential care, while level 3.7 and level 4 describe patients who need around the clock medically managed intensive inpatient monitoring by professionals.

Level 4 Medically Managed Intensive Inpatient Services

Level 4 patients (the highest level of the ASAM scale) may require medically managed intensive inpatient services. This stage includes services like medication-assisted treatment (MAT) and medical detoxification. Patients who begin treatment with a heavy dependency on a substance and intense withdrawal symptoms will need help getting through these side effects.

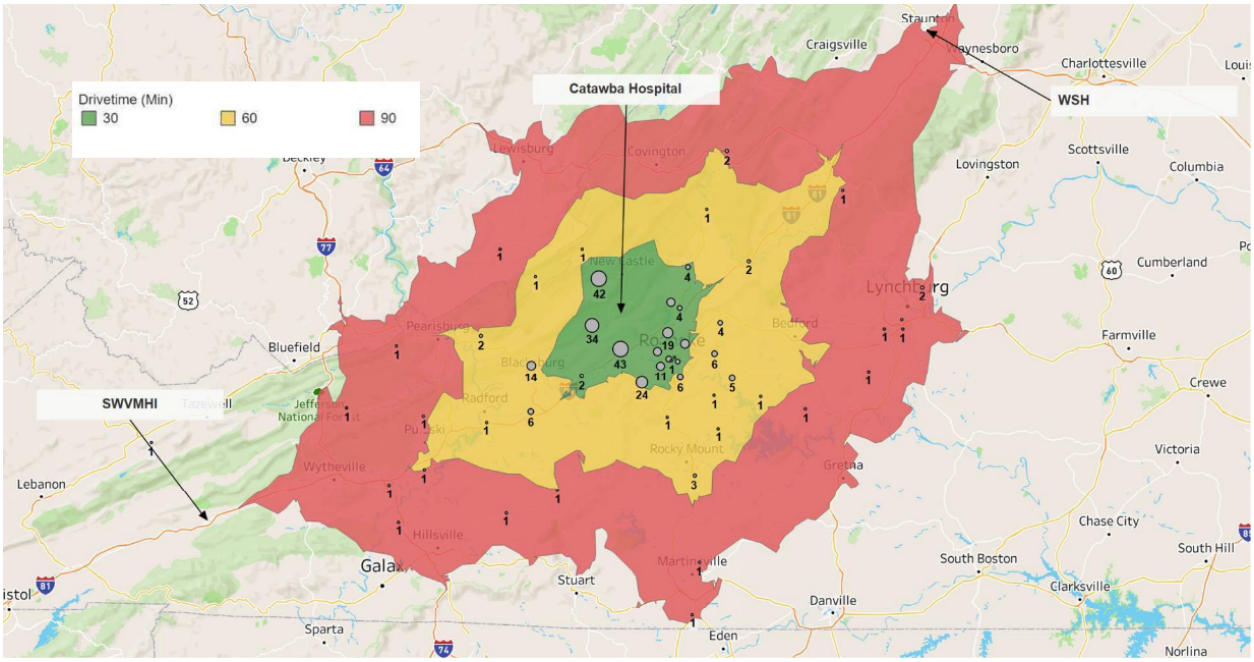
Medically managed intensive inpatient services are similar to the care patients receive at medical hospitals for acute medical cases. Patients will have access to 24/7 care for the duration of their treatment. Withdrawal symptoms can be dangerous or life-threatening, and this level of care can help individuals start their recovery safely.

Workforce Development

Catawba Hospital has sufficient staff to perform its mission per the facility Director. However, in any of the option models, additional staff with potentially different expertise will be needed. The effects of the pandemic and rising wages have resulted in a tight labor market across the country, Virginia is no different and is not immune to the effects. The transformed Catawba Hospital will need to be attractive to recruit the necessary to staff to support the enhanced mission.

To recruit the necessary staff, Catawba Hospital will need to offer what is not offered anywhere else. There are only a few treatment facilities that offer the full continuum of care in the nation. A transformed Catawba Hospital would join an elite group that would be enticing to many professionals. In addition, all the options provide for the possibility of partnering with educational institutions that can provide training and research opportunities for the current and additional staff.

To improve access to behavioral health care, we must implement strategic efforts to attract and retain a high-quality, diverse, and culturally responsive workforce and identify new ways to accelerate training and entry into behavioral health careers. The new education program elements in the proposed outpatient research building help achieve this goal. It is recommended that the space programmed for educational space in this building is explored with the current university partners that have students working on the campus to ensure that the new construction meets all the needs and requirements for state-of-the-art training facilities needed by those institutions.



The diagram above provides the time it will take the potential workforce to drive from nearby residential areas to come to the campus.

The team used a special program that analyses drive time from point to point. This shows actual time to travel to the campus from every zip code of every employee at Catawba Hospital. The number below the various circles represent the number of employees in that zip code. The colors show drive time to Catawba Hospital in 30-minute increments. This can help focus recruiting and marketing of new staff and future staff and provide recommended housing areas for new hires moving to the area.

Transportation

According to the American Hospital Association and their *Social Determinants of Health Series: Transportation and the Role of Hospitals*, 3.6 million people in the United States do not obtain medical care each year due to transportation issues. Access to reliable and adequate transportation is a critical component for any healthcare facility as a lack of access leads to missed or delayed appointments, poorer health outcomes, and ultimately increased health expenditures for an organization. Lack of access increases the potential for social isolation as well, a critical issue here given the patient population served by Catawba Hospital. Public transportation can also have an impact on staffing and the resources consequently available to an organization. This is particularly true for support service employees providing functions like environmental services, food services, and security.

Public transportation is especially important to Catawba Hospital and its future as a center of excellence for a continuum of care for both behavioral health and substance use disorder

The Smart Way Route Map with the location for the proposed extension to Catawba

treatment given its somewhat remote location in the Roanoke Valley Metro Area and potential access concerns during inclement weather. Currently, Valley Metro, the local public transportation provider, does not service this area. As a part of the master planning effort, the team met with the operations leadership team at Valley Metro to explore potential options and estimated costs for implementing those options that could potentially be subsidized by the Commonwealth to support Catawba Hospital. There is an existing route between Roanoke and Blacksburg (the Smart Way Bus Route), that could be easily modified to add a stop a Catawba Hospital – see map above.

As next step, a study would need to be commissioned and completed by a licensed transportation engineering firm to fully scope out the specifics (number of stops per day, times, etc.) for the route that would serve and support Catawba Hospital both in the current day state and future state. This solution could be implemented with a yearly operating budget under $500,000 based upon the cost metrics provided by Valley Metro (~ $52/hour to add a stop to an existing route).

Behavioral Health & Substance Use Disorder Public-Private Care Models

Introduction

The demand for behavioral health (BH) and substance use disorder (SUD) services has progressively increased to such a point it has been characterized as a crisis by many industry experts. Across the general population, some level of behavioral health need exists. Certain sub-groups, like pediatrics, veterans, and seniors, etc., are identified as high need or high users of behavioral health services. When the behavioral needs of a community exceed capacity (or capability) the opportunity to forge partnerships to gain efficiencies, reduce costs, and scale services becomes a priority for both care providers and the purchasers of care.

Public Behavioral Health Facilities being Operated by Private Companies

Partnership models designed to address a defined scope of health care needs can involve a variety of players. A partnership facilitates the shared reward and risk of services strengthened or expanded to support a shared goal. Healthcare delivery partnerships are forged between healthcare providers; providers and payors; providers and employers; a provider and a public agency commonly called public and private partnerships (PPPs); and many other model variations.

Public-private partnerships (PPPs) can be a form of arrangement in which private companies are contracted to operate public behavioral health facilities. PPPs involve a collaboration between the public sector and private companies to deliver a public service or project. In the context of behavioral health care, a PPP might involve a private company partnering with a public healthcare system to operate a public behavioral health hospital or clinic.

Under a PPP arrangement, the private company may be responsible for managing the day-to-day operations of the facility, including hiring and supervising staff, managing budgets, and providing clinical services to patients. The public sector may provide funding for the facility and set performance standards and quality benchmarks for the private company to meet. The private company may also be required to meet certain financial and performance targets, such as reducing costs or improving the quality of care. PPPs can be beneficial in that they can bring private sector expertise and efficiency to the delivery of public services.

Public healthcare systems have been contracting with private companies to operate public behavioral health facilities in various countries around the world for some time. These facilities provide specialized care for individuals with mental health and substance use disorders and may offer a range of therapeutic services such as individual and group therapy, medication management, and support for recovery and rehabilitation.

For example, in the UK, the NHS Any Qualified Provider program allows private companies to bid for contracts to deliver NHS-funded healthcare services. Under this program, private

companies can operate public mental health hospitals and clinics, while the NHS provides the facilities and equipment. One case of a private company operating an NHS mental health facility is the Cygnet Health Care group, which has a contract to operate several mental health hospitals and clinics in the UK.

In Canada, some provinces also contract with private companies to operate public mental health facilities. For example, the province of Ontario contracts with private companies to provide mental health services in certain regions. The Canadian Mental Health Association is one such organization that operates several public mental health clinics and hospitals in Ontario under contract with the province.

In the United States, many states have contracts with private companies to operate public mental health clinics and hospitals. Some examples of private companies that operate public behavioral health hospitals in the United States include Aurora Behavioral Health Services, Universal Health Services (UHS), HCA Healthcare, and Acadia Healthcare.

Overall, this arrangement allows the public healthcare system to provide the building and infrastructure for these facilities, while a private company is responsible for the day-to-day operations and ensuring that the quality of care meets the needs of patients. The public system may also set performance standards and monitor the care provided by the private company to ensure that it meets the necessary standards.

Benefits and Drawbacks:

Public-private partnerships can offer several potential benefits to Catawba Hospitals, including:

Increased funding: Private sector partners can bring additional financial resources to a mental health hospital, which can be used to improve and expand services, purchase new equipment, or invest in research and development.

Improved efficiency: Private sector partners may have expertise in managing and operating hospitals more efficiently, which can lead to cost savings and improved quality of care.

Innovation: PPPs can provide opportunities for the introduction of new technologies, approaches, and practices that may not have been possible without private sector participation.

Access to new markets: PPPs can help mental health hospitals expand their services to new geographic areas or populations that may not have been served otherwise.

Risk sharing: PPPs can help mental health hospitals manage and share the financial and operational risks associated with running a hospital, which can help stabilize and secure the hospital's long-term future.

It's important to note that PPPs can also have potential drawbacks and challenges, including the need to carefully manage the balance of public and private interests, and to ensure that private sector partners are held accountable for their performance. It's also important to consider the

potential impact on patients, staff, and other stakeholders, and to ensure that any PPP is structured in a way that prioritizes the needs and interests of these groups.

Below are three profiles of partnership models supporting behavioral health services and how they approached the behavioral health needs of a defined population. The Roanoke Valley represents the largest metropolitan statistical area in western Virginia with a population of 325,000. The area of the Catawba Hospital catchment area as defied in the data section of this report represents 1.8 million in population.

Links are provided to other resources applicable to the example.

EXAMPLE 1:

WakeMed Behavioral Health Network (Wake County, NC)
In 2017, WakeMed Health and Hospitals established an integrated, collaboration with numerous public and private agencies called the WakeMed Behavioral Health Network (WMBHN) within Wake County, NC. The Wake County population was over 1.1 million in 2021 making it the largest county in the state of North Carolina. The intent behind this initiative was to improve access and care coordination for patients suffering from mental and chronic health conditions. The Network was designed with the goal of improving disease detection, accelerate access to services, improve patient engagement, and impact avoidable costs by reducing emergency department (ED) visits and reducing inpatient readmissions. The WMBHN has evolved over the years and has subsequently expanded its partnerships. Partners are grouped by their service focus across five categories with the umbrella program being WakeMed Behavioral Health. While this model **does not specifically include a public agency**, it does illustrate how the pooling of resources facilitates right care at the right place for patients thus serving a broader public benefit while fulfilling private sector goals. Performance metrics focused on reduced emergency room visits, admissions, and length of stay. Due to North Carolina laws, financial incentives between partners were be limited or prohibited.

Partner categories include:

Connected Community. This subset brings together social service agencies and positions them to receive referrals from network providers to manage inflow and resources. They participate in and are the beneficiary of network-wide fundraising, grant applications/administration, and other funding activities. Similarly, health impact data in the form of referral volumes, health outcomes, and direct/indirect service impact are shared across the network. The organizations represented in Connected Community also participate in NCCARE360, a statewide network uniting healthcare and human service organizations with a shared technology that enables a coordinated, community-oriented, person-centered approach for delivering care. Prominent members include: Healing Transitions, a Place for Recovery; NC MedAssist, Dispensing Hope for the Uninsured; Neuro Community Care; The Center for Volunteer Giving; The Green Chair Project; and StepUp Ministry, Jobs|Life Skills|Stability. Other organizations focusing on food banks and food access are also in this group.

Triangle Behavioral Health Council (TBHC). Members of this group offer inpatient behavioral health services and include hospital providers and recovery centers. The shared goal of this group is to provide accelerated access to high-performance inpatient, outpatient, and social service networks. A patient referred to one of these providers is educated on the treatment options for their illness and benefit from access to the services within the Connected Community group. Agencies share care coordination services with an emphasis on data. Performance dashboards highlight avoidable bed days, involuntary commitments, readmissions, time to access, average length of stay (ALOS), patient activation and engagement rates, care integration, and fiscal impact. Prominent members include Fellowship Hall, Drug and Alcohol Recovery Center; Holly Hill Hospital; Triangle Springs; and UNC Hospitals-Wakebrook. Other members include Brynn Marr, Maria Parham, and Old Vineyard Hospital.

Network for Advancing Behavioral Health (NABH). Representing the outpatient side of behavioral health services, these organizations share some of the same benefits as the TBHC as well as pre-qualified referrals and, in some cases, direct admission to BH crisis and inpatient facilities. Member organizations benefit from data sharing and support patient care coordination. This group can also benefit from value-based contracting incentives related to outcomes but the NABH does not serve as the contract negotiating capacity for members. Members include Carolina Outreach; The Carter Clinic; Daymark Recovery Services; Easterseals|UCP; Fellowship Health Resources; Fernandez Community Center, LLC; Holly Hill Hospital; Hope Services, LLC; Mindpath Health; Monarch; Morse Clinics; RHA Health Services; Sigma Health Services, LLC; SouthLight; Triangle Springs; WakeMed; Yelverton's Enrichment Services; and Eleanor Health.

WakeMed Services. This branch of WakeMed Behavioral Health reflects the WakeMed Health System and provides BH crisis & assessment; psychiatry; transitional care management; and community case management.

WakeMed Physician Practices. A large component of this branch are WakeMeds primary care practices support disease screening; low-risk BH care; Project OBOT (office-based opioid treatment); and Co-lo/Reverse Co-locations. The co-location models either have BH embedded into a primary care practice (co-location) or a primary care capability within a BH practice (reverse co-location). Project OBOT is a program initiated by the North Carolina Medical Society helping to bridge the delivery of Medication Assisted Treatment (MAT) to treat opioid use disorders. A virtual platform for this service (Project VBOT) reflects the next generation of this program.

Take-Away's: Building an extensive partner network requires clear participation criteria, good communication, and a commitment to share data. The categorization of partners supports functional synergies and supports increased referral opportunities. While not addressed in publicly available profiles, capacity limitations with a partner could interrupt the patient's journey to wellness. How and when partners enter and exit the network should be clearly defined to maintain amicable relationships. The establishment of performance metrics on the front-end of any initiative enables the unbiased assessment of partner performance.
The WakeMed Behavioral Health Network model can be applied to Catawba Hospital in several ways. One key aspect of the WMBHN model is the grouping of partners into categories based on their service focus. This allows for a more coordinated and streamlined approach to care delivery, with each category working together to provide a full range of services to patients. This model could be replicated by grouping potential partners into categories based on the services they offer, which could help facilitate better care coordination and improve patient outcomes.

Another key aspect of the WMBHN model is the emphasis on data sharing and care coordination. This can help ensure that patients receive the right care at the right place and that care is delivered efficiently and effectively. By implementing similar strategies for data sharing and care coordination in new collaborations, it may be possible to improve patient outcomes and reduce avoidable costs. Effective data sharing among all entities (public and private) can streamline communication across all points of care and allow patients to move more seamlessly through the continuum of care. This can include information sharing on bed and provider availability, referrals, health outcomes, disease screening, length of stay, patient activation and engagement rate, and more. Patients struggling with mental health and addiction often receive care across this continuum, so the success of their treatment depends on effective communication and coordination among all providers on the continuum, including primary care. Utilizing shared technology enables a coordinated, community-oriented, person-centered approach to delivering care and should be considered for this project.

It may also be helpful to consider how new collaborations can facilitate access to a wide range of services, as the WMBHN does through its Connected Community category. This may involve working with social service agencies and other organizations that can provide support and resources to patients outside of the healthcare setting.

Finally, it may be helpful to consider how new collaborations can involve multiple stakeholders, including primary care practices, hospitals, and behavioral health providers. By establishing relationships with a wide range of partners, it may be possible to create a more comprehensive and integrated approach to care that meets the needs of patients more effectively.

EXAMPLE 2:

Michigan Mental Health Integration Partnership (MIP) (Ann Arbor, MI)

Since 2006, a collaboration between Ann Arbor-based University of Michigan (U-M) and the Michigan Department of Health and Human Services called the Michigan Mental Health

Integration Partnership (MIP) has been addressing behavioral health access through community partnerships, project sponsorship, and the implementation of innovative, state-of-the-art care models. The MIP focuses their efforts on children and adults participating in the State's Medicaid program. Projects funded through the U-M Department of Psychiatry leveraged 1:1 matching funds from foundations and the Centers for Medicare and Medicaid Services so the MIP could underwrite evidence-based collaborative care interventions (EBIs). Because projects are initiated through the University of Michigan, faculty members representing psychiatry, internal medicine, family medicine, pediatrics, emergency medicine, social work, and public health can connect with public health experts and contribute their expertise to slate of initiative(s) planned for the coming year. U-M investigators follow a process or roadmap for transitioning the completed project to the stakeholder agency. By having the stakeholder partner part of the project team, the transition of ownership is intended to be fluid. However, due to a reported varied approach to project planning complications have been known to arise. Additional time with project planning is considered the remedy to this challenge but a greater one exists with the project's long-term sustainability due to uncertain funding guarantees. Still, this partnership supports care innovations within the Medicaid population by initiating projects in settings like primary care clinics, federally qualified healthcare centers (FQHC), middle and high schools, hospitals, and community mental health.

Examples of funded investigative initiatives include:

1. Expansion of child/adolescent access to mental health services using telepsychiatry in Flint, MI
2. Integrating of mental health services in primary care for vulnerable populations
3. Implementation of school-based cognitive behavioral therapy (CBT) for students across Michigan
4. Development of a new support program to help fathers enhance family engagement and parenting skills in Wayne County, MI

Take-Away's: Internet-published materials describing the Mental Health Integration Project appear to be much stronger on the University of Michigan side opposed to the Michigan Department of Health & Human Services. The absence of DHHS internet references could simply reflect how Michigan government agencies choose to describe their activities. What is also unclear is how U-M researchers work with the DHHS to determine need so funded initiatives can provide incremental value to the physical and mental health needs of the Michigan Medicaid population. Because projects typically have a study period of one year, decisions about its continuation would have to be made because then grants or other funding sources must be established.

Beyond this project, partnerships with Academic Medical Centers (AMCs) can provide mutually beneficial service structures. For instance, AMCs need venues to train medical students on how to work in rural communities where patients have challenging circumstances. Oftentimes, an AMC will forge a relationship with a FQHC and rotate their providers through that setting to have that kind of training. In return, the FQHC gains access to medical providers they might not

have been able to recruit on their own. Other benefits of an AMC partnership include improved access to specialty providers. Access to specialized, higher acuity services is a challenge for some patient populations for multiple reasons. Therefore, should an AMC partnership centered on activating research engagements what type of projects and their short and long-term benefits should be clearly defined. An AMC partnership has many benefits, but the terms of engagement need to be clearly established in order to maintain the patient as the ultimate beneficiary of the arrangement. This partnership relies heavily on grant funding for its initiatives; no performance pay or other similar financial agreements appear to be in place. Ann Arbor, Michigan is located in Washtenaw County where the 2020 estimated population totaled 372, 258.

Catawba Hospital has a relationship with many regional providers and educators: Virginia Tech School of Medicine, Radford Universality, and local Hospital Corporation of America (HCA) and the Carilion Clinic. These partners can enhance their current staff and students on the campus. These staff psychiatrists hold faculty positions and help educate psychiatry residents and medical students on the campus. The hospital also offers clinical practicum opportunities for students in various fields, such as nursing, psychology, social work, music therapy, recreation therapy, and food and nutritional services. This partnership, along with connections to organizations such as Blue Ridge Behavioral Health Care, provides an opportunity to form a network for community partnerships, project sponsorships, and the implementation of innovative mental health and addiction care models. This network can secure funding from various sources, including academia and foundations, to develop evidence-based care interventions in schools, community mental health centers, and other hospitals. This can lead to more innovation and integration in the care continuum and potentially increase access to care for vulnerable populations, depending on the funded research initiatives.

Establishing a new collaboration similar to the Michigan Mental Health Integration Partnership (MIP) would require consideration of several key factors. First identify the specific goals and objectives of the collaboration. For example, Catawba may want to focus on improving access to behavioral health services for a particular population or implementing innovative care models to improve the quality of care. It will also be important to consider how Catawba will fund the collaboration. This may involve seeking grants or matching funds from foundations or government agencies, or it may involve seeking funding from other sources.

It will also be important to consider how Catawba will engage with community partners and stakeholders, as the MIP did through its partnerships with primary care clinics, FQHCs, schools, hospitals, and community mental health centers. Building strong relationships with these partners can help ensure the success of the collaboration and help Catawba achieve their goals. Additionally, Catawba may want to consider how they will involve faculty members and other experts from different disciplines, as MIP did with representatives from psychiatry, internal medicine, family medicine, pediatrics, emergency medicine, social work, and public health.

Finally, it will be important to consider how Catawba will plan and implement their projects and initiatives, and how they will ensure their long-term sustainability. This may involve developing a

roadmap or process for transitioning completed projects to stakeholder agencies and establishing clear terms of engagement for partnerships with academic medical centers (AMCs). It will also be important to consider how Catawba will evaluate the impact and effectiveness of their projects and initiatives, and to be prepared to adapt and adjust their approach as needed.

EXAMPLE 3 - The East Metro Mental Health Roundtable (Minneapolis-Saint Paul, MN)

The East Metro Mental Health Roundtable is a collaboration of over 25 community organizations in the Twin Cities east metro region (Minneapolis-Saint Paul) that share a common goal of improving mental health care in the community. The Minneapolis-Saint Paul region has an estimated 3.16 million population with the City of Saint Paul having 307,193 residents. The Roundtable focuses on initiatives that aim to improve care, educate the public, prevent mental health crises, and reduce the use of emergency room, hospital, and legal resources for mental health issues. Through public-private partnerships, the Roundtable has been successful in improving care and reducing costs for treating mental illnesses.

One of the Roundtable's first initiatives was to identify and track key mental health care metrics in order to identify gaps in the system and track the community's progress. These include average wait time in hospital emergency departments; number and percentage of people in jail and correction facilities who need mental health follow-up; number and percentage of police/sheriff calls related to emotionally disturbed people; and several measures to determine wait times of hospital inpatient for referrals to community-based services. This dataset was used to identify areas where care was lacking or where there were inefficiencies in the system, and the Roundtable worked to address these issues in order to improve care for those with mental illnesses.

In addition to tracking metrics and identifying areas for improvement, the Roundtable also has several programs in place to address specific issues related to mental health care. For example, the Mental Health Drug Assistance Program (MHDAP) was implemented in order to provide timely access to psychiatric medications, which can be a major factor in preventing mental health crises that require hospital care. The MHDAP covers co-pays, deductibles, or the full cost of medications for up to three prescription fills in 90 days for adults living in the east metro who receive care from designated clinics. This program has been successful in reducing the cost of prescriptions by 84% (filling prescriptions with medications on HealthPartners formulary) and has also led to decreases in psychiatric hospitalization, jail visits, homelessness, and thoughts of self-harm.

The Roundtable has also made efforts to improve crisis management in the community. Many mental health crisis situations are urgent, but often do not require a visit to the emergency room. However, many people in these situations go to the hospital due to a lack of other options or a lack of awareness of those options. In order to address this issue, the East Metro Crisis Alliance has worked with the Roundtable to design and implement several programs that provide alternatives to hospitalization for those facing a mental health crisis. These programs include the Mental Health Crisis Stabilization service, which provides short-term treatment and helps move individuals from crisis to ongoing care, and the Urgent Care for Adult Mental Health in St.

Paul, which provides walk-in access to crisis services and has prevented the use of emergency room resources for 227 patients each year.

The Roundtable has also worked to improve emergency room readiness for mental health situations that do require hospitalization. In partnership with several local hospitals, the Roundtable has increased the number of mental health beds in the east metro by nearly 20% since 2007. Additionally, they have implemented programs such as the Medical Respite Unit at the Higher Ground shelter, which provides a place for individuals to recover after a mental health crisis before returning to their homes or other housing options, and the Mental Health Emergency Department Navigation program, which provides support and assistance to those with mental illness in navigating the emergency room process.

In addition to these specific programs, the Roundtable has also implemented community support initiatives such as the Integrated Primary and Behavioral Health Care program, which aims to improve the coordination and integration of primary and behavioral health care, and the Strong Kids, Strong Families program, which provides support and resources to families with children experiencing mental health challenges.

Take-Away's: There are several ways that the East Metro Mental Health Roundtable's concepts and initiatives could be applied to improve mental health care a Catawba Hospital. Some potential options include:

Identifying and tracking key mental health care metrics: One of the Roundtable's first initiatives was to identify and track key mental health care metrics in order to identify gaps in the system and track progress. This could be done at Catawba Hospital as well to identify areas where care is lacking or where there are inefficiencies in the system, and to track progress over time.

Implementing programs to improve care and reduce costs: The Roundtable has implemented several programs that aim to improve care and reduce costs for treating mental illnesses, such as the Mental Health Drug Assistance Program and the Integrated Primary and Behavioral Health Care program. These programs could be replicated at the Catawba Hospital to improve care and reduce costs for patients with mental illness.

Providing education and resources: The Roundtable has made efforts to educate the public about mental health issues and the importance of seeking treatment when needed. Catawba Hospital could follow this example by providing information and resources on their website and participating in public events and campaigns to raise awareness about mental health.

Implementing prevention initiatives: The Roundtable has implemented several initiatives that aim to prevent mental health crises, such as the Mental Health Drug Assistance Program and the Mental Health Crisis Stabilization service. Catawba Hospital could adopt similar initiatives in order to prevent mental health crises and reduce the need for emergency care.

Reducing the use of emergency room and other resources: The Roundtable's efforts have led to a reduction in the use of emergency room, hospital, and legal resources for mental health

issues. Catawba Hospital could adopt similar initiatives in order to reduce the use of these resources and improve the overall efficiency of care.

Overall, by applying the concepts and initiatives of the East Metro Mental Health Roundtable, Catawba Hospital could make significant improvements to mental health care in the community and have a positive impact on the lives of those with mental illness and their families.

Members include: Allina Health, Canvas Health, Catholic Charities Twin Cities, Children's Hospital, City of St. Paul, CLUES (Comunidades Latinas Unidas En Servicio), Dakota County Social Services, East Metro Crisis Alliance, Emergency Care Consultants, Fraser, Guild Incorporated, Hamm Clinic, HealthEast, HealthPartners, Hearth Connection, Mental Health Resources, Minnesota Department of Health, Minnesota Department of Human Services, Minnesota Philanthropy Partners, National Alliance for Mental Illness Minnesota, People Incorporated, Ramsey County District Court, Ramsey County Human Services, Regions Hospital, St. Joseph Hospital, St. Paul Police Department, St. Paul Public Schools, United Hospital, Washington County Community Services, Westside Community Health Services, Amherst H. Wilder Foundation.

Other Partnership Examples. A broad-based internet search on public-private partnerships suggests the engagement target is narrowly focused to either a defined group of beneficiaries or addressing a specific behavioral health issue. These partnerships function within the sphere of behavioral health services but often work in isolation to other complementary services. There is an argument to be made that a focused effort is more impactful but it potentially addresses a narrow subset of individuals. Other partnerships that are more contractual in nature like an operating agreement or joint venture can fully define operating terms and establish success measures. These, too, tend to focus on a certain subset of the behavioral health eco-system and their intent is generally to build capacity and operating structure to support a well-defined patient category.

In all, a successful partnership must include a specific range of services and their beneficiaries. A narrow focus can help establish goals and movement along the learning curve helps inform best practices and sets the stage for expansion.

Conclusion:

Catawba Hospital should explore strategic partnerships to streamline care delivery across providers in order to effectively address the behavioral health continuum in their region. Patients struggling with mental health and addiction often receive care across this continuum and have multiple comorbidities, so the success of their treatment depends on effective communication, coordination, and treatment among all providers on the continuum, including primary care.

One way to accomplish this is by forging partnerships between healthcare providers, payers, employers, educational entities, and public agencies through public and private partnerships. These partnerships can help to improve communication and coordination between all the different parties involved in a patient's care and can also help to elevate the level of treatment

provided across all points of care. Additionally, these partnerships can allow patients to move more seamlessly through the continuum of care, which is particularly important for patients struggling with behavioral health issues.

For example, if a patient receives preventative care from a primary care provider in partnership with Catawba Hospital, and then later receives inpatient treatment at Catawba, it is critical that there is effective communication and coordination between the two entities for the patient to receive the most effective care. If effective partnerships are not in place prior to a patient's entry (preventative care) or once they are released from Catawba (recovery-oriented care), this can lead to a revolving door with patients left with inadequate resources and access to programs to maintain their sobriety and the necessary mental health treatment to thrive.

Current entities that partner with Catawba Hospital include Carilion Clinic, Hospital Corporation of America, Radford University and Virginia Polytechnic Institute. By building more robust partnerships with these existing entities and other community-based organizations, Catawba Hospital can improve the level of care provided to patients struggling with behavioral health issues and addiction, while also helping to reduce costs and improve the overall health outcomes in the region.

It is essential for Catawba Hospital and DBHDS to identify and track key mental health metrics to identify areas for improvement and measure progress, as a way of determining the most effective partnerships across the continuum of care moving forward. To achieve this, Catawba County would benefit from new collaborations involving multiple stakeholders such as primary care practices, residential treatment facilities, outpatient care, hospitals, behavioral health providers, social service agencies, and other community-based organizations, that can provide support and resources to patients outside of the healthcare setting.

More specifically, services on Catawba Hospital's current campus that would benefit from such partnerships include hiring a private entity for administrative support for the new residential treatment program (Building 15) and the outpatient clinic. Furthermore, educational and workforce services can also be located in the outpatient building, which can be managed by a private entity. This will help bridge the gap in current system and create a more effective continuum of care and provide more comprehensive support for those dealing with behavioral health and addiction issues.

Partnerships with Academic Medical Centers (AMCs) can also be advantageous for Catawba Hospital, by creating opportunities for research engagement and mutually beneficial service structures such as training for students in fields such as social work, nursing, psychiatry, and psychology, and providing internships, in rural communities where patients face unique challenges. Collaborating with academic institutions can also improve access to behavioral health services for specific populations and implement innovative care models to enhance the quality of care. Research and laboratory space with a focus on emerging technologies in behavioral health and addiction treatment can also be beneficial. There are several advantages of partnering with private entities to train different types of providers such as social workers

(SWs), nurses, psychiatrists, and psychologists, provide alternative programming, and provide internships. These include:

Access to specialized expertise: Private entities often have specialized expertise in certain areas such as providing training, education, or services. By partnering with them, Catawba Hospital can benefit from this specialized knowledge, resources and improve the quality of care provided to patients.

Cost-effectiveness: Private entities may have the resources and financial capabilities to provide training, education, and services in a cost-effective manner, which can help to reduce costs for Catawba Hospital.

Expand reach: Private entities may have a wider network of contacts and resources that can be used to expand the reach of the services provided by Catawba Hospital, such as providing training, internships and alternative programming to a wider range of individuals and communities.

Flexibility: Private entities may be more nimble and able to respond to changing market conditions and trends in healthcare. This can help Catawba Hospital to adapt and make changes more quickly, which can be an important advantage in a rapidly evolving healthcare landscape.

Innovation: Private entities are often at the forefront of innovation in healthcare and may be better equipped to adopt and implement new technologies, approaches, and practices that can help improve the quality of care provided to patients.

Additional financial resources: By partnering with private entities, Catawba Hospital may have access to additional financial resources that can be used to improve and expand services, purchase new equipment, or invest in research and development.

Provide alternatives: Private entities may provide different models of care or different approaches to care that may be beneficial for patients that did not respond well to traditional methods, or for patients with special needs.

Catawba Hospital already collaborates with a number of regional providers and educators, including the Virginia Tech School of Medicine, Radford University, and the local Hospital Corporation of America (HCA) and Carilion Clinic. These partnerships enhance the current staff and students on the campus. For example, staff psychiatrists hold faculty positions and help educate psychiatry residents and medical students on the campus. The hospital also offers clinical practicum opportunities for students in various fields, such as nursing, psychology, social work, music therapy, recreation therapy, and food and nutritional services.

This collaboration, combined with connections to organizations such as Blue Ridge Behavioral Health Care, provides an opportunity to form a network for community partnerships, project sponsorships, and the implementation of innovative mental health and addiction care models. This way, Catawba Hospital can work together with academic partners to improve patient

outcomes and enhance the overall quality of care for behavioral health and addiction patients in the community.

Partnerships under a public-private partnership (PPP) arrangement can facilitate the shared responsibility of providing access to the continuum of care in the region, along with the shared rewards. Under a PPP, a partnered company could be responsible for managing the day-to-day operations of a Catawba-owned facility, such as the new residential treatment program and outpatient facility. This could include responsibilities such as hiring and supervising staff, managing budgets, and providing clinical services to patients. The public sector, represented by the Department of Behavioral Health and Developmental Services (DBHDS) and Catawba Hospital, may provide funding for the facility and set performance standards and quality benchmarks for the private company to meet. The partner company may also be required to meet certain financial and performance targets set by DBHDS and Catawba Hospital, such as reducing costs or improving the quality of care.

These partnerships also allow Catawba Hospital to expand its services to new geographic areas or populations that may not have been served otherwise, including marginalized populations and low-income communities of color. PPPs are beneficial in that they can bring private sector expertise and efficiency to the delivery of public services provided by Catawba and DBHDS. These partnerships with the private sector can also bring additional financial resources to Catawba Hospital, which can be used to improve and expand services, purchase new equipment, or invest in research and development. Additionally, private sector partners may have expertise in managing and operating SUD facilities more efficiently, leading to cost savings and improved quality of care, not to mention new technologies, approaches, and practices that may not be possible without private sector participation.

To implement successful partnerships, it is important to develop a clear roadmap or process for transitioning completed projects to stakeholder agencies and establish well-defined terms of engagement for partnerships. This includes setting clear goals and objectives, outlining the roles and responsibilities of each partner, and establishing a system for communication and collaboration. Additionally, it is important for Catawba to have a method for evaluating the impact and effectiveness of their projects and initiatives and be prepared to make changes to their approach as needed, in order to continuously improve the quality of care provided to patients. Performance metrics describing program impact may include shared ones among the partners or internal ones, specific to the organization. Agreements or metrics tied to financial elements must be chosen with care so they are in accordance with legal requirements like Stark, anti-kickback laws. Still, public reporting emphasizing cost savings may be needed but how those estimates are developed may be expressed in general terms. For instance, emergency room visits may be a calculation of average cost per outpatient visit multiplied by the number of estimated patients not seeking care in that venue. Any performance metrics associated with the collaboration should have an established baseline to reference impact.

There are other PPP models that can be beneficial for the transformation of Catawba Hospital, and some of these models may require legislative approval before they can be enacted or even

explored such as the model used for the Virginia Center for Behavioral Rehabilitation (VCBR) [§ 37.2-909(A)] which focused on patients with dual diagnoses of behavioral health and addiction disorders. By exploring different PPP models and partnerships, Catawba can identify the most effective ways to address the behavioral health continuum in their region and ensure that patients receive the care and support they need.

By building relationships with a wide range of partners, Catawba Hospital can create a more comprehensive and integrated approach to care that is better equipped to meet the needs of patients. This includes partnering with other hospitals, primary care providers, social service agencies, educational institutions, private companies, and other organizations that can provide support and resources to patients both within and outside of the healthcare setting. A diverse network of partners can help to ensure that patients have access to a full range of services, including preventive care, early intervention, and ongoing support and resources. This will make it possible for Catawba Hospital to provide care that is tailored to the specific needs of patients and improve the overall health outcomes in the region.

Resources:

Acadia Healthcare. Integrative Behavioral Health Partnerships

Milwaukee County Behavioral Health Services. Community-centric partnership

Associations Between Cross-Sector Partnerships and Local Health Department Participation in Population-Based Activities to Prevent Mental Health Conditions. Overview of partnerships with local health departments (LHDs) and community organizations

The East Metro Mental Health Roundtable
https://www.healthpartners.com/ucm/groups/public/@hp/@public/documents/documents/entry_202255.pdf

Existing Facilities Assessment

An assessment of the buildings and facilities on the Catawba Hospital campus indicated that there were five buildings which could be used -- renovated, or otherwise modified to support the mission to create a state-of-the-art facility to provide the desired continuum of care.

The main hospital, building 15, is currently having significant upgrades made and therefore will play a prominent role to support therapeutic programs. Buildings 16 and 17, Dining Hall and Treatment Mall respectively, along with Building 15 will serve as the core of the existing facilities that will be part of providing the new services on the campus. Also building 22 will be repurposed to support the program. All the buildings noted above will require some level of renovation as part of the project. The Assessment of all the buildings in addition to those addressed above is provided in Appendix C.

The Catawba campus infrastructure, such as the central plant utilities (power, water treatment and wastewater treatment) will likely require some upgrades and expansion to provide for any increased demand required for new structures. With that noted, there appears to be no obvious obstacles to providing any additional buildings necessary on the campus.

Physical Description and Environmental Considerations

The design of a modern, state-of-the-art state substance use disorder and psychiatric facility is a careful balance among budget, appearance, internal environment, amenity, safety, security, staffing, operational and maintenance efficiencies. By properly addressing the above, and using well-trained and capable staff, it can be expected that the facility will contain all of the elements that will directly result in successful treatment outcomes, staff attraction and retention, and enhanced performance, and safety and security for patients, staff, and the community.

The program and conceptual facility layouts provided in this document are just the basic outline that begins to describe how this facility can fulfill the above-stated objectives. It is in the execution of the detailed design that these critical factors come together to create a whole that is greater than the sum of its parts. A design team experienced in this specific facility type is essential to the project's success.

Exterior Objectives

Catawba Hospital is an important member of the local and state community and its architecture should reflect its stature. It should be complementary to the local architectural context and reflect as much as possible a non-imposing, non-threatening residential character. The hospital is a place of healing and personal discovery and should inspire those who reside and work there. At the same time, it must be built in a manner that is cost-effective and provides for ease of maintenance. Thus, it is important that every effort be made to explore appropriate design and building solutions that respect and respond to both criteria.

The final site plan should include outdoor recreation and related areas, especially gardens and walking/running paths. Efforts should be made to provide appropriate screening of patients in these areas from public view and to minimize the opportunity for contraband finding its way into the facility.

Interior Objectives

The major design focus for the project should be applied to the interior patient and staff areas of the facility. For a truly effective treatment and rehabilitative environment, special attention must be paid to designing for an abundance of natural light, views to the outdoors (sky, gardens, courtyards, sculpture gardens, etc.), use of color and pattern, spatial variety, formal and informal spaces for programming and socializing, way finding, and transparency. Small, enclosed, and claustrophobic spaces; narrow, dead-end corridors must be avoided. All of these considerations will benefit the well-being and behavior of both patients and staff alike, contributing to a safer operation, enhanced human performance, and more effective treatment.

Overall, a purely institutional character should be minimized while focus on more normative, residential-style qualities should be heightened. The term "normative" refers to the experience that users would have in the "real world." Living units should feel home-like. Program,

education, and vocational areas should feel school-like, while the treatment malls should emulate a town center feel. In creating a variety of familiar experiences throughout the facility, as well as comfortable, familiar individual spaces, a stimulating daily journey can be achieved to help normalize the experience of patients, therefore enhancing their response to treatment. In turn, this same approach creates a much more treatment-amenable, comfortable, and safe working environment for staff.

Operations

The operational aspects of the transformed Catawba campus will include greater staffing efficiency, ease of movement, durability, minimal maintenance, and safety and security, to name a few. The single most expensive aspect of operating a facility of this type and size is staffing. After the initial capital cost of construction and outfitting, cost of staffing is an ongoing expense that far outweighs any other cost. Therefore, the facility must be planned and designed to be operated efficiently with the staff required to meet required treatment, service, maintenance, safety and security needs.

Clear circulation, unobstructed lines of sight, easy monitoring of patient activities and movement all help to minimize the number of staff required to maintain a safe and secure facility. Other considerations include a practical layout of the living units and functional spaces that are used by patients, a durable facility that requires minimal maintenance. The better the design, the fewer auxiliary staff will be required to operate the facility, resulting in tangible savings over the life of the facility.

During the detailed planning and design of the facility, it is imperative to focus on how people move through and use the facility's many departments not just the building, finish materials and furnishings. With careful consideration and response, this project can be designed to require a minimal number of auxiliary staff resulting in considerable saving to ongoing staffing costs. Sound planning and design will also require less security staff to maintain safety in the day-to-day operations of the facility.

In the end, the facility is there to support the treatment mission in the most effective manner possible. It is a vehicle for the delivery of these services but must also allow all of the staff to deliver their respective services safely and efficiently. A well-designed facility can accomplish these goals while enhancing patients' treatment and staff performance.

Circulation

Simple and well-monitored circulation is an important planning consideration for any secure psychiatric and substance use disorder facility. Safety, security, rapid emergency response, facility evacuation and the ease of way finding throughout the facility all depend on clear and simple circulation.

Ample corridor width is also important to allow for ease of movement and enhanced monitoring. The main circulation corridors of the expanded Catawba Campus Acute Care building, as currently envisioned, will consist of a primary corridor connecting the new bed units. This circulation corridors will connect to the existing building 17 treatment mall and Dining Building 16. The main corridor leads to a new lobby central control in options B and C. Option A lobby/central control remains in its current location. The back-of-house support areas remain in current locations on all options. The other corridor leads from one living community to the other. Secondary circulation is provided to allow ease of movement within each living community and between living units, programs spaces, support areas and the primary circulation corridors.

Each living community will have its own dedicated, simple corridor system that contains secondary security observation posts for monitoring patient movement within each community. Access to the actual living units will be controlled in all cases, with control doors at the all unit entries.

Tertiary circulation is provided to allow for movement of staff and goods through the facility at large. All tertiary corridors would be considered staff-only, except in cases where “privileged” patients may assume support roles within the facility. This is purely an operational consideration, but the strategic placement of control doors and sally ports will allow for any combination of access according to programmatic and operational preferences.

Efficient circulation is all about finding your way. This will be accomplished and enhanced primarily by how the circulation paths are designed using landmarks and visual locational cues along the journey. This supported by clear signage and color-coding applied in a variety of ways will facilitate way finding.

In the detailed planning and design of the facility, every effort should be made to avoid dead-end corridors or long corridors with just a door at one end. Attention to these areas of circulation are important in providing an appropriately therapeutic environment where patients (especially those on psychotropic medications) aren’t disturbed by the appearance of being “trapped” at the end of a long tunnel-like corridor. This too is an important factor in way finding. This is a current challenge of the units in building 15.

Security and Security Zoning

The overall security approach for the transformed Catawba Campus is like other projects of this type. The perimeter of the facility would need to be full controlled using a medium-level security fence line and vehicular/pedestrian sally ports. The internal security in a modern psychiatric facility catering to patients of varying acuity levels and types of commitment is specifically responsive to the requirements for each sector of the population within the facility's two patient residential communities, Acute Behavioral and Residential / Transitional.

Our philosophy regarding psychiatric facility security is two-fold; one, the physical facility planning and second the use of electronic systems. The physical relies on ois lines of sight, wall construction, etc. and accounts for the first line of safe and secure operations. The electronic systems (locking/control mechanisms, CCTV, duress alarms, etc.) provide a secondary means of supporting the security needs at the facility. A well-planned facility will have clear, un- obstructed lines of sight throughout and the ability to minimize staffing by providing easy monitoring of patient activities and movement.

In a modern psychiatric facility, and to the extent allowable for the intended mode of operations, our belief is "maximum security outside, maximum freedom inside." This approach allows for the most "normative" living environment possible for the patients, providing physical and electronic controls as required to maintain the acceptable degree of safety and security for staff, patients, and the community.

Internal Security

As stated above, well-informed, intelligent planning by a designer experienced in this building type is one of the most critical elements in creating a safe and secure facility. It is imperative that staff have, as a first line of safe operations, the ability to visually monitor patient activities and all movement throughout the facility. This factor should apply not only to areas designated for daily patient use, but also in areas designated as "staff-only."

All areas of the facility and its two communities (Acute and Residential / Transitions) will offer varying degrees of access and movement for both patients and staff using a combination of control doors placed strategically throughout the facility. Efforts will be made to ensure that anyone traversing through the facility can do so in an expeditious yet controlled manner. It is anticipated that a card-/chip-banded access system will be used for both staff and patients to allow complete control over who goes where while at the same time allowing security staff to monitor and log this movement using their control system.

A staff duress system, with transmitters carried on-person will allow security to immediately locate and respond to emergency situations that may arise anywhere within the facility.

Departmental Narratives

Living Units

The new Adult Acute living units have been programmed to provide nearly identical floor plates for ease of use among all staff members who may migrate from one unit to another. This familiarity helps to enhance delivery of services, efficiency of operations, safety and security.

Each living unit has a separate, staff-only service and access corridor. This gives the staff a safe “back-of-house” zone from which they can enter and exit the unit without direct contact with patients if needed. This zone also allows service personnel to access the unit for a variety of maintenance, security and service needs without introducing them to the patient population and potentially disrupting daily on-unit activities.

Because of the dual populations the hospital must serve, two living unit concepts are employed; one for Adult Acute Behavioral and another for Residential Transitional patients. Every unit is planned with an activity zone, sleeping zone, support services zone and a nursing center.

Living Unit – Residential Transitional Patient Room

Each living unit has a variety of dedicated spaces to support the patient population and offers a variety of daily activities. Spaces include quiet and active program rooms, comfort room, group room, exam/physical survey room, enclosed outdoor patio, consultation room, and seclusion rooms. This level of variety promotes variation in daily patient activities and enhanced operational flexibility as the facilitation of services and treatment may change over time.

Toilets and showers are also centrally located off the unit core to allow staff maximum observation and management of their use. In addition to the centrally located toilet facilities, the

patients will have specially designed ensuite toilet facilities that can be managed by staff as necessary. The residential transitional SUD patients would not have ensuite toilet facilities because of the current layout and the narrow building 15 floorplate.

Other program spaces within the unit (including the above) are traditionally included in psychiatric nursing units as required by current planning standards.

Special focus during design should be placed on the provision of non-institutional, residential "feel" finishes and furnishings. Use of carpet or carpet tile where possible is recommended. Acoustics are extremely important in creating a calm and treatment-amenable environment. Abundant light and views are also required to help provide a normative environment.

Each living unit will have both active and passive zones and access to an outdoor recreation area. Where living units are on the second floor, a stairway to the outdoor recreation area, fully glazed to maximize observation of patient movement, should be provided. The units have electronically and manually operable doors and sleeping rooms are located away from the activity zone.

Programs

Admissions

The admissions program is a suite for receiving and processing new patients that will be located in the existing building 15 in Option A and B and for Option C would be in the New Adult Behavioral Building. The new admissions unit will be as comfortable as possible in finish and furnishings balanced with the need for enhanced durability and security. The admissions process is traditionally one in which patients feel at their most vulnerable and on edge. A soothing environment will help to calm patients and consequently create a safer, more expedient admissions process.

Program Staff

This department would be located near the new adult care beds and would include all program staff (psychologists, therapists, social workers, and support staff). They would access their space by going through the lobby and security in all options. They would go directly to their office areas and to the core of the facility to serve their treatment mission. The environment should be professional and like a typical office in appearance. There should be abundant daylight via windows and/or skylights to create the healthiest and most productive work environment.

Patient Dining (Provided in Existing Building 16)

The existing dining rooms will serve the Adult Acute Behavioral population and Residential transitional SUD population located within their separate building in the new complex. The existing dining rooms are not sized for all patients to be able to dine off the unit as on unit dining is also provided. Both populations need to have the flexibility to dine on unit based on level of

acuity. Each housing unit will have a small food break out area. The existing dining room is located well for both populations and is adjacent to the food service kitchen for ease and efficiency of service. The location takes advantage of exterior access views and has large windows overlooking the outdoors.

Treatment Mall (Provided in Building 17 and Building 15)

The treatment malls (one for residential transitional SUD patients and one for Adult Acute Behavioral patients are the figurative “town squares” of the facility and contain all programs available to the patients, including treatment, education, vocation, and amenities such as a library, computer rooms, recreation, and other service and support components. These areas are an important part of a patient’s daily journey and should reinforce a positive and desirable routine. They should be designed in a way that emulates a public mall or “main street,” with storefronts, signage, colors, and materials that normalize the environment to allow patients to be more open to treatment and other activities.

Since this is a highly structured living situation, accommodation should be made wherever possible for informal seating and meeting places to encourage unscheduled conversation and activities between patients or patients and staff. This approach will help in making positive interaction and thus communication between and among all users a natural and desirable feature of the design.

Education

The education components of each treatment mall consist of classrooms, arts and crafts, computer rooms, library, and support spaces. These areas should be designed with abundant light and large windows to the mall for easy observation and with good acoustics in mind. The glass may be fritted (up to approximately 4- to 5-feet high) to prevent distraction to the patients from passers-by. This area should emulate a high school or junior college classroom environment.

Vocational Services

Vocational Services are provided for both the residential Transitional SUD patients and Adult Acute Behavioral patients. This suite is composed of labs and classrooms, a computer lab, and areas for car wash, horticulture (including the existing greenhouse), housekeeping, and instruction and support areas. To gain entry to this suite, patients with the appropriate acuity must pass through a security portal to prevent patients from obtaining contraband from the workshops.

Associated with this project component could be a donated clothing store that could take in lightly used items and these could be, repaired and cleaned as needed, and offered for free or at a minimal cost to patients who need them. It can best be equated to a thrift shop for the patients.

As with the education components, they should be designed with abundant light, large windows to the mall for easy observation and with good acoustics in mind. This department should also emulate a high school or junior college classroom environment.

Recreation Services

Residential Transitional SUD patients and Adult Acute Behavioral patients' communities will have nearly identical amenities in this area, including gymnasiums (existing gym is shared), physical therapy, and weight rooms. The current gym has natural light, the positioning of clerestory windows prevent glare on the floor.

Shared Patient Services

This series of program support components are of a variety that the designer can be quite creative in how the support components appear. These components form the heart of the treatment malls, and are much like the center of town, with multiple store fronts. Each community's mall includes:

- Group therapy rooms
- Multi-denominational worship room
- Barber/beautician
- Game room
- Independent living skills lab
- Music therapy rooms
- Meditation rooms
- Exam/physical survey rooms

As with all other "public" areas of the communities, transparency for ease of patient monitoring is of great importance, as is the creation of as normative environment as possible. If possible, centralized gardens (or "parks") should be located directly off the malls so that patients can walk freely from inside. This feature will also introduce views and light into the mall. Other considerations for the malls are park-like benches and informal seating areas and a wider area in the center of this most active part of the mall.

Support

The support areas of the hospital and residential units consist of both administrative and service areas where each should be designed according to use and with a modern professional design aesthetic.

Public Lobby

This area should be designed to a standard as would be the case in any new community hospital. The environment should be bright, pleasant and welcoming. Warm materials, color

palettes, and furnishings should set the tone for a safe and calm place of arrival. Video information kiosks and other modern amenities to assist in dissemination of information and way finding are desirable. The reception station should be front and center and have good line of sight throughout the lobby, including the screening area and public toilet entries.

Executive Administration, Human Resources and Staff Development
All of these are traditional administrative office areas that have been collocated to maximize efficiency by sharing support functions such as restrooms, work and copy rooms, storage, housekeeping, and other needs.

Special attention to a modern and pleasant working environment is important, as is abundant daylight with windows where possible and skylights or monitors where necessary. If possible, internal office areas should have clerestories and/or glazed transoms over doors to allow as much daylight as possible from adjacent areas. These areas will be located in the outpatient building for the substance use disorder program only. Existing hospital administration remains in its current location.

Kitchen
The existing kitchen will provide space to receive and store ingredients, prepare, cook and distribute meals to the patients as necessary based upon the particular needs of the patients and of the units. Each unit will house an area to distribute food once delivered to the unit. Each 16-bed housing residential housing unit will have one residential kitchen to promote life skills and success after discharge.

Housekeeping
This component is strictly utilitarian in design and layout and remains in its current location adjacent to the maintenance/materials management department and loading dock. It may also be used for vocational training of privileged patients.

Maintenance/Material Management
This component is also strictly utilitarian in design and layout and remains in its current location adjacent to housekeeping and the loading dock. It may also be used for vocational training of privileged patients.

Energy Plant
A small energy plant would be built directly adjacent to the Adult Acute Behavioral building and the Outpatient Building. This would be contiguous with the rest of the building in order to minimize construction costs. It should be secure from access to any patients.

Medical/Dental
The medical and dental would be upgraded or replaced in the options. If replaced it would be adjacent to the treatment mall in building 15, but on the 1st floor.

Pharmacy
The pharmacy upgraded or replaced in the options. If replaced it would be adjacent to the treatment mall in building 15, but on the 1st floor and will provide both outpatient and inpatient

support.

Facility Modeling, Functional and Space Programming

The data analysis initial programming indicates that additional space is needed and must address:

1. Detoxification for medically stable patients,
2. Inpatient facilities to treat those with both SUD and behavioral health disorders,
3. Biotechnological facilities for the advanced assessment and treatment of patients,
4. Satellite nursing workforce training and development facility -- Workforce development for practitioners, nurses, and behavioral health technologists in the behavioral health continuum of care continues to be a critical need. The Catawba project would provide square footage for a satellite campus of a nursing school for one of the local universities to provide on-site nursing education and clinical experience on the campus with the new proposed programs. This square footage would be provided in one of the new buildings, potentially a floor of the outpatient building. Long-term planning considerations would allow the growth of this program on the campus to a full-scale behavioral health nursing school.
5. Approximately 100 residential treatment beds. Not to be confused with “hospital” beds; the residential treatment bed would be very similar to small dorms. A major problem in treating SUD is the inability to continue treatment after detoxification is complete, but before the patient is ready to return home. The result is multiple readmissions. In effect, the residential treatment is the necessary stabilization point in a supportive treatment setting that sets the stage for return to home, family and work that the Commonwealth desires Catawba Hospital provide.

These spaces have been scheduled, planned, and cost estimated as part of this report

Space Programming

To develop the program for the transformed hospital campus, collected data and combined with best practices and developed into space requirements. On the next page is the summary of the square footages derived from the space programming effort. Due to time constraints no meetings with departments took place. HDR used our team's experience in designing behavioral health facilities, referencing the current standards and guidelines listed in the concept narratives to create the program. The full space program is included in **Error! Reference source not found.**E

Option A Program

	Option A			Renovation	New Construction
Space Program Summary					
Program	**NSF**	**Grossing Factor**	**Comments**	**DGSF**	**DGSF**
Residential Treatment					
RT Unit 2 - Level 6 - half floor (16 Beds)	5,230	1.40	1 16 bed units		
RT Unit 3 - Level 7 (32 Beds)	10,050	1.40	2 16 bed units		
Treatment Mall - Level 3	9,240	1.35			
	24,520		48 beds	**31,774**	
Acute Adult Behavioral					
AB Unit 1 (32 Beds)	13,637	1.60	2 16 bed units		**21,819**
AB Unit 2 (32 Beds)	13,637	1.60	2 16 bed units		**21,819**
Renovated Treatment Mall	28,000	1.10	(Includes new connecting corridor	**36,400**	
	55,274		64 beds		
Detox					
Detox Unit - Level 6 (1/2)	5,495	1.40	1 16 bed unit		
	5,495		16 beds	**7,693**	
Outpatient Education and Research Building					
Outpatient Clinic	11,259	1.35			
Education and Research	11,620	1.30			
Administration	4,872	1.30	Shared Floor, Admin. & Clinical		
Addiction - Clinical Support	7,466	1.30	Shared Floor, Admin. & Clinical		
	35,217				**46,345**
Total NSF					
Total DGSF				**75,867**	**89,983**
Mechanical/Electrical				-	8,099
Building Grossing				-	8,998
Total Building Gross SF (BGSF)				**75,867**	**107,080**

Option B Program

	Option B			Renovation	New Construction
Space Program Summary					
Program	**NSF**	**Grossing Factor**	**Comments**	**DGSF**	**DGSF**
Residential Treatment					
RT Unit 1 - Level 5 - Half floor (16 Beds)	5,230	1.40	1 16 bed units		
RT Unit 2 - Level 6 (32 Beds)	10,050	1.40	2 16 bed units		
RT Unit 3 - Level 7 (32 Beds)	10,050	1.40	2 16 bed units		
Treatment Mall - Level 3	9,240	1.35			
	34,570		80 beds	**47,936**	
Acute Adult Behavioral					
AB Unit 1	13,637	1.60	2 16 bed units		**21,819**
AB Unit 2	13,637	1.60	2 16 bed units		**21,819**
AB Unit 3	13,637	1.60	2 16 bed units		**21,819**
Renovated Treatment Mall	28000	1.30	includes new connecting corridor	**36,400**	
	68,911		96 beds		
Detox					
Detox Unit - Level 5 (1/2)	8,967	1.60	1 16 bed unit		
Intake	5,443	1.60			
	14,410		16 beds	**23,056**	
Outpatient Education and Research Building					
Outpatient Clinic	11,259	1.35			
Education and Research	11,620	1.30			
Administration	4,872	1.30	Shared Floor, Admin. & Clinical		
Addiction - Clinical Support	7,466	1.30	Shared Floor, Admin. & Clinical		
	35,217				**46,345**
Renovate Bldg 22 for Staff Apartments	**5,000**	1		**5,000**	
Total NSF					
Total DGSF				**112,392**	**111,803**
Mechanical/Electrical				-	10,062
Building Grossing				-	11,180
Total Building Gross SF (BGSF)				**112,392**	**133,045**

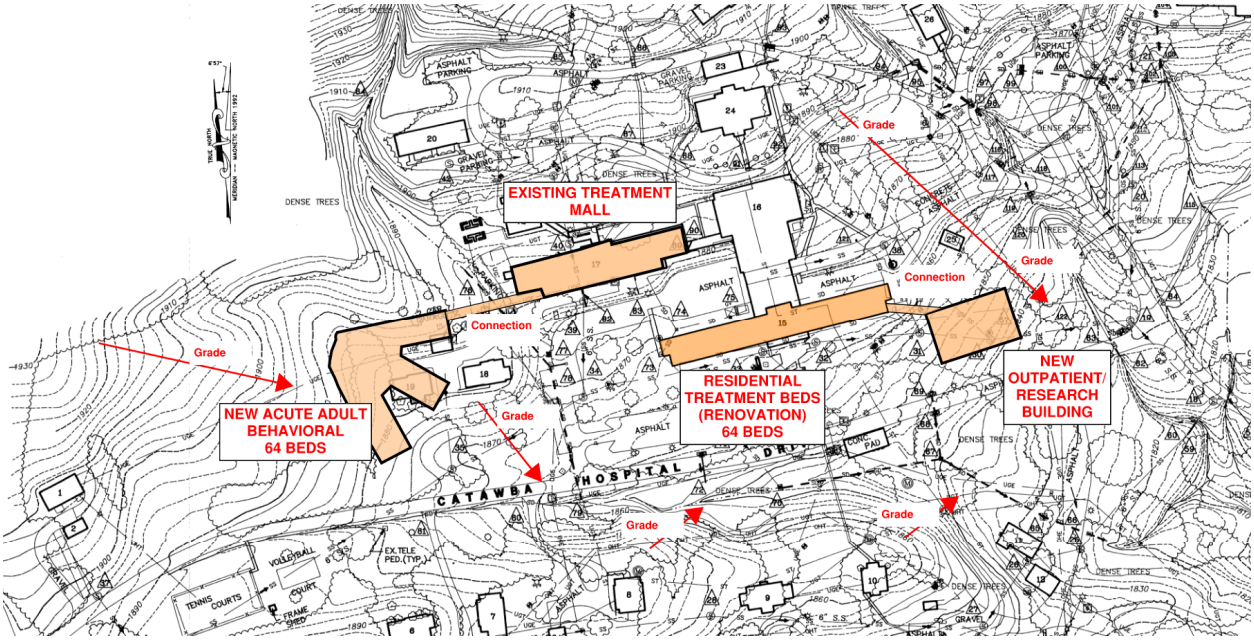
Option C Program

	Option C			Renovation	New Construction
Space Program Summary					
Program	**NSF**	**Grossing Factor**	**Comments**	**DGSF**	**DGSF**
Residential Treatment					
RT Unit 1 - Level 5	10,050	1.40	2 16 bed units		
RT Unit 2 - Level 6	10,050	1.40	2 16 bed units		
RT Unit 3 - Level 7	10,050	1.40	2 16 bed units		
RT Unit 4 - Level 4	8,450	1.40	2 16 bed units		
Treatment Mall - Level 3	9,240	1.35			
	47,840		128 beds	66,514	
Acute Adult Behavioral					
AB Unit 1	13,637	1.60	2 16 bed units		21,819
AB Unit 2	13,637	1.60	2 16 bed units		21,819
AB Unit 3	13,637	1.60	2 16 bed units		21,819
AB Unit 4	13,637	1.60	2 16 bed unit		21,819
Renovated Treatment Mall	28,000	1.30	includes new connecting corridor	36,400	
	82,548		128 beds		
Detox					
Detox Unit	8,967	1.60	1 16 bed unit		
Intake	5,443	1.60			
	14,410		16 beds		23,056
Outpatient Education and Research Building					
Outpatient Clinic	11,259	1.35			
Education and Research	11,620	1.30			
Administration	4,872	1.30	Shared Floor, Admin. & Clinical		
Addiction - Clinical Support	7,466	1.30	Shared Floor, Admin. & Clinical		
Building Shell Space	15,000	-			
	50,217				61,345
Renovate Bldg 22 for Staff A	**5,000**	1		5,000	
Total NSF					
Total DGSF				107,914	171,678
Mechanical/Electrical				-	15,451
Building Grossing				-	17,168
Total Building Gross SF (BGSF)				**107,914**	**204,297**

Site Analysis

Several locations were explored during the preplanning period. The overall footprint as developed was used to determine site space requirements. The area directly west of building 17 was mostly open and sloped less than other areas. It was also large enough to house the footprint needed for the new Adult Acute beds. This building needs a direct connection to the treatment mall, so the location selected works well. To the east of building 15 is also an open and sloped less than other areas and provided a direction connection to building 15. The area is small so the smaller footprint of the outpatient building worked well for this location. Other parameters evaluated included location of existing utilities, disturbance of natural resources, site grading cost, and demolition cost.

Site Diagram Overall

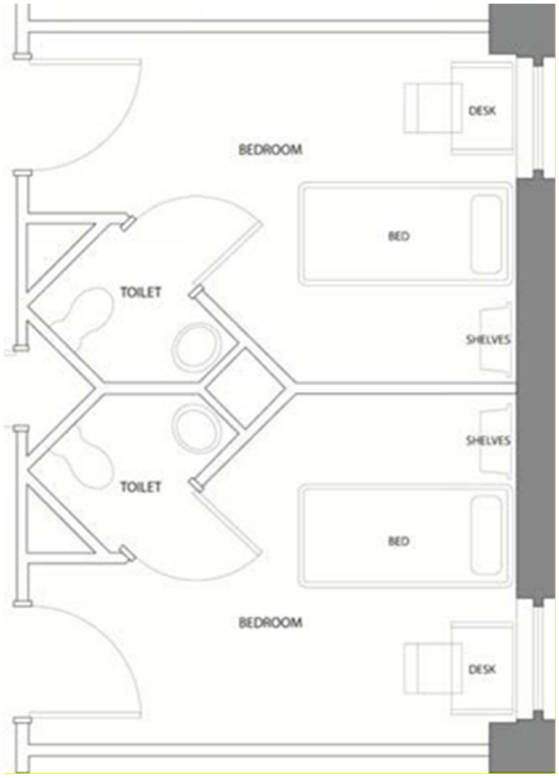


Concept Plan

The program and conceptual facility layout provided in this Study are just the basic “kit of parts” that describes how the facility can fulfill the previously stated objectives. It is in the execution of the detailed design that these critical factors come together to create a whole that is greater than the sum of its parts. A design team experienced in this specific facility type is essential to the project’s success.

As with most design challenges there are multiple solutions. Many factors must be considered when developing a concept for a new facility. Constraints such as budget, staffing, operational treatment model, and available sites are just some of the many issues to consider. The Acute Adult Behavioral patient rooms would be in the new building and would include ensuite toilet rooms where appropriate for the hospital’s population. Accordingly, the Western State Hospital patient rooms are appropriate for the Catawba Hospital populations. The bedrooms with ensuite toilets will be approximately 150 net square feet in area for ADA and 130 net square feet for non-ADA. The SUD patient rooms would be similar in size and would be located in building 15. The existing footprint is not conducive to ensuite toilets.

Typical Acute Adult Patient Rooms



Living Units Pods

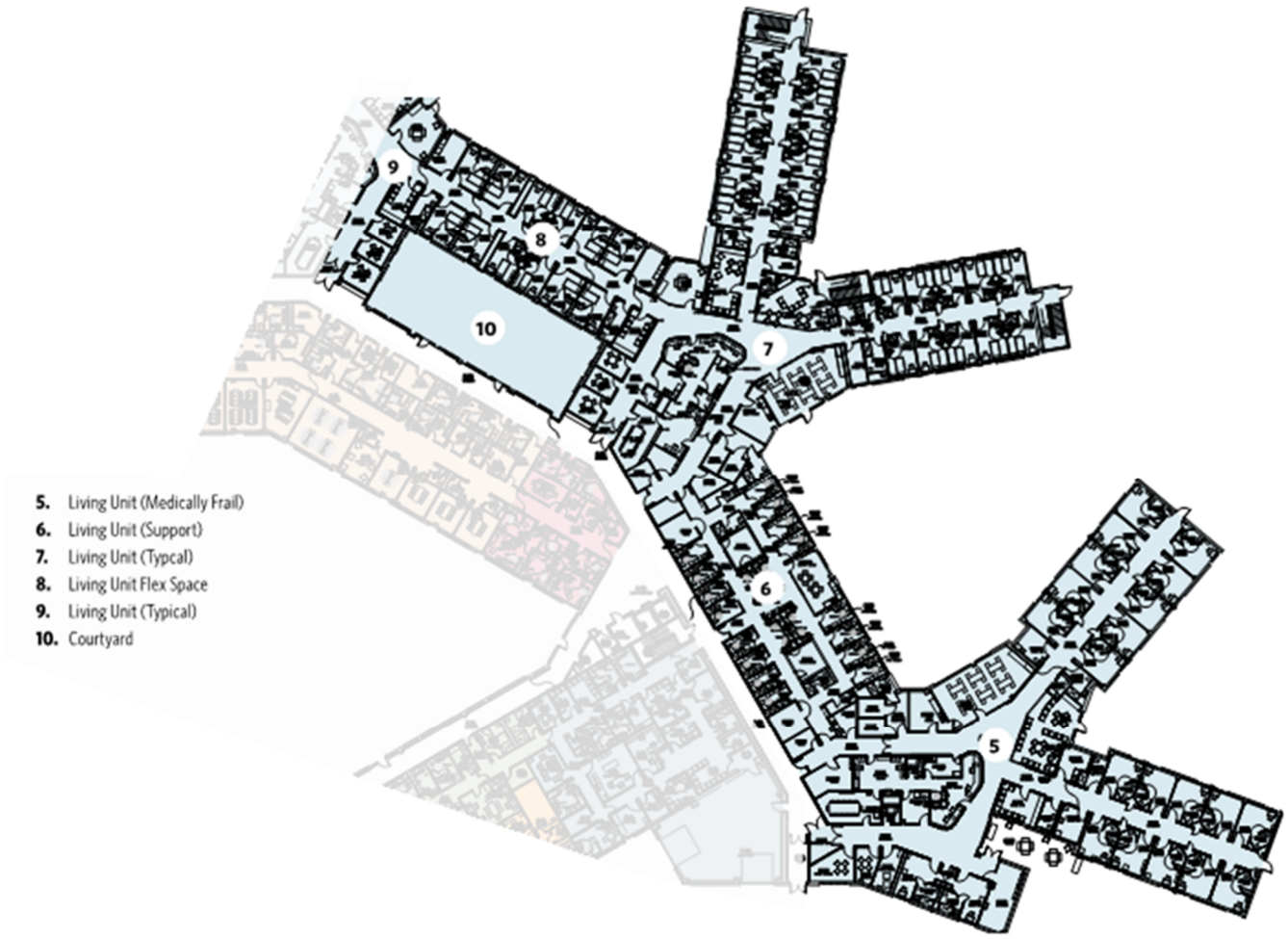
As discussed in the departmental narratives, two living unit concepts are used to accommodate the two populations that are served. The diagrams below illustrate Adult Acute concept.

Living Pod – Adult Acute Behavioral

In a more detailed look, each living unit will have a separate, staff-only service and access corridor and a central day and/or dining core to maximize staff observation of patient activities and movement. The above diagram shows the relationship of the sleeping, activity, and support zones with the nursing node.

Site Diagram Adult Acute Behavioral Health Addition

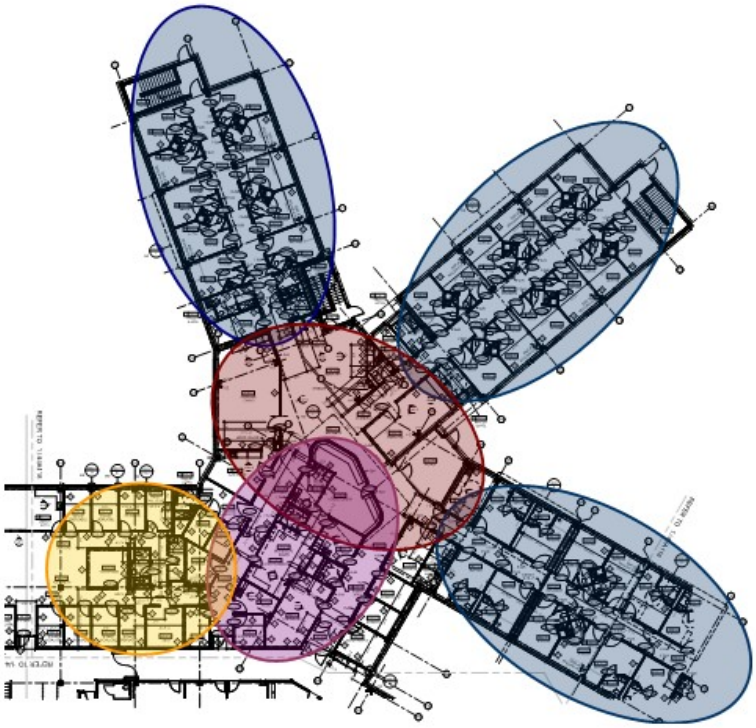
Western State Hospital (WSH) Living Unit



The Adult Acute living unit will have a separate, staff-only service and access corridor and a central day and/or dining core to maximize staff observation of patient activities and movement. However, the Adult Acute living unit places the sleeping zone farther from the nursing node and is not as intimate with the activity zone, all while providing patient “observable privacy.” This relationship, as shown in the diagram on the following page, helps to create a more normative environment for patients.

The figure below shows how the Living Pod bubble diagram was translated into the Patient Care Units at Western State Hospital.

WSH Living Unit



Facility Zoning

The transformed campus will consist of four major zones: Outpatient, Research and Education, Acute Adult Housing and SUD Housing, administrative and support. This zoning approach recognizes that two distinct security and treatment modalities will exist at the new facility. Using living unit concepts above, the following scaled planning blocks were developed:

Lobby / Front of House / Administration – Lobby, Security, Clinic, Executive Administration Human Resources and Staff Development

Support / Back of House – Housekeeping, Materials Management, Laundry, Kitchen, Maintenance, and Pharmacy

Central Energy Plant – Sized for Option C level expansion

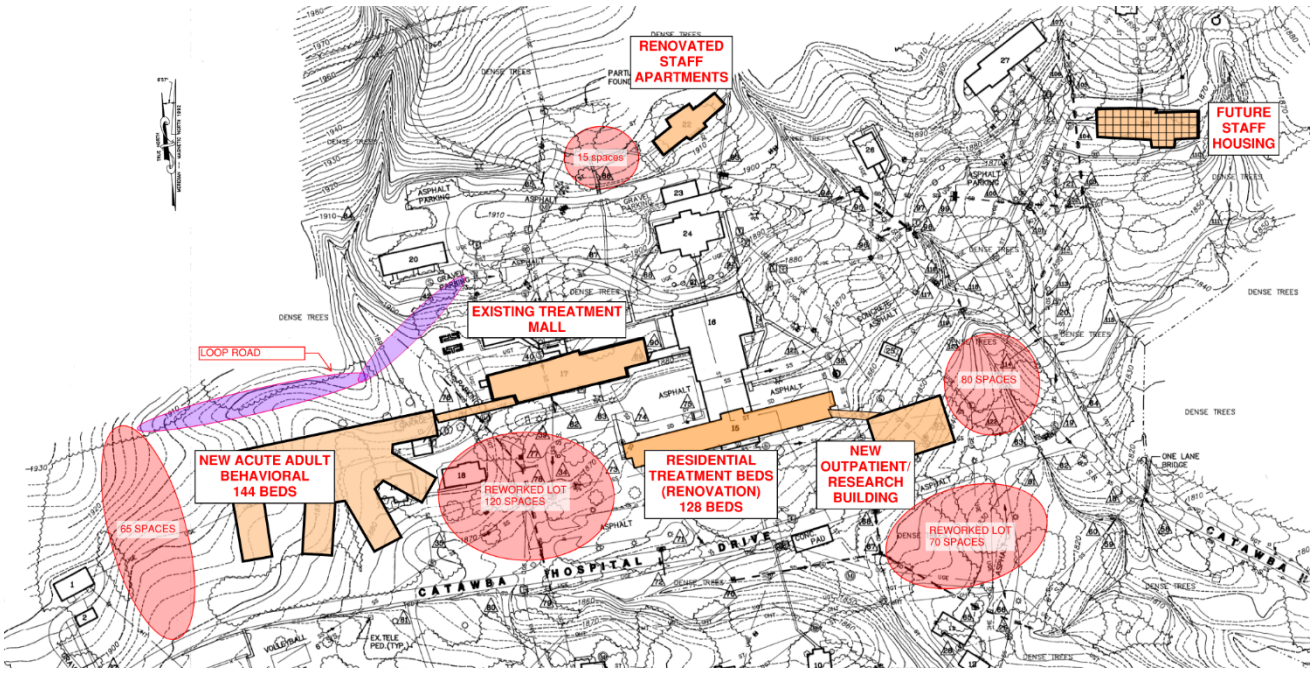
Admissions – One unit provided, existing in Option A and B and New in Option C.

Living Units – 16-Bed Units for both Acute Adult and SUD Residential Transitional

Adult Acute and SUD Treatment Malls -- Education, Vocation, Recreation, Shared Resident Services Program Staff, Visitation, Dining and Transportation

Facility Layout

Using the planning blocks and overlaying them on a same scaled topographical site plan, various layout was explored. Based upon the concepts and principles noted throughout this study, the Transformed Catawba State Hospital layout with possible future options.



Site Concept Plan

This concept organizes the building components around building 15, with strategic placement of expansion of the complex generally to the east and west portions of property. The public-oriented shared “core” elements are located to the south of the complex, facing the vehicular approaches from Catawba Hospital Drive. The expanded Acute Housing units are to the west of building 17 and SUD residential transitional housing are to the east. The “back of house” elements remain to the rear of building 15 as they exist today. Parking is decentralized, with potential for dedicated lots for staff, visitors, and service purposes as shown in the diagram above.

The building organization maximizes access to daylight, provides a circulation system, and offers a secure outdoor space. The public shared elements are located to the southeast, the “back of house” shared elements are to the north, with the two housing units to the west of the Outpatient building courtyard and forming a parallel connected system of circulation with excellent separation of public and service as well as clear zoning of housing security.

Concept Schematic Narratives

Existing Campus Overview

Nestled in the foothills of the Blue Ridge Mountains, the Catawba Hospital campus is comprised of a variety of buildings, ranging from small residential structures along the perimeter to a large 7-story concrete hospital at its core. Due to its remote location, the campus is very self-sustaining and houses its own water treatment plant, a central boiler plant, and a wastewater treatment plant. Water for each building is gravity fed from two large water tanks located uphill from the campus.

The campus originally started out as a resort built in 1858, which was later purchased by the Commonwealth of Virginia and converted into a tuberculosis treatment facility in the early 1900's. Many of the original resort buildings have since been demolished. The only evidence of the original resort that remains is an ornate iron gazebo located over one of the many springs on site and an old two-story building located up the hill.

Now the hospital specializes in serving adults including geriatric individuals who need mental health care. Many current buildings on campus were constructed in the early to mid-1900's, but the greenhouses and gymnasium were built in the later part of the century. The newest building on site was built in the late-2000's, but most of these buildings are 70 to 80+ years old. Descriptions of each building and its general condition are in the attached conditions assessment report. Introduction

The following section provides a schematic narrative for creating a cost estimate for the concepts. The concept schematic narratives assume the basis of design the three options:

Option A Mini Continuum of Care Model

Option B Base Continuum of Care Model

Option C Enhanced Continuum of Care Model

CIVIL

Design Criteria

The site and associated improvements will be designed to meet all applicable standards, codes, and regulations of the Authorities Having Jurisdictions (AHJ). At a minimum, this will include review and approval from DEB, the Virginia Department of Transportation, Virginia Department of Environmental Quality, and the Virginia Department of Health. Additional agencies that may require approval include the Virginia Department of Conservation, and the Virginia Department of Historical Resources. If wetlands or waters of the US are to be disturbed, review and permitting will be required by the US Army Corps of Engineers or DEQ, depending on the nature of the disturbance and whether it is covered under the Nationwide Permit 39 or the Virginia SPGP-01.

As design progresses, the final material, system, and infrastructure selection will be made with input from the appropriate regulatory agency and end user to ensure the operation is efficient and the systems are easily maintainable. All aesthetic characteristics involving the site will be coordinated with the Commonwealth.

Existing utilities may be required to be relocated during the construction. At no time will existing utility service be interrupted. Temporary services will be designed and installed to serve existing buildings.

Where existing buildings are to be abandoned, or appropriate infrastructure, the buildings or utility shall be decommissioned for safety and security after each phase.

SITE CONSTRUCTION

A geotechnical investigation has not been performed at the project site. This will be performed during formal design. At a minimum, soil borings will be performed to determine bearing capacity for the building foundation, pavement design, and the depth to groundwater and rock. Infiltration tests will also be performed to determine applicable stormwater practices.

The existing site is mountainous terrain, with maximum grades varying between 2 and 50 percent. Barring the existence of a great volume of unsuitable soils, the site will target a balanced site, meaning no additional material will be transferred onto or away from the site. The grading activities will include mass grading, trench excavation, rock excavation, structural fill, over-excavation, compaction, and the construction of erosion and sediment control measures.

A blue line stream runs through the site through a combination of manmade channels and natural channels. This stream is classified as a R4SBC (Riverine, Intermittent, Streambed, Seasonally Flooded). In all options, portions of this stream are proposed to be disturbed so permitting through the US Army Corps will be necessary.

STORMWATER MANAGEMENT

The development of the site will result in a significant increase in stormwater runoff. To achieve minimum water quality requirements, a portion of the site could be converted into a conserved open space easement. As the property is large, there is enough area that is considered unsuitable that could be conserved to meet this requirement. To achieve water quantity requirements, underground storage would be the most applicable based on the site constraints. To reduce the conservation area, additional manmade water quality devices could be implemented.

In general, the parking and lawn areas will be graded to curb inlets or yard drains and the roof drains will be collected in an underground pipe network. To assist with energy code compliance and assist with the load on the water system, a rainwater harvesting system could be utilized. Regardless of implementation, all stormwater will be directed to a detention system prior to leaving the site.

There are many options to achieve stormwater compliance. To ensure we have chosen the most cost-effective solution for both implementation and long-term maintenance cost, it is imperative that we coordinate closely with the Commonwealth to evaluate all possibilities.

SANITARY SEWER

The existing sanitary sewer system is served by an on-site sewer treatment plant and associated sanitary sewer piping. The sewer system is fed by gravity from the hospital towards the treatment plant, which discharges into an unnamed tributary of Catawba Creek. Currently, the treatment plant uses a combination of extended aeration and settlement chambers to achieve permitted levels.

Currently the system uses an extended aeration system to treat about 30,000 gallons per day, with a maximum treatment capacity of 120,000 GPD. However, upon assessing the site, it does not appear that there is sufficient storage volume to double the current usage on the campus. Based upon this assessment, additional study is needed to determine what upgrades to the system are needed. However, we plan to double the current capacity of each chamber. As a full survey was not completed, we cannot verify the current capacity of the gravity sewer piping. However, as there is ample fall across the site, it can be assumed that the current piping is adequate for both the existing and proposed conditions. Some piping was noted by staff to be terracotta, so any piping that is disturbed by construction should be assumed to need to be fully replaced. Some of the manholes on site are very old and are not properly sealed. In all options, we recommend that any old manholes in the vicinity of construction be replaced with a current design.

POWER DISTRIBUTION

The project will utilize existing power distribution from the power companies that serve the site. Power will be provided to all on-site signage, lighting, security, and other miscellaneous improvements. Existing easements may need to be relocated.

FIRE PROTECTION

Fire protection will be provided by an internal fire sprinkler system for new or renovated buildings and exterior fire hydrants. Needed fire flows will be calculated based on ISO calculations and site-specific building characteristics. Fire hydrants will be placed as required by the fire marshal to provide adequate coverage. Based on fire flow tests performed during the existing conditions study, there seems to be 1250 gpm for fire coverage for 90 minutes. This equates to 112,500 gallons of total volume, out of an available 250,000 gallons. Improvements to the water supply system will be discussed in the water section below.

Backflow prevention will be required on the fire line. This will be in an external fire connection vault or inside the building if space is available and the required access can be provided. Fire department connections will be located by coordinating hydrant locations and internal fire system design.

STEAM

Site steam lines are fed from the boiler plant located across from Catawba Hospital Drive. These lines serve various buildings around the campus. No improvements or modifications to the existing system are proposed or anticipated.

WATER

Potable Water is currently treated and distributed onsite. The treatment plant provides 50,000 gallons of water per day, which serves 285 people during peak condition, on average 175 gallons/person. Currently the water supply can provide 102,000 gallons per day via the natural spring that feeds the treatment plant. This water is then treated using media filtration and chlorination.

In all options, further analysis is needed to determine if the line sizes that feed the new or renovated buildings can provide the needed fire and domestic demand. A full analysis of the system will be provided during final design. It would be assumed with what is known today that some piping upgrades will be needed, specifically bringing existing pipes of 6” or less that feed these buildings up to an 8” or 10” pipe.

The proposed options differ slightly in what improvements are needed.

Option A:
Increases total peak demand to 358 people. Using the per person ratio, Option A increases the demand to 62,650 gallons per day, which is less than the 102,000 gallons permitted.

The chlorination tank is a 100,000-gallon tank, which has more than enough capacity to handle this additional load. While new pumps to pump from the chlorination tank to the top of the mountain storage tanks are not required to keep up with the demand, it is recommended that an automatic system be installed to avoid the issue of manually having to operate the pumps to fill the tanks. While considering this upgrade, we recommend the pumps be upgraded to allow for the storage tanks to fill faster.

The gravity tanks at the top of the mountain that pressurize the campus distribution system store 250,000 gallons. When including the new fire demand of 112,500 gallons, that brings the potential used volume of water during a fire event to 175,150 gallons. This does not provide an adequate factor of safety during a fire event. We recommend another 125,000-gallon tank be installed to bring the new volume up to 375,000 gallons.

Option B:
Increases total peak demand to 570 people. Using the per person ratio, Option A increases the demand to 99,750 gallons per day, which is less than the 102,000 gallons permitted. However, this number is too close to the permitted number. As such, the water treatment plant needs to be upgraded. Along with the water treatment plant upgrades, rainwater harvesting could be used to reduce the demand on the water treatment plant, along with other benefits of stormwater reduction and energy code compliance.

Improvements to the water treatment plant would be to double the current capacity of the existing system which would allow for additional expansion. Utilizing a similar method of treatment would be recommended, if allowed by the Department of Health. As such, a new structure would need to be added to handle the additional treatment.

The chlorination tank is a 100,000-gallon tank, which has more than enough capacity to handle this additional load. New pumps would be needed to handle the additional domestic demand, along with setting up an automatic system for filling the tanks instead of the manual operation.

The gravity tanks at the top of the mountain that pressurize the campus distribution system store 250,000 gallons. When including the new fire demand of 112,500 gallons, that brings the potential used volume of water during a fire event to 212,250 gallons. This does not provide an adequate factor of safety during a fire event. We recommend a 200,000-gallon tank be installed to bring the new volume up to 450,000 gallons.

Option C:
Increases total peak demand to 586 people. Using the per person ratio, Option A increases the demand to 102,550 gallons per day, which is just slightly more than the 102,000 gallons permitted. As such, the water treatment plant needs to be upgraded. Along with the water treatment plant upgrades, rainwater harvesting could be used to reduce the demand on the water treatment plant, along with other benefits of stormwater reduction and energy code compliance.

Proposed improvements to the water treatment plant would be to double the current capacity of the existing system which would allow for additional expansion. Utilizing a similar method of treatment would be recommended, if allowed by the Department of Health. As such, a new structure would need to be added to handle the additional treatment volume. The chlorination tank is a 100,000-gallon tank, which has more than enough capacity to handle this additional load. New pumps would be needed to handle the additional domestic demand, along with setting up an automatic system for filling the tanks instead of the manual operation.

The gravity tanks at the top of the mountain that pressurize the campus distribution system store 250,000 gallons. When including the new fire demand of 112,500 gallons, that brings the potential used volume of water during a fire event to 215,050 gallons. This does not provide an adequate factor of safety during a fire event. We recommend a 200,000-gallon tank be installed to bring the new volume up to 450,000 gallons.

ASPHALT PAVING

Asphalt paving will be utilized for all on-site drives and parking areas. Final pavement design recommendations will be provided by the geotechnical engineer. Drive aisle and fire access will be coordinated with the fire marshal to ensure emergency access requirements are met. Heavy duty and light duty pavement will be placed so that emergency vehicles and large vehicles do not destroy the asphalt or degrade the surface beyond what is typical for the life cycle of this pavement material.

CONCRETE PAVING

Concrete pavement is proposed for all sidewalks, plazas, and loading areas. All decorative paving, stamping, and paintings will require a mock-up/sample to be reviewed and approved by the owner.

FENCES AND GATES

Fences and gates will be placed as necessary around the site to prevent ingress or egress where needed.

SOIL PREPARATION, TURF AND GRASSES, AND PLANTS

The final design will include a detailed landscape plan showing limits of turf grass, plant type, trees, shrubs, and irrigation.

TELEPHONE, DATA, COMMUNICATIONS

The site is currently served by telephone, data, and communications services. Those services will be relocated or extended as necessary to serve the new or renovated areas.

Architecture & Life Safety

New Design Concepts

BUILDING 15: RESIDENTIAL TREATMENT & TRANSITIONAL SPACES

Built in 1953, this existing building is a large seven-story concrete building with load bearing concrete walls at the exterior and a single row of columns and a continuous drop panel running parallel along the central corridor. The floors and roof structure appear to consist of one-way slab construction. This building will be renovated to provide residential treatment and transitional spaces for the residents. It will undergo a mix of cosmetic and invasive renovations across all three options, with additional floors being renovated with each sequential option. Below lists the renovated floors included in each option:

Option A

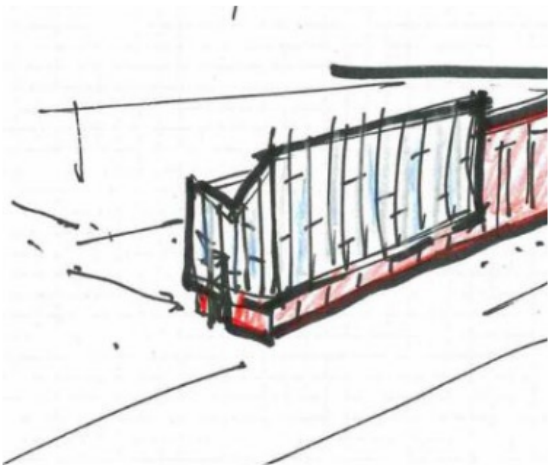
- Light renovation: Floors 1, 2, and 3
- Significant renovations: Floors 6 and 7

Option B

- Light renovation: Floors 1 and 2
- Significant renovations: Floors 3, 5, 6, and 7

Option C:

- Light renovation: Floors 1 and 2
- Significant renovations: Floors 3, 4, 5, 6, and 7



The existing building is assumed to be a Type 1A construction building. The building is fully sprinklered and provided with a fire alarm detection and notification system. The existing building is roughly 88-feet in height, under the allowable limit of 180 feet for a fully sprinkler Group I-2 occupancy building. The highest occupied floor level is 70-feet above grade, so the building is not considered a high-rise. As a Group I-2 occupancy building, the VCC requires Type 1A construction for sprinklered I-2 facilities exceeding 5 stories in height. Similarly, for a Type 1A I-2 facility, the building area is unlimited.

All corridors in Group I-2 occupancies shall be continuous to exits and shall be separated from other areas per VCC § 407.3 except waiting and similar areas. All corridors shall be constructed as smoke partitions.

Smoke barriers shall be provided to subdivide every story used by persons receiving care, treatment or sleeping into not fewer than two smoke compartments. Smoke barriers shall be provided to subdivide other stories with an occupant load of 50 or more persons, into not fewer than two smoke compartments. Smoke compartments are limited to 22,500 square feet, except a 40,000 square foot limit is permitted for I-2, Condition 2 occupancies under certain conditions. Smoke barriers shall have a 1-hour fire-resistance rating. Travel distance from any point to a smoke compartment to a smoke barrier door shall not be greater than 200 feet.

Building 15 will be connected to the multi-story office building via a new pedestrian walkway connector constructed in accordance with the VCC Chapter 3104. The connector shall be built from non-combustible construction. The walls separating the connector from each building shall be capable of resisting the passage of smoke as required by VCC § 3104.5.2 and shall be fully sprinklered. Only materials and decorations approved by the building official shall be in the pedestrian walkway.

BUILDING 17: RESIDENTIAL TREATMENT

Built in 1939, this existing building is a large two-story concrete and masonry building with a partial basement. The floor structure appears to consist of concrete on metal lathe supported by open web steel joists which bear on interior and exterior load bearing walls. The roof structure appears to consist of wood rafter framing that bears on a concrete roof slab that spans between the exterior and interior load bearing walls. For all 3 options, this building will be renovated to become a residential treatment unit for the residents. It will undergo a mix of significant cosmetic and invasive renovations across all three options.

The existing building is assumed to be a Type VA construction building. The building is fully sprinklered and provided with a fire alarm detection and notification system. Record documents indicate that the building is considered a Group B occupancy. The existing building is approximately 30,175 square feet.

Building 17 will be connected to the new Acute Care Building via a new pedestrian walkway connector constructed in accordance with the VCC Chapter 3104. The connector shall be built from non-combustible construction. The walls separating the connector from each building shall be capable of resisting the passage of smoke as required by VCC § 3104.5.2 and shall be fully

sprinklered. Only materials and decorations approved by the building official shall be in the pedestrian walkway.

BUILDING 22: STAFF APARTMENTS

Built in 1928, this existing building is a one-story wood-framed building with a partial basement. The wall, floor, and roof structure appear to consist of wood frame construction. The building is currently being used for bulk storage. Option A excludes this renovation work, however for Options B and C this building shall be renovated into staff housing. This building will undergo a mix of cosmetic and invasive renovations across Options B and C.

The existing building is assumed to be a Type VB construction building. The building will undergo a change of use from Storage to Residential (R-1). As such, the change of use will require the building to be fully sprinklered and provided with a fire alarm system.

Walls separating dwelling units in the same building, walls separating sleeping units in the same building and walls separating dwelling or sleeping units from other occupancies contiguous to them in the same building shall be constructed as fire partitions. The fire partitions shall have a 30-minute fire resistance rating for corridor walls, dwelling units, and sleeping units.

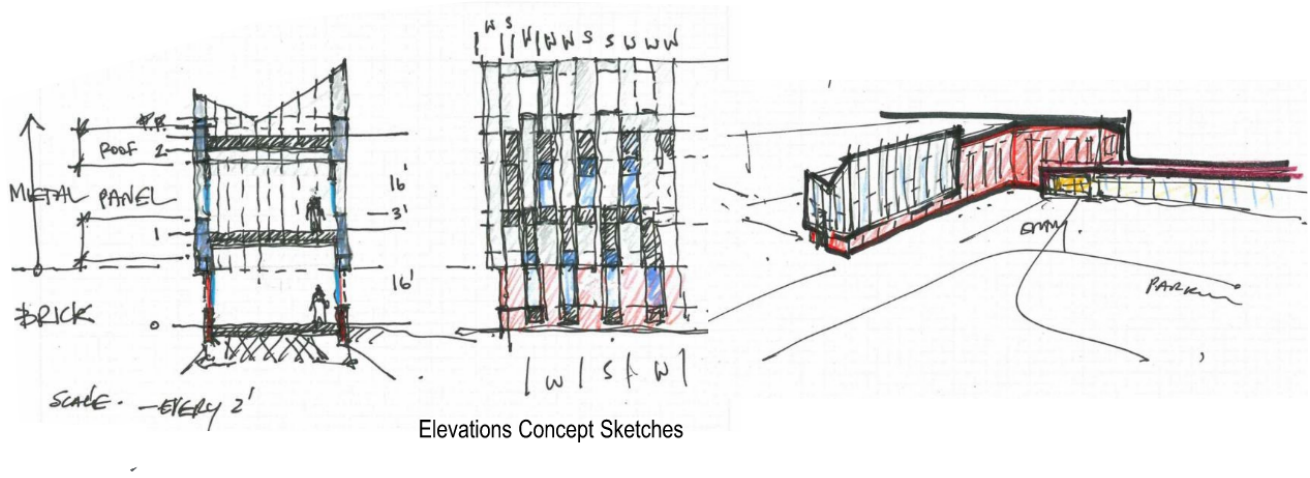
NEW 3 TO 4 STORY BUSINESS OCCUPANCY BUILDING

This new steel framed building is intended to serve as an outpatient education and research building for the residents. The building would also house new administrative and support spaces. Options A and B will be similar in scope and size (3 story structure); however, Option C introduces an additional top floor of shell space for future expansion (4 story structure).

The building will be Type IIA or Type IIB construction. The VCC permits the building to be 3 stories and unsprinklered for Type IIB construction and 5 stories and unsprinklered for Type IIA construction. If the building will be fully sprinklered, the VCC permits the building to be 4 stories for type IIB construction and 6 stories for type IIA construction. It is assumed that the building will be type IIB construction for this report.

The building will be fully sprinklered under Option C. In all options the building will be provided with a new fire alarm system.

Fire and smoke barriers will be provided to protect areas with high hazard of contents if applicable. New exit stair and shaft enclosures shall be 1-hour fire resistance rated under options A and B, and shall be 2-hour fire resistance rated under option C.



Elevations Concept Sketches

NEW 2-STORY HEALTHCARE OCCUPANCY BUILDING

This new two-story steel and masonry building is intended to serve as an acute adult behavioral building for incoming residents. Option A provides two 32-bed units, with additional units being added for each sequential option. Below lists the number of units included in each option:

- Option A: 2 units (32 beds each) 64 beds total
- Option B: 3 units (32 beds each) 96 beds total
- Option C: 4 units (32 beds each) Detox unit (16 beds) 144 beds total

The building will be Type IIA construction as required for multiple story buildings classified as I-2. The VCC permits the building to be 3 stories when sprinklered at a maximum height of 85 feet. The allowable area per floor without taking advantage of perimeter access is 45,000 square feet per floor. The building will be provided with a new fire alarm system.

All corridors in Group I-2 occupancies shall be continuous to exits and shall be separated from other areas per VCC § 407.3 except waiting and similar areas. All corridors shall be constructed as smoke partitions.

Smoke barriers shall be provided to subdivide every story used by persons receiving care, treatment or sleeping into not fewer than two smoke compartments. Smoke barriers shall be

provided to subdivide other stories with an occupant load of 50 or more persons, into not fewer than two smoke compartments. Smoke compartments are limited to 22,500 square feet, except a 40,000 square foot limit is permitted for I-2, Condition 2 occupancies under certain conditions. Smoke barriers shall have a 1-hour fire-resistance rating. Travel distance from any point to a smoke compartment to a smoke barrier door shall not be greater than 200 feet.

Design Criteria
Building construction and life safety requirements design will conform with the design guidelines of all applicable codes and standards of the Authorities Having Jurisdiction (AHJ).

ARCHITECTURAL

Codes, Design Guidelines, and Material Standards
Applicable codes include but are not limited to:

- 2018 Virginia Uniform Statewide Building Code (VUSBC)
- 2018 Virginia Construction Code (VCC)
- 2018 Virginia Statewide Fire Prevention Code
- 2010 ADA Standards for Accessible Design
- NFPA 10 – Standard for Portable Fire Extinguishers (2018 edition)
- NFPA 13 – Standard for Installation of Sprinkler Systems (2016 edition)
- NFPA 14 – Standard for the Installation of Standpipe and Hose System (2016 edition)
- NFPA 70 – National Electrical Code (2017 edition)
- NFPA 72 – National Fire Alarm and Signaling Code (2016 edition)
- NFPA 101 – Life Safety Code (2018 edition)
- CPSM – Latest version of the CPSM to be used during design

CONSTRUCTION TYPE AND USE GROUP

- Construction type see building narratives
- 2 Hr. Exterior Walls (load Bearing)
- 2 Hr. Structural Frame
- 2 Hr. Ceiling/Floor Separation
- 1 Hr. Ceiling/Roof Assembly
- Use group for the concept would be I-2 with mixed uses, with any required this separation per code of B use group, various A use groups to be further defined in full design.

EXTERIOR ARCHITECTURAL DESIGN AND CORE ELEMENTS

Exterior Wall

- Pre-cast insulated concrete panels with a combination of sandblasted finish and brick veneer inserts. Allow 50% of area sandblasted finish and 50% of area brick veneer inserts. Precast concrete will have custom aggregate mixture and white cement matrix.
- Brick Color: standard manufacturer's colors and finishes.
- Wall system is to have value of R-23 minimum.

Exterior Windows, Doors, and Louvers

- Aluminum clear anodized storefront window framing system with insulated glazing;
- At patient access areas, provide 1" insulated glass system at exterior with tempered and laminated glass panels and ½" tempered glass interior safety panel
- At areas with no patient access, provide 1" insulated glass system with tempered and laminated glass panels
- Windows are primarily inoperable. Those that are operable within patient areas shall be provided with security screens with access areas keyed locks on interior face. Horizontal blinds are integral to the window unit.
- All non-patient area windows are to be ½" tempered laminated glass.
- Aluminum clear anodized doors and frames with ½" tempered clear glass
- Aluminum clear anodized louvers and integral profiled vertical and horizontal mullions and glass.

Roofing System

- For pitched roofs – standing seam metal roof (steel with fluorocarbon finish) in manufacturer standard colors. Roof concept based on UL P-515 with roofing insulation on the top cord of the light gage steel truss. Minimum roof R-values of R-30ci or R-38 for attic.
- For flat roofs – built-up roof sloped to drain with tapered insulation, protection board and vapor barrier, and minimum roof R-values of R-40ci.

Miscellaneous Metal Work

- Painted galvanized metal parapet caps, overflow scuppers, coping, exposed flashing, and metal railings
- Architecture metal work for railings

Vertical Transportation

- Stairs shall be metal pan, concrete filled

- Elevators shall be hydraulic elevators with two (2) stops each. Elevator interior finishes shall be stainless steel. Elevators shall have glass doors for safety reasons.

INTERIOR ARCHITECTURAL DESIGN

Floor and Base Finish Materials

- Carpet tile with rubber base in office areas, waiting rooms, consult rooms and office corridors areas where carpet is appropriate for the activity.
- Resilient vinyl tile with rubber base in staff and heavy traffic corridors, storage rooms and clean & soiled rooms
- Rubber sheet goods with integral base in patient rooms, seclusion rooms and patient group/activity rooms where rubber sheet goods are appropriate for the activity
- Fluid Applied Flooring – epoxy based in patient toilet/shower rooms and private toilet rooms. Provide ceramic tile wainscot, 54” AFF in all patient/private/public toilet rooms.
- Sealed concrete floors with rubber base in mechanical, electrical, telecom/security equipment rooms and loading dock areas
- Recessed Walk-off mat in all entrance vestibule areas.

Interior Partitions

- Typical partition is 3-5/8” metal stud wall with sound attenuation batts and Type X 5/8” impact resistant gypsum wall board both sides to structural deck above.
- Partitions in patient units shall be 3-5/8” metal studs with sound attenuation batts and acrovyn wall protection to 10’-0” AFF with 5/8” impact resistant drywall.
- Corridor side walls in patient units to be similar construction to partitions within patient units but with acrovyn wall protection to 10’-0” AFF with 5/8” impact resistant drywall.
- Furred partition is 1-5/8” metal stud furred partition with Type X 5/8” gypsum wall board, one side only, for plumbing chases.
- Plumbing wall partition is 6” metal stud wall with 5/8” FR gypsum wall board both sides to structural deck above to conceal plumbing fixture supply or drainage piping or fixture carriers.
- 1-hour fire-rated smoke and fire-rated partitions, where required for room enclosure or smoke compartmentalization.
- 2-hour fire-rated smoke and fire-rated partitions, where required for room enclosure or smoke compartmentalization.

Ceiling and Finish Materials

- Suspended acoustical tile ceiling materials with high STC rating used in corridors, office areas, consult rooms, large storage areas, clean and soiled rooms, etc.

- In patient corridor areas, group rooms, dining and day rooms, etc. acoustical tile ceilings shall be installed at 10'-0" AFF, typical. In Maximum Security corridor areas, group rooms, dining and day rooms, etc. use gypsum wallboard ceiling materials with acoustical ceiling panels where appropriate for sound control
- Gypsum wallboard ceiling materials used in public, private and patient bedrooms, toilet rooms, shower areas, janitor/housekeeping closets, secure areas etc.
- In patient bedrooms, toilet rooms, shower areas, gypsum wall board ceilings shall be installed at 10'-0" AFF, typical.
- Provide access panels in ceilings as required by code. Access panels shall meet adjacent wall/ceiling fire rating. All access panels' doors shall be spring loaded and provided with keyed entry and installed with tamper resistant screws.

Interior Windows and Doors

- Solid wood doors, stained, shall be used for offices, patient exam rooms, patient rooms, toilet rooms, closets, etc.
- Hollow metal doors, painted in penthouses areas and loading area
- Office/Patient areas:
    - All interior windows in patient areas to be 1/2" tempered glass or equal in hollow metal frames.
    - All other interior windows to be ½" tempered glass.

Casework

- Public Areas:
    - Case fronts and doors – plastic laminate veneer finish on medium density fiber board (MDF) substrate and water resistant MDF in wet areas. Color selection from standard manufacturer's color range. All casework to be fully lockable.
    - Handles on casework to be recessed, typ.
    - Countertops and backsplash – solid surface materials from manufacturer's standard color range.
- Patient Areas:
    - Door-less cubbies to be provided for patient's belongings. Cubbies shall be bolted to wall with tamper resistant screws.

Fixtures, Furniture, and Equipment

The behavioral healthcare furniture, fixtures, and equipment will be specified to help patients care in behavioral health environments. Behavioral healthcare furniture needs to be designed to meet the unique needs of patients, combining durability and safety with comfort and aesthetic. Furniture for behavioral healthcare units must provide patients with a calming and safe environment. In addition, furniture and seating products should not have surface joints or seams to mitigate bacteria growth.

Structural

New Design Concepts

BUILDING 15: RESIDENTIAL TREATMENT & TRANSITIONAL SPACES

Built in 1953, this existing building is a large seven-story concrete building with load bearing concrete walls at the exterior and a single row of columns and a continuous drop panel running parallel along the central corridor. The floors and roof structure appear to consist of one-way slab construction. This building will be renovated to provide residential treatment and transitional spaces for the residents. It will undergo a mix of cosmetic and invasive renovations across all three options, with additional floors being renovated with each sequential option. Below lists the renovated floors included in each option:

Option A:
Light renovation: Floors 1, 2, and 3

Significant renovations: Floors 6 and 7

Option B:
Light renovation: Floors 1 and 2

Significant renovations: Floors 3, 5, 6, and 7

Option C:
Light renovation: Floors 1 and 2

Significant renovations: Floors 3, 4, 5, 6, and 7

Structurally, we expect to analyze and reinforce the existing structure where required at new mechanical units and at areas where floor live loading has increased. The floor and load-bearing wall structure may also need to be modified and reinforced for any new mechanical or architectural openings required in the new renovations. Given the buildings' age, we anticipate that minor structural repairs may also be necessary.

BUILDING 17: RESIDENTIAL TREATMENT

Built in 1939, this building is a large two-story concrete and masonry building with a partial basement. The floor structure appears to consist of concrete on metal lathe supported by open web steel joists which bear on interior and exterior load bearing walls. The roof structure appears to consist of wood rafter framing that bears on a concrete roof slab that spans between the exterior and interior load bearing walls. For all 3 options, this building will be renovated to become a residential treatment unit for the residents. It will undergo a mix of significant cosmetic and invasive renovations across all three options.

Structurally, we expect to analyze and reinforce the existing structure where required at new mechanical units and at areas where floor live loading has increased. The floor and load-

bearing wall structure may also need to be modified and reinforced for any new mechanical or architectural openings required for the new renovations. Given the buildings' age, we anticipate that minor structural repairs may also be necessary.

BUILDING 22: STAFF APARTMENTS

Built in 1928, this building is a one-story wood-framed building with a partial basement. The wall, floor, and roof structure appear to consist of wood frame construction. The building is currently being used for bulk storage. Option A excludes this renovation work, however for Options B and C this building shall be renovated into staff housing. This building will undergo a mix of cosmetic and invasive renovations across Options B and C.

Structurally, we expect to analyze and reinforce the existing structure where required at areas where floor live loading has increased. We assume mechanical units for the building will sit on concrete mechanical pads on grade outside the building. The floor and wall structure may also need to be modified and reframed for any new mechanical or architectural openings required in the new renovations. Given the buildings' age, we anticipate that minor structural repairs may also be necessary.

NEW 3 TO 4 STORY BUSINESS OCCUPANCY BUILDING

This new steel framed building is intended to serve as an outpatient education and research building for the residents. The building would also house new administrative and support spaces. Options A and B will be similar in scope and size (3 story structure); however Option C introduces an additional top floor of shell space for future expansion (4 story structure).

NEW 2 STORY HEALTHCARE OCCUPANCY BUILDING

This new two-story steel and masonry building is intended to serve as an acute adult behavioral building for incoming residents. Option A provides two 32-bed units, with additional units being added for each option. Below lists the number of units included in each option:

Option A: 2 units (32 beds each) 64 beds total

Option B: 3 units (32 beds each) 96 beds total

Option C: 4 units (32 beds each) Detox unit (16 beds) 144 beds total

Design Criteria

Structural design will conform with the design guidelines of all applicable codes and standards of the Authorities Having Jurisdiction (AHJ).

Codes, Design Guidelines and Material Standards

2018 Virginia Uniform Statewide Building Code (VUSBC)

2018 Virginia Construction Code (VCC)

American Society of Civil Engineers (ASCE), Minimum Design Loads for Buildings and Other Structures (ASCE 7-16)

American Concrete Institute (ACI), Building Code Requirements for Structural Concrete (ACI 318-14)

American Institute of Steel Construction (AISC), AISC Manual of Steel Construction - 15th edition, AISC 360-16

American Welding Society, AWS, D1.1, D3.1, & D1.4

Steel Deck Institute (SDI), SDI Diaphragm Design Manual

American Society for Testing and Materials (ASTM), material standards as noted

American Iron and Steel Institute (AISI), AISI Specifications for Design of Cold Formed Steel Structural Members

Steel Joist Institute (SJI), SJI Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders

American Concrete Institute (ACI), ACI Building Code Requirements and Specifications for Masonry Structures (ACI 530-14 and ACI 530.1-14)

Foundations

Building foundations will be designed based upon recommendations set forth in the geotechnical report. No geotechnical information has been gathered for this site as of the writing of this study, therefore, the method of excavation, site preparation, ground water mitigation design and foundation design for the proposed site cannot be described. For pricing purposes it is assumed that a conventional shallow foundation system will be used. Frost depth in this area is 24 inches, thus the bottom of all exterior footings shall bear 24 inches below exterior grade at a minimum. Columns will be supported on individual square spread footings and walls would be supported on a continuous strip footing. These footings would be poured integral to each other where column and wall footings overlap.

The project site contains existing buildings; as part of this project, all structures within the footprint of the new hospital buildings would be demolished. The foundations of the existing building should be removed within the new building footprint. If outside of the building footprint, they may be abandoned in place below grade.

Superstructures

Typical grade slabs will consist of a conventional 5-inch-thick concrete slab on grade with welded wire fabric reinforcing on porous fill and a continuous vapor retarder. At areas subject to trucking, such as at a loading dock or at any wheeled traffic areas, the grade slab will be an 8-inch-thick slab on grade with reinforcing bars. Anticipated column spacing at all new buildings will be approximately 30 feet.

For the new 2 story healthcare occupancy building connected to Building 17, the main gravity support shall consist of reinforced 8-inch-thick CMU load-bearing wall construction. Exterior CMU walls will be used along the perimeter and steel columns will be used at the interior to provide program flexibility and to maintain adequate bay sizes. Elevated floors would comprise of a 3-1/4-inch-thick lightweight concrete slab on 2-inch composite decking (5-1/4 total thickness) reinforced with welded wire fabric (UL D925). The deck will be supported on composite steel beam framing with maximum spacing limited to 9 feet on center. At sloped gable and hip roofs, the roof system can be comprised of cold-formed metal trusses spaced at 4 feet on center maximum supporting 1-1/2-inch-deep metal roof deck (UL P526). The trusses would bear on the CMU walls and steel beam framing. At flat roof sections, the roof shall consist of 1-1/2-inch-deep metal roof deck supported by open web steel joist framing spaced at 5 feet on center maximum (UL P719). The main lateral force resisting system for the building will be ordinarily reinforced masonry shear walls.

At the new 3 to 4 story business occupancy building connected to building 15, the main gravity support shall consist of composite steel beam and column framing. Exterior walls will be comprised of 8-inch cold-formed steel framing. Elevated floors would consist of a 3¼ inch thick lightweight concrete slab on 2-inch composite decking (5¼ total thickness) reinforced with welded wire fabric (UL D925). The deck will be supported on composite steel beam framing with maximum spacing limited to 9 feet on center. Assuming the roof of this building is flat, the roof shall consist of 1½ inch deep metal roof deck supported by open web steel joist framing spaced at 5 feet on center maximum (UL P719). The main lateral force resisting system for this building will be comprised of concentric braced frames.

Materials of Construction:

Concrete

- 28-day concrete strengths:
- Interior foundations and slabs on metal deck - 3,000 psi (coordinate with final UL rating)
- Interior grade slabs – 4,000 psi
- Exterior concrete such as exterior footings, site retaining walls, exterior grade slabs, and exterior mechanical pads - 4,500 psi. Additionally, all exterior concrete shall be air entrained.
- Reinforcing Steel, ASTM A615, Grade 60 deformed bars, Fy = 60 ksi
- Welded Wire Fabric per ASTM A185

Masonry

- Concrete Masonry Units (CMU) F'm = 1,500 psi
- Reinforcing Steel, ASTM A615, Grade 60 deformed bars, Fy = 60 ksi
- Grout, ASTM C476 F'm = 3000 psi
- Mortar, ASTM C270, Type M or S F'c = 1,800 psi
- Joint Reinforcement, ASTM A82 - Truss type in unreinforced CMU walls/ ladder type in CMU walls with vertical reinforcing steel. Joint reinforcing shall be hot dipped galvanized after fabrication.

Structural Steel

- Wide Flange and Tee shapes, ASTM A992 Fy = 50 ksi
- Angles, channels and plates, ASTM A36 Fy = 36 ksi
- Tubes, ASTM A500, Grade B Fy = 46 ksi
- Pipes, ASTM A53, Grade B Fy = 35 ksi
- Headed Studs Fy = 50 ksi
- Anchor Bolts, ASTM A36 or ASTM F1554, UNO Fy = 33 ksi
- High Strength Connection Bolts, ASTM A325
- Welding Electrodes E70XX
- Steel Joists
- K series and KCS series per the Steel Joist Institute
- Steel Decking
- Metal Roof Deck, Galvanized ASTM A653, G60 Fy = 33 ksi, Type B
- Metal Floor Deck, Galvanized ASTM A653, G60 Fy = 50 ksi, Composite

Design Loads

Design loads will conform to the minimum requirements of the IBC. The structure shall be designed to support all dead loads such as the weight of the structure, partitions, flooring, ceiling, sprinklers, high density file storage, mechanical equipment, roofing, and all other built-in installations. Additionally, all minimum live loads as indicated shall be supported.

GRAVITY LOADS

- Floor Dead Load:
- Dead Load = 80 PSF (includes assumed self-weight of structure)
- Floor Live Load:
- Assembly areas = 100 PSF
- Offices = 50 PSF (+ 15 PSF for partitions)
- Resident Rooms = 40 PSF
- Stairways = 100 PSF
- Lobbies = 100 PSF
- Corridors (first floor) = 100 PSF
- Corridors (upper floors) = 80 PSF
- Electrical and Mechanical Rooms = 150 PSF
- Roof Dead Load:
- Dead Load = 30 PSF (includes assumed self-weight of structure)
- Roof Live Load:
- Live Load (roof) = 30 PSF minimum
- Snow Load:
- The campus sits within a Case Study area.
- Ground snow load = 30 PSF (provided by Roanoke County government)
- Snow exposure factor (Ce) = 1.0

- Snow load importance factor (Is) = 1.10 (Risk Category III)
- Thermal factor (Ct) = 1.0 (heated)
- Minimum snow load = 22 PSF
- Flat roof snow load = 24 PSF + drift
- Drifting snow = as required by ASCE 7-16
- LATERAL LOADS:
- Wind Loads:
- Risk Category III
- The project is not in a high velocity hurricane zone.
- Wind loads will be established based upon the provisions of ASCE 7-16
- Use method 2 – Analytical procedure
- The new buildings in this project are low to mid-rise buildings.
- Basic wind speed (Vult) = 115 MPH (3-sec. gust)
- Nominal design wind speed (Vasd) = 89 MPH
- Internal pressure coefficient (GCpi) = ±0.18
- The assumed exposure category for the project site is exposure C.
- Velocity pressure (qh) = varies with height of building
- Seismic Loads:
- Mapped Spectral Response Accelerations: Ss = 0.202 / S1 = 0.065
- Spectral Response Coefficients: Sds = 0.215 / Sd1 = 0.104
- Importance factor (Ie) = 1.25 (Risk Category III)
- Assumed site class D (to be verified by a geotechnical engineer)
- Seismic Design Category B
- Basic Seismic Force-Resisting System and Response Modification Factor (R):

Mechanical

Building 15

Building 15 is primarily heated and cooled by a 4-pipe fan coil system. Chilled water is generated by a water-cooled modular chiller, and heating hot water is generated by steam-to-water heat exchangers. Air is only exhausted from select locations, such as resident day rooms and recently constructed restrooms. Original restrooms are not exhausted.

Outdoor ventilation air is provided by dedicated outdoor air handling units staggered among the building floors. Ventilation air is delivered to corridors and common spaces, such as resident day rooms, and staff areas but not resident rooms.

Project 720-18576-24-02 is currently in development to replace and upgrade the mechanical systems of Building 15. The extent of the system upgrades is unclear but may include modernizing the building ventilation and exhaust system to current code and standards requirements. Valley Engineering recommends that the project currently in development be coordinated with the needs of this project to ensure the replacement systems are sufficient for

this project's needs. At a minimum, we recommend the replacement ventilation systems be sized for 15% additional airflow.

This study assumes that all mechanical recommendations for building 15 included in the Existing Conditions report have been performed under project 720-18576-24-02, and that installed building systems can provide sufficient ventilation to meet the current code requirements. If this is not the case, then the scope of this study will require modification.

Building 17
Building 17 is primarily cooled and heated with two central station variable air volume air handlers and VAV terminal units with hot water reheat coils. VAV boxes with hot water heat modulate airflow and temperature to condition each heating and cooling zone independently of other zones. Some perimeter heating is provided by hot water radiators. Hot water is generated by two separate heat exchanger systems in the basement. The older system serves building 17 radiators, while the newer system provides heating water to building 17 VAV terminal units, and buildings 18, 19, and 20 via buried piping.

Building 22
Building 22 is currently used for storage only and has no heating, cooling, or ventilation systems.

Refer to the Existing Conditions Report for information on any building not included herein.

New Design Concepts

OPTION A

Building 15
Floors 1, 2, and 3 – Finish upgrades only. Mechanical systems recently upgraded in project 720-18576-24-02. Reuse recently upgraded fan coil units, registers, diffusers, grilles, and other mechanical materials and equipment. Remove materials and equipment and return to the original location as needed to accommodate finish upgrades. Minor relocation may be required.

Floors 4, 5, and 6 – No work

Floors 6 and 7 – Renovation to Residential Treatment / Transitions. Reuse recently upgraded fan coil units and DOAS units where suitable. Provide new fan coil units and additional ventilation air to reconfigured spaces to meet current mechanical code.

Building 17
Floors 1 and 2 – Interior and light exterior renovations. Remove existing central station air handling units on first and second floors and replace with new. Remove existing ductwork, VAV terminal units, exhaust fans, and radiant heaters and replace with new.

New Air Handling Units: 12,500 CFM each

Remove HX-2 and HX-3 steam to hot water heat exchanger systems in their entirety, including piping and radiant heaters, and replace with heating water from new central plant. HX-3 currently provides heating water to building 17 VAV boxes, and buildings 18, 19, and 20.

Provide new chilled and hot water connections from the new central plant to the basement of building 17 via direct buried piping and the west crawl space.

Provide two heating water distribution pumps sized for N+1 redundancy and new piping system to air handling units, VAV terminal units, and radiant heaters. The pumps shall meet the full heating load of buildings 17 and 20.

Provide two chilled water distribution pumps sized for N+1 redundancy and new piping system to air handling units. The pumps shall be sized to provide the full cooling load of building 17.

Buildings 18 and 19 are being demolished to allow for installation of new Acute Adult Behavioral building. Remove direct buried hot water piping system back to building 17 crawl space.

Building 22

4,500 ft^2, low-rise multi-family residential.

Low-rise multi-family residential.

Provide each residential unit with a dedicated high-end, ducted, split system heat pump with electric emergency heat to provide heating, cooling, and ventilation.

Provide exhaust fan in each toilet room.

Provide kitchen range exhaust system.

Acute Adult Behavioral (Connected to Building 17)

Single-story, I-2 occupancy, 64 Beds, 42,000 ft^2

Provide two new roof-mounted variable air volume (VAV) air handling units sized for 22,000 CFM each. Air handling units will provide code-required ventilation and utilize chilled and hot water from a new stand-alone central plant described in the following section. Humidification for each air handling unit will be provided by a stand-alone propane-fired humidifier and unit-mounted dispersion panel. Air handling unit will include the following: 2” thick double wall insulated casing, VAV return or exhaust fan array, exhaust energy recovery, relief air section, Air mixing section with air blender, Prefilter section with 2” MERV-8 prefilters, Hot water preheat coil, steam dispersion panel, chilled water-cooling coil, and supply fan array. A final filter section with MERV-14 filters will be provided on any air handling unit that serves resident spaces

4-pipe fan coil units and hot water cabinet heaters will be provided in stairways, vestibules, and other miscellaneous spaces to offset heating and cooling loads. Unit heaters will be used in mechanical and equipment rooms.

Dual chilled water and hot water pumps will be in a first-floor mechanical room to provide chilled and hot water from the central plant primary loops to the air handling units on the roof. The pumps will be selected for N+1 redundancy.

Outpatient Education and Research (Connected to Building 15)
Three-story Business Occupancy, 48,000 ft^2.

Level 1: Outpatient Care

Level 2: Education

Level 3: Administration/ Support

Provide Three new roof-mounted variable air volume (VAV) air handling units sized for 16,000 CFM each. Air handling units will provide code-required ventilation and utilize the chilled and hot water from a new stand-alone central plant described in the following section. Humidification for each air handling unit will be provided by a stand-alone propane-fired humidifier and unit-mounted dispersion panel. Air handling units will include the following: 2" thick double wall insulated casing, VAV return or exhaust fan array, exhaust energy recovery, relief air section, Air mixing section with air blender, Prefilter section with 2" MERV-8 prefilters, Hot water preheat coil, steam dispersion panel, chilled water-cooling coil, and supply fan array. A final filter section with MERV-14 filters will be provided on any air handling unit that serves resident spaces

4-pipe fan coil units and hot water cabinet heaters will be provided in stairways, vestibules, and other miscellaneous spaces to offset heating and cooling loads. Unit heaters will be used in mechanical and equipment rooms.

Dual chilled water and hot water pumps will be in a first-floor mechanical room to provide chilled and hot water from the central plant primary loops to the air handling units on the roof. The pumps will be selected for N+1 redundancy.

OPTION B

Building 15
Floors 1, 2, and 3 – Finish upgrades only. Mechanical systems recently upgraded in project 720-18576-24-02. Reuse recently upgraded fan coil units, registers, diffusers, grilles, DOAS units, and other mechanical materials and equipment. Remove materials and equipment and return to the original location as needed to accommodate finish upgrades. Minor relocation may be required.

Floor 3 – Additional Treatment Mall. Reuse recently upgraded fan coil units and DOAS units when suitable. Provide new fan coil units and additional ventilation air to reconfigured spaces to meet current mechanical code.

Floor 4 – No work

Floors 5, 6 and 7 – Renovation to Residential Treatment / Transitions. Reuse recently upgraded fan coil units and DOAS units when suitable. Provide new fan coil units and additional ventilation air to reconfigured spaces to meet current mechanical code.

Building 17

Floors 1 and 2 – Interior and light exterior renovations. Remove existing central station air handling units on first and second floors and replace with new. Remove existing ductwork, VAV terminal units, exhaust fans, and radiant heaters and replace with new.

New Air Handling Units: 12,500 CFM each

Remove HX-2 and HX-3 steam to hot water heat exchanger systems in their entirety, including piping and radiant heaters, and replace with heating water from new central plant. HX-3 currently provides heating water to building 17 VAV boxes, and buildings 18, 19, and 20.

Provide new chilled and hot water connections from the new central plant to the basement of building 17 via direct buried piping and the west crawl space.

Provide two heating water distribution pumps sized for N+1 redundancy and new piping system to air handling units, VAV terminal units, and radiant heaters. The pumps shall meet the full heating load of buildings 17 and 20.

Provide two chilled water distribution pumps sized for N+1 redundancy and new piping system to air handling units. The pumps shall be sized to provide the full cooling load of building 17.

Buildings 18 and 19 are being demolished to allow for installation of new Acute Adult Behavioral building. Remove direct buried hot water piping system back to building 17 crawl space.

Building 22

4,500 ft^2, Low-rise multi-family residential.

Provide each residential unit with a dedicated high-end, ducted, split system heat pump with electric emergency heat to provide heating, cooling, and ventilation.

Provide exhaust fan in each toilet room.

Provide kitchen range exhaust system.

Acute Adult Behavioral (Connected to Building 17)

Two-story, I-2 occupancy, 96 Beds, 80,000 ft^2

Provide four new roof-mounted variable air volume (VAV) air handling units sized for 20,000 CFM each. Air handling units will provide code-required ventilation and utilize chilled and hot water from a new stand-alone central plant described in the following section. Humidification for each air handling unit will be provided by a stand-alone propane-fired humidifier and unit-

mounted dispersion panel. Air handling unit will include the following: 2" thick double wall insulated casing, VAV return or exhaust fan array, exhaust energy recovery, relief air section, Air mixing section with air blender, Prefilter section with 2" MERV-8 prefilters, Hot water preheat coil, steam dispersion panel, chilled water-cooling coil, and supply fan array. A final filter section with MERV-14 filters will be provided on any air handling unit that serves resident spaces

4-pipe fan coil units and hot water cabinet heaters will be provided in stairways, vestibules, and other miscellaneous spaces to offset heating and cooling loads. Unit heaters will be used in mechanical and equipment rooms.

Dual chilled water and hot water pumps will be in a first-floor mechanical room to provide chilled and hot water from the central plant primary loops to the air handling units on the roof. The pumps will be selected for N+1 redundancy.

Provide four new roof-mounted variable air volume (VAV) air handling units sized for 15,000 CFM each. Air handling units will provide code-required ventilation and utilize the chilled and hot water from a new stand-alone central plant described in the following section. Humidification for each air handling unit will be provided by a stand-alone propane-fired humidifier and unit-mounted dispersion panel. Air handling units will include the following: 2" thick double wall insulated casing, VAV return or exhaust fan array, exhaust energy recovery, relief air section, Air mixing section with air blender, Prefilter section with 2" MERV-8 prefilters, Hot water preheat coil, steam dispersion panel, chilled water-cooling coil, and supply fan array. A final filter section with MERV-14 filters will be provided on any air handling unit that serves resident spaces

4-pipe fan coil units and hot water cabinet heaters will be provided in stairways, vestibules, and other miscellaneous spaces to offset heating and cooling loads. Unit heaters will be used in mechanical and equipment rooms.

Dual chilled water and hot water pumps will be in a first-floor mechanical room to provide chilled and hot water from the central plant primary loops to the air handling units on the roof. The pumps will be selected for N+1 redundancy.

OPTION C

Building 15

Floors 1 and 2 – Finish upgrades only. Mechanical systems recently upgraded in project 720-18576-24-02. Reuse recently upgraded fan coil units, registers, diffusers, grilles, DOAS units, and other mechanical materials and equipment. Remove materials and equipment and return to the original location as needed to accommodate finish upgrades. Minor relocation may be required.

Floors 3 – Additional Treatment Mall. Reuse recently upgraded fan coil units and DOAS units when suitable. Provide new fan coil units and additional ventilation air to reconfigured spaces to meet current mechanical code.

Floors 4, 5, 6 and 7 – Renovation to Residential Treatment / Transitions. Reuse recently upgraded fan coil units and DOAS units when suitable. Provide new fan coil units and additional ventilation air to reconfigured spaces to meet current mechanical code.

Building 17

Floors 1 and 2 – Interior and light exterior renovations. Remove existing central station air handling units on first and second floors and replace with new. Remove existing ductwork, VAV terminal units, exhaust fans, and radiant heaters and replace with new.

New Air Handling Units: 12,500 CFM each

Remove HX-2 and HX-3 steam to hot water heat exchanger systems in their entirety, including piping and radiant heaters, and replace with heating water from new central plant. HX-3 currently provides heating water to building 17 VAV boxes, and buildings 18, 19, and 20.

Provide new chilled and hot water connections from the new central plant to the basement of building 17 via direct buried piping and the west crawl space.

Provide two heating water distribution pumps sized for N+1 redundancy and new piping system to air handling units, VAV terminal units, and radiant heaters. The pumps shall meet the full heating load of building 17 and 20.

Provide two chilled water distribution pumps sized for N+1 redundancy and new piping system to air handling units. The pumps shall be sized to provide the full cooling load of building 17.

Buildings 18 and 19 are being demolished to allow for installation of new Acute Adult Behavioral building. Remove direct buried hot water piping system back to building 17 crawl space.

Building 22

4,500 ft^2, Low-rise multi-family residential.

Provide each residential unit with a dedicated high-end, ducted, split system heat pump with electric emergency heat to provide heating, cooling, and ventilation.

Provide exhaust fan in each toilet room.

Provide kitchen range exhaust system.

Acute Adult Behavioral (Connected to Building 17)

Two-story, I-2 occupancy, 144 Beds, 150,000 ft^2

Provide eight new roof-mounted variable air volume (VAV) air handling units sized for 20,000 CFM each. Air handling units will provide code-required ventilation and utilize chilled and hot water from a new stand-alone central plant described in the following section. Humidification for each air handling unit will be provided by a stand-alone propane-fired humidifier and unit-mounted dispersion panel. Air handling unit will include the following: 2” thick double wall insulated casing, VAV return or exhaust fan array, exhaust energy recovery, relief air section,

Air mixing section with air blender, Prefilter section with 2" MERV-8 prefilters, Hot water preheat coil, steam dispersion panel, chilled water-cooling coil, and supply fan array. A final filter section with MERV-14 filters will be provided on any air handling unit that serves resident spaces

4-pipe fan coil units and hot water cabinet heaters will be provided in stairways, vestibules, and other miscellaneous spaces to offset heating and cooling loads. Unit heaters will be used in mechanical and equipment rooms.

Dual chilled water and hot water pumps will be in a first-floor mechanical room to provide chilled and hot water from the central plant primary loops to the air handling units on the roof. The pumps will be selected for N+1 redundancy.

Outpatient Education and Research (Connected to Building 15)
Four-story business Occupancy, 70,000 ft^2.

Level 1: Outpatient Care

Level 2: Education

Level 3: Administration/ Support

Level 4: Shell Space

Provide four new roof-mounted variable air volume (VAV) air handling units sized for 15,000 CFM each. Air handling units will provide code-required ventilation and utilize the chilled and hot water from a new stand-alone central plant described in the following section. Humidification for each air handling unit will be provided by a stand-alone propane-fired humidifier and unit-mounted dispersion panel. Air handling units will include the following: 2" thick double wall insulated casing, VAV return or exhaust fan array, exhaust energy recovery, relief air section, Air mixing section with air blender, Prefilter section with 2" MERV-8 prefilters, Hot water preheat coil, steam dispersion panel, chilled water-cooling coil, and supply fan array. A final filter section with MERV-14 filters will be provided on any air handling unit that serves resident spaces

4-pipe fan coil units and hot water cabinet heaters will be provided in stairways, vestibules, and other miscellaneous spaces to offset heating and cooling loads. Unit heaters will be used in mechanical and equipment rooms.

Dual chilled water and hot water pumps will be in a first-floor mechanical room to provide chilled and hot water from the central plant primary loops to the air handling units on the roof. The pumps will be selected for N+1 redundancy.

Design Criteria

Mechanical design will conform to the design guidelines of all applicable codes and standards of the Authorities Having Jurisdiction (AHJ).

CODES, DESIGN GUIDELINES, AND MATERIAL STANDARDS

- Virginia Construction Code 2018

- Virginia Existing Building Code 2018
- Virginia Maintenance Code 2018
- Virginia Statewide Fire Prevention Code 2018
- Virginia Energy Conservation Code 2018
- Virginia Energy Conservation and Environmental Standards (VEES)
- Major Referenced Standards
- ICC International Building Code 2018
- ICC International Plumbing Code 2018
- ICC International Mechanical Code 2018
- NFPA 70 National Electric Code 2017
- ICC International Fuel Gas Code 2018
- ICC International Residential Code 2018
- ICC International Fire Code 2018
- IECC International Energy Conservation Code 2018

Guidelines

- Guidelines for Design and Construction of Hospitals 2022
- Design Guide for the Built Environment of Behavioral Health Facilities 2022
- Health Care Facilities Handbook NFPA 99 - 2018
- Life Safety Code Handbook 101 - 2018
- ASHRAE Standard 62.1-2016: Ventilation for Acceptable Indoor Air Quality
- NFPA 90A Standard for the installation of Air Conditioning and Ventilation Systems, 2012 Edition
- SMACNA HVAC Duct Construction Standards: Metal and Flexible 2016, 4th Edition
- ASHRAE Standard 90.1-2016: Energy Standard for Buildings Except Low-Rise Residential Buildings
- ASHRAE Handbooks and Standards

SITE UTILITY SYSTEMS

Air Distribution

Air distribution from each of the air handling units shall consist of a medium-pressure galvanized duct system serving double wall VAV single-duct terminals equipped with hot water heating coils. Low-pressure ductwork shall convey air from the VAV terminals to ceiling diffusers and/or sidewall supply registers. Supply duct systems shall be fully ducted to ceiling, wall, and floor-mounted air devices.

- Medium pressure ductwork shall be one of the following: Spiral oval ductwork, Spiral round ductwork or TDC flanged rectangular duct.
- All return air shall be ducted and shall be low pressure. Return duct systems shall be fully ducted to ceiling and wall devices.
- All exhaust air shall be ducted and shall be low pressure. Exhaust duct systems shall be fully ducted to ceiling and wall devices.
- All concealed supply and return ductwork shall be externally wrapped with 2.2” thick fiberglass blanket insulation with aluminum skin vapor barrier facing and 0.27 k factor. All exposed supply ductwork shall be externally wrapped with 2.0” thick fiberglass board insulation with aluminum skin vapor barrier facing and 0.23 k factor.
- All supply diffusers, return grilles, and exhaust grilles shall be aluminum construction

with a scratch-resistant white powder coating.

- Diffusers, registers, and grilles in spaces accessible to residents shall be ligature resistant and secured in place with temper-resistant fasteners.
- Exhaust systems used for energy recovery shall be insulated as follows: Concealed ductwork shall be externally wrapped with 2.2" thick fiberglass blanket insulation with aluminum skin vapor barrier facing and 0.27 k factor. Ductwork exposed in mechanical rooms and unconditioned spaces shall be externally wrapped with 2.0" thick fiberglass board insulation with aluminum skin vapor barrier facing and 0.23 k factor.
- Exhaust ductwork not used for energy recovery shall be uninsulated except for 10 feet of the duct from the roof deck. Exhaust duct insulation shall be 2.2" thick fiberglass blanket insulation with aluminum skin vapor barrier facing and 0.27 K factor.
- All ductwork openings shall be sealed for shipping and sealed while in construction.
- Exhaust fans for general exhaust service shall be aluminum construction with centrifugal fan wheels, motor operated dampers, and shall be arranged for up-blast discharge.
- Room exhaust not suitable for energy recovery shall be exhausted to the outdoors thru a central exhaust system.
- Supplemental hot water baseboard radiation shall be provided under the windows in waiting areas.
- Computer rooms, security server rooms, and other IT dedicated spaces shall be heated and cooled with independent wall mounted ducted split systems.

Air Handling Units

- Custom Air Handling Unit Construction
- 2" thick double wall insulated casings.
- VAV Exhaust fan array section.
- Plate and frame energy recovery section
- Relief section.
- Air mixing section.
- Fresh air intake.
- 2" MERV 8 pre-filters.
- Air blender section
- Hot water preheat coil section.
- Dual-sloped stainless steel drain pans.
- Humidification Section
- Insulated steam dispersion tubes.
- Dual-sloped stainless steel drain pans.
- Cooling coil section.
- Stainless steel coil casing.
- Dual-sloped stainless steel drain pans.
- Hot water heating section
- Dual-sloped stainless steel drain pans.
- VAV supply fan array section.
- MERV 14 final-filters (When required for patient spaces).
- VAV Terminal Unit Construction
- Double wall solid metal liner system.
- 1" thick R-Value = 4.1
- Capacities ranging from 50 to 4,000 cfm.
- Pressure independent operation.

- Bottom Access Door. (Insulated.)
- Double row heating coil with slip and drive duct connections.
- Multipoint flow sensor.
- Damper blade constructed of two layers heavy gauge galvanized steel with peripheral gasket of cross-linked polyurethane foam.
- Plated damper shaft mounted in self-lubricating bearings.

Controls

- The HVAC systems shall be controlled by an expansion of the existing Trane Building Automation System. The BAS controls manufacturer shall provide complete automatic monitoring and control of all HVAC equipment and shall provide a complete web-based graphical user interface package.
- BAS controls shall interface with lighting the lighting control system and can control lighting with the building schedule.
- BAS controls shall monitor status of domestic water systems, domestic water booster pump, domestic hot water booster pump, and med gas systems.
- Controls shall be capable of monitoring power consumption for each individual AHU, Pump(s), Chiller(s), Cooling Towers(s), Boiler(s), Lighting Panels and Receptacle Panels.
- BAS controls shall be factory installed on the VAV terminals by the terminal manufacturer, and on the AHU's by the AHU manufacturer.
- AHU controls shall include supply air, return air, and outside air airflow stations.
- Temperature sensors shall be adjustable and include a display indicating the room temperature.
- Temperature sensors in seclusion rooms shall be mounted in the anteroom with remote sensor in the return air duct serving the room.

Hydronic Systems

- Hydronic pumps
- Base-mounted end suction, in-line split coupled centrifugal, or double-suction
- Selected for N+1 redundancy
- Variable speed
- Premium efficiency inverter duty motors with Aegis shaft grounding ring
- Suction diffuser
- High-performance butterfly valves on the suction and discharge sides.
- Stainless steel flex connectors on the suction and discharge sides
- Y-strainer on the suction side
- Check valve on the discharge side
- Common pressure gauge connected to the suction, discharge, and suction diffuser flange ports via a valve isolation/distribution block.
- Centrifugal water-cooled chillers, N+1 redundancy.
- Variable speed
- Configured for future expansion
- Evaporator Entering Water Temperature – 54°F
- Evaporator Leaving Water Temperature – 38°F
- ASHRAE 90.1 compliant
- Marine Condenser water box

Cooling Towers

- N+1 redundancy
- Configured for future expansion
- Entering Water Temperature – 95°F
- Leaving Water Temperature – 85°F
- Wet Bulb Temperature – 79.7°F
- Bottom Equalizer connections
- Premium Efficiency Motor
- Variable Frequency Drive Service
- Mechanical vibration cutout switch
- Electric immersion heaters
- Stainless Steel Basin
- Basin Weir Dams
- Fiberglass Reinforced Polyester Casing Panels
- Fiberglass Reinforced Polyester Air Inlet Louvers
- PVC Fill & Drift Eliminators
- Ultrasonic level control system, control valve, level controller
- Plenum Access Doors
- Fan Deck and Ladder with Handrails and Safety Gate
- Louver Face External Platforms
- Access Door Platforms
- Stainless Steel Internal Walkway
- Internal ladder and service platform

Chilled Water System Ancillary Equipment

- Air Separator
- Expansion Tank(s) Bladder Style
- One tank each for chilled and condenser water systems.
- Cooling Tower Chemical Treatment System: Shot feeder
- 12 Pulse Variable Frequency Drives for all Pumps and cooling tower fans.
- All VFD’s shall have bypass switches
- All VFD’s shall have communication cards for communication with the BAS
- All VFD’s shall have line reactors and line filters
- All VFD motors shall be premium efficiency inverter duty with Aegis Shaft Grounding Ring
- Refrigerant monitoring system with sensor at each chiller
- Exhaust fans and motor operated louvers for general space ventilation
- Refrigerant evacuation system
- Exhaust fan and ductwork with exhaust grilles mounted 12” above finished floor
- One exhaust duct drop per chiller
- Constant volume air handling unit for room heating and cooling in the mechanical room with distribution ductwork and high induction diffusers
- Chilled water plant control system with optimization control programming logic
- Propane Fired condensing boilers, N+1 Redundancy
- Independently vented.
- Configured for future expansion
- Heating water System Ancillary Equipment

- Air Separator -- Expansion Tank(s) Bladder Style
- Shot feeder
- 12 Pule Variable Frequency Drives for all Pumps
- All VFD's shall have bypass switches
- All VFD's shall have communication cards for communication with the BAS
- All VFD's shall have line reactors and line filters
- All VFD motors shall be premium efficiency inverter duty with Aegis Shaft Grounding Ring
- Exhaust fans and motor-operated louvers for general space ventilation

Piping Schedule

SYSTEM	*PRESSURE (PSIG)*	*PIPE SIZE*	*MATERIAL*	*PIPE SCHEDULE*	*FITTINGS*
HEATING HOT WATER	100	¾" to 2"	Copper	Type L	Wroughtt Copper
HEATING HOT WATER	100	2-½ " to 14"	Black Steel	40	Weld
CHILLED WATER	100	¾" to 2"	Copper	Type L	Wrought Copper
CHILLED WATER	100	2-½ " to 24"	Black Steel	40	Weld
LIQUID PROPANE	0 – 5	¾" to 2"	Black Steel	40	Malleable Threaded Class 150
LIQUID PROPANE	0 – 5	2-½ " to 14"	Black Steel	40	Weld
LOW PRESSURE STEAM	0-25	¾" to 2"	Black Steel	40	Malleable Threaded Class 150
LOW PRESSURE STEAM	0-25	2-½ " to 14"	Black Steel	40	Weld
STEAM CONDENSATE LOW PRESSURE	0-25	¾" to 2"	Black Steel	80	Malleable Threaded Class 150
STEAM CONDENSATE LOW PRESSURE	0-25	2-½ " to 14"	Black Steel	80	Weld
AHU DRAIN PAN PIPING	-	¾" to 3"	Copper	Type L	Wrought Copper
MAKEUP WATER	-	¾" to 3"	Copper	Type L	Wrought Copper
CONDENSER WATER	100	¾" to 2"	Copper	Type L	Wrought Copper
CONDENSER WATER	100	2-½ " to 24"	Black Steel	40	Weld

Direct buried piping between the chilled and hot water plants and the adjacent buildings shall be a polypropylene piping system confirming to ASTM F 2389-21.

Hydronic valves

Chilled, Heating, and Condenser Water

- Shut-off Duty
- 1/2" to 2" pipe Size: two-piece bronze Ball valve with stainless steel trim, PTFE seats
- 2-1/2" and larger pipe size: High-performance butterfly valve, lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange.

Makeup water

- ½" to 2" pipe size: two-piece bronze Ball valve with stainless steel trim, PTFE seats

- 2-1/2” and larger pipe size: High-performance butterfly valve, lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange.

Steam and condensate:

- 1/2” to 2” pipe Size: two-piece bronze Ball valve with stainless steel trim, PTFE seats

Piping Insulation

Heating hot water supply and return

- Insulation Type: Fiberglass
- Indoor Finish and jacket: All service jacket with self-sealing lap
- Outdoor Finish and jacket: All service jacket with self-sealing lap, and aluminum jacket, stucco embossed.
- 1/2” to 1-1/4” pipe: 1-1/2” insulation thickness
- 2” pipe and larger: 2” insulation thickness

Direct Buried heating hot water supply and return

- Insulation Type: Cellular Glass
- Finish and jacket: Heat sealing jacket specifically designed for burial applications
- All pipe sizes: 1” insulation thickness

Chilled water supply and return

- Insulation Type: Fiberglass
- Indoor Finish: All service jacket with self-sealing lap
- Outdoor Finish: All service jacket with self-sealing lap, and aluminum jacket, stucco embossed.
- 1/2” to 1-1/4” pipe: 1” insulation thickness
- 2” pipe and larger: 1-1/2” insulation thickness

Low-pressure steam and condensate

- Insulation Type: Fiberglass
- Indoor Finish: All service jacket with self-sealing lap
- Outdoor Finish: All service jacket with self-sealing lap, and aluminum jacket, stucco embossed.
- 1/2” to 1-1/4” pipe: 2” insulation thickness
- 2” pipe and larger: 2-1/2” insulation thickness

Condenser Water Supply and Return

- Insulation Type: Fiberglass
- Indoor Finish: All service jacket with self-sealing lap
- Outdoor Finish: All service jacket with self-sealing lap, and aluminum jacket, stucco embossed.
- 1/2” to 3/4” pipe: 1” insulation thickness
- 1” pipe and larger: 1-1/2” insulation thickness

Makeup water

- Insulation Type: Fiberglass
- Indoor Finish: All service jacket with self-sealing lap
- Outdoor Finish: All service jacket with self-sealing lap, and aluminum jacket, stucco embossed.

- 1/2” insulation thickness

AHU drain piping, outdoor

- Insulation Type: Fiberglass
- Indoor Finish: All service jacket with a self-sealing lap
- Outdoor Finish: All service jacket with self-sealing lap, and aluminum jacket, stucco embossed.
- 1/2” insulation thickness
- 2” pipe and larger: 1-1/2” insulation thickness

CENTRAL PLANT

General Description:

The heating and cooling plants for the new Adult Behavioral and Outpatient Education and Research buildings shall be stand-alone and adjacent to the Adult Behavioral building. The two plants shall be included in a single structure and separated by a floor-to-deck wall. Both heating and cooling plants shall be no less than 3,000 square feet each.

The Chilled water plant shall be sized to provide 1 ton of cooling for every 225 square feet of new construction and configured for N+1 redundancy where N is the number is chillers needed to meet the total cooling demand. The capacity of the redundant standby chiller will match the capacity of the largest standby chiller. All plant components, condensers, chilled water piping and controls will be sized and selected to match the N+1 requirement.

One primary variable speed pump will be provided for each chiller. All pumps will be manifolded together, so any pump can provide full flow to any chiller.

Heating water is provided by fully condensing propane-fired boilers. Each boiler will have a dedicated, factory-fabricated double-wall stainless steel flue vent system. Combustion air shall be provided direct from the outside via ductwork. The boiler plant will be configured for N+1 redundancy.

One variable speed pump will be provided for each boiler. All pumps will be manifolded together so any pump can provide full flow to any chiller.

Piping shall be distributed from the central plant via direct buried piping. The direct buried piping shall include a supply branch to building 15 and sized to replace the existing chilled water plant in building 15 plus an additional 15 percent for future load.

The central plant and distribution piping shall be constructed so that both cooling and heating plants can be expanded to include the heating and cooling loads for building 15, 16, 17, and 73, plus an additional 15 percent for a future load, and maintain N+1 redundancy.

All piping mains shall be sized for future plant.

All expansion tanks shall be sized for current and future needs.

A refrigerant management system will be provided.

Ventilation fans will be provided in both the boiler and chiller plants for free cooling when available.

Blower coils will be utilized for heating and cooling when free cooling is not available.

Chemical treatment for condenser, chilled, and heating hot water will be provided.

A parallel backflow preventer arrangement shall be provided leaving one backflow preventer for redundancy.

Floor drains will be provided at:

Chillers

Boilers

Pumps

Cooling Towers

Backflow preventers

Option A
Chiller plant:

Day One Configuration: Three 350- ton centrifugal chillers

Final configuration after expansion: Five 350- ton centrifugal chillers

Final load is based on option A square footage and includes buildings 15, 16, and 73 in addition to day one load.

Hot Water Plant

Day one Configuration: Two (3) 2,500 MBH condensing boilers

Final Load after Expansion: Five 2,500 MBH condensing boilers

Final load is based on option A square footage and includes buildings 15, 16, and 73 in addition to day one load.

Option B
Chiller plant:

Day One Configuration: Three 375- ton centrifugal chillers

Final configuration after expansion: Five 375- ton centrifugal chillers

Final load is based on option B square footages and includes buildings 15, 16, and 73 in addition to day one load.

Hot Water Plant

Day one Configuration: Two (3) 3,500 MBH condensing boilers

Final Load after Expansion: Five 3,500 MBH condensing boilers

Final load is based on option B square footage and includes buildings 15, 16, and 73 in addition to day one load.

Option C

Chiller plant:

Day One Configuration: Three 600- ton centrifugal chillers

Final configuration after expansion: Five 600- ton centrifugal chillers

Final load is based on option C square footages and includes buildings 15, 16, and 73 in addition to day one load.

Hot Water Plant

Day one Configuration: Two (3) 5,000 MBH condensing boilers

Final Load after Expansion: Five 5,000 MBH condensing boilers

Final load is based on option C square footage and includes buildings 15, 16, and 73 in addition to day one load.

CENTRAL PLANT PROPANE TANK SYSTEM

A propane storage system consisting of four 20,000-gallon tanks will be provided to serve the new central plant heating hot water system. The tanks shall connect to dual propane lines serving the boiler plant to provide redundancy.

Piping shall be schedule 40 steel with welded or threaded fittings, all valves used in the gas piping shall be UL rated for gas service.

Dual independent vaporizing systems shall be provided to vaporize propane during cold weather.

Electrical

Existing Structures

BUILDING 15

The existing facility normal power services are fed from three individual disconnects. The switchboards are labeled as 'MDP-1'(2of3), 'MDP-2'(2of3), 'MDP-3'(1of3) and 'MDP-1' Bldg. 16. The switchboards are in the Basement of Building 15 and the Loading Dock area of Building 16. Switchboard 'MDP-1' Bldg. 15 is Westinghouse Panelboard, 800A, 480/277V, 3Phase, 4Wire. Switchboard 'MDP-2' Bldg. 15 is Westinghouse Panelboard, 800A, 480/277V, 3Phase, 4Wire. Switchboard 'MDP-3' Bldg. 15 is Siemens, 1600A, 208/120V, 3Phase, 4Wire.

The existing facility emergency power services are fed by two 500kW Generac generators. The generators are labeled as 'Generator A' and 'Generator B'. The generators are fed with #2 Fuel Oil via local belly tank. The mass storage tank has a capacity of 4,000 gallons. The generators and day tanks are in an exterior utility yard. Generator 'A' is Generac, 500kW/625kVA, 750A Output, 480/277V, 3Phase, 4Wire. Generator 'B' is Generac, 500kW/625kVA, 750A Output, 480/277V, 3Phase, 4Wire. The two generators feed one Switchboard. The Switchboard is labeled as 'EDPH'. The paralleling switchboard is in the Basement of Building 15. The Switchboard 'EDPH' is EATON Cutler-Hammer Pow-R-Line C, 2000A, 480/277V, 3Phase, 4Wire. The Switchboard feeds a Transformer that feeds Switchboard 'EDPL'. Switchboard 'EDPL' is EATON Cutler-Hammer Pow-R-Line C, 1600A, 208/120V, 3Phase, 4Wire.

There is one 480/277V switchboard responsible for providing emergency power to the two existing automatic transfer switches for the facility. There is one 208/120V switchboard providing emergency power to four existing automatic transfer switches for the facility. All automatic transfer switches are in the basement of Building 15. 'ATS-1' is ASCO Power Technologies 7000 Series Automatic Transfer Switch, 400A, 208/120V, 3Phase, 4Wire. 'ATS-2' is ASCO Power Technologies 7000 Series Automatic Transfer Switch, 400A, 208/120V, 3Phase, 4Wire. 'ATS-3' is ASCO Power Technologies 7000 Series Automatic Transfer Switch, 400A, 208/120V, 3Phase, 4Wire. 'ATS-4' is ASCO Power Technologies 7000 Series Automatic Transfer Switch, 800A, 208/120V, 3Phase, 4Wire. 'ATS-5' is ASCO Power Technologies 7000 Series Automatic Transfer Switch, 800A, 480/277V, 3Phase, 4Wire. 'ATS-6' is ASCO Power Technologies 7000 Series Automatic Transfer Switch, 1000A, 208/120V, 3Phase, 4Wire.

BUILDING 17

The existing facility normal power service is fed by one panel labeled Panel 'MAIN' (Unmarked). The panel is FPE FDP-BDP Panelboard, 800A, 240/120V, 3Phase, 4Wire.

BUILDING 22

As Building 22 is currently used for storage only it is assumed Building 22 is served in similar capacity to other residential style buildings on campus. Service is expected to be a 240/120V residential type service.

New Design Concepts

ELECTRICAL DESIGN WILL CONFORM WITH THE DESIGN GUIDELINES OF OPTION A

Building 15

Floors 1, 2, and 3 – Finish upgrades only. Existing wiring devices and coverplates shall be replaced in the same location. Existing light fixtures shall be replaced in the same location. Existing nurse call devices shall be replaced in the same location. Existing fire alarm devices shall be replaced in the same location. Existing access control devices shall be replaced in the same location. Existing telecommunications outlets shall be replaced in the same location.

Floors 4 and 5 – No work

Floors 6 and 7 – Renovation to Residential Treatment / Transitions. Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

It is recommended that all main electrical distribution such as switchboards be replaced due to the age, condition, and non-compliance with current codes. Panels shall be replaced as needed. It is recommended that all transfer switches (at minimum) have their programming and controls replaced with modern controls. A complete replacement would be appropriate to provide modern era switches suitable for a hospital environment. An additional generator shall be considered once formal loads are determined to confirm n+1 redundancy is still maintained.

Building 17

Floors 1 and 2 – Renovation to Residential Treatment Mall. Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

It is recommended that all main electrical distribution such as the main panel be replaced due to the age, condition, and non-compliance with current codes. All other panels shall be replaced as needed.

Provide new emergency power service.

Buildings 18 and 19 are being demolished to allow for installation of new Acute Adult Behavioral Building. Remove all electrical services, equipment, and devices direct buried hot water piping system back to building 17 crawl space.

Building 22
No work as a part of Option A.

New Building with Connector to Building 17

Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

- Provide two new normal power switchgears.
- Provide one new emergency power switchgear.
- Provide two new emergency power generators.
- Provide five new automatic closed transition bypass isolation transfer switches.
- Provide normal power and emergency power branch circuit distribution.

New Building with Connector to Building 15

Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

- Provide one new normal power switchboard.
- Provide one new emergency power switchboard.
- Provide one new emergency power generators
- Provide three new automatic open transition transfer switches.
- Provide normal power and emergency power branch circuit distribution.

OPTION B

Building 15

Floors 1, 2, and 3 – Finish upgrades only. Existing wiring devices and cover plates shall be replaced in the same location. Existing light fixtures shall be replaced in the same location. Existing nurse call devices shall be replaced in the same location. Existing fire alarm devices shall be replaced in the same location. Existing access control devices shall be replaced in the same location. Existing telecommunications outlets shall be replaced in the same location.

Floor 3 (additional work) – Additional Treatment Mall. Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

Floor 4 – No work

Floors 5, 6, and 7 – Renovation to Residential Treatment / Transitions. Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

It is recommended that all main electrical distribution such as switchboards be replaced due to the age, condition, and non-compliance with current codes. Panels shall be replaced as needed. It is recommended that all transfer switches (at minimum) have their programming and controls replaced with modern controls. A complete replacement would be appropriate to provide modern era switches suitable for a hospital environment. An additional generator shall be considered once formal loads are determined to confirm n+1 redundancy is still maintained.

Building 17

Floors 1 and 2 – Renovation to Residential Treatment Mall. Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

It is recommended that all main electrical distribution such as the main panel be replaced due to the age, condition, and non-compliance with current codes. All other panels shall be replaced as needed.

- Provide new emergency power services.

Buildings 18 and 19 are being demolished to allow for installation of new Acute Adult Behavioral Building. Remove all electrical services, equipment, and devices direct buried hot water piping system back to building 17 crawl space.

Building 22

Renovation to Residential Staff Housing. Provide new wiring devices, light fixtures, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

It is recommended that all main electrical distribution such as the main panel be replaced due to the age, condition, and non-compliance with current codes. All other panels shall be replaced as needed.

New Building with Connector to Building 17

Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

- Provide two new normal power switchgears.
- Provide one new emergency power switchgear.
- Provide two new emergency power generators.
- Provide five new automatic closed transition bypass isolation transfer switches.
- Provide normal power and emergency power branch circuit distribution.

New Building with Connector to Building 15

Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

- Provide one new normal power switchboard.
- Provide one new emergency power switchboard.
- Provide one new emergency power generators
- Provide three new automatic open transition transfer switches.
- Provide normal power and emergency power branch circuit distribution.

OPTION C

Building 15

Floors 1, 2, and 3 – Finish upgrades only. Existing wiring devices and coverplates shall be replaced in the same location. Existing light fixtures shall be replaced in the same location. Existing nurse call devices shall be replaced in the same location. Existing fire alarm devices shall be replaced in the same location. Existing access control devices shall be replaced in the same location. Existing telecommunications outlets shall be replaced in the same location.

Floor 3 (additional work) – Additional Treatment Mall. Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

Floors 4, 5, 6, and 7 – Renovation to Residential Treatment / Transitions. Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

It is recommended that all main electrical distribution such as switchboards be replaced due to the age, condition, and non-compliance with current codes. Panels shall be replaced as needed. It is recommended that all transfer switches (at minimum) have their programming and controls replaced with modern controls. A complete replacement would be appropriate to provide modern era switches suitable for a hospital environment. An additional generator shall be considered once formal loads are determined to confirm n+1 redundancy is still maintained.

Building 17

Floors 1 and 2 – Renovation to Residential Treatment Mall. Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

It is recommended that all main electrical distribution such as the main panel be replaced due to the age, condition, and non-compliance with current codes. All other panels shall be replaced as needed.

Provide new emergency power services.

Buildings 18 and 19 are being demolished to allow for installation of new Acute Adult Behavioral Building. Remove all electrical services, equipment, and devices direct buried hot water piping system back to building 17 crawl space.

Building 22

Renovation to Residential Staff Housing. Provide new wiring devices, light fixtures, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

It is recommended that all main electrical distribution such as the main panel be replaced due to the age, condition, and non-compliance with current codes. All other panels shall be replaced as needed.

New Building with Connector to Building 17

Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

- Provide two new normal power switchgears.
- Provide one new emergency power switchgear.
- Provide three new emergency power generators.
- Provide five new automatic closed transition bypass isolation transfer switches.
- Provide normal power and emergency power branch circuit distribution.

New Building with Connector to Building 15

Provide new wiring devices, light fixtures, nurse call devices, fire alarm devices, access control devices, and telecommunications as required to meet project programming and applicable codes.

- Provide one new normal power switchboard.
- Provide one new emergency power switchboard.
- Provide one new emergency power generators
- Provide three new automatic open transition transfer switches.
- Provide normal power and emergency power branch circuit distribution.

Design Criteria

all applicable codes and standards of the Authorities Having Jurisdiction (AHJ).

CODES, DESIGN GUIDELINES, AND MATERIAL STANDARDS:

Codes

- Virginia Construction Code 2018
- Virginia Existing Building Code 2018
- Virginia Maintenance Code 2018
- Virginia Statewide Fire Prevention Code 2018
- Virginia Energy Conservation Code 2018
- Virginia Energy Conservation and Environmental Standards (VEES)
- Major Referenced Standards
- ICC International Building Code 2018
- NFPA 70 National Electric Code 2017
- ICC International Residential Code 2018
- ICC International Fire Code 2018
- IECC International Energy Conservation Code 2018
- Health Care Facilities Handbook NFPA 99 - 2018
- Life Safety Code Handbook 101 – 2018

Guidelines

Guidelines for Design and Construction of Hospitals 2022

Design Guide for the Built Environment of Behavioral Health Facilities 2022

MATERIAL STANDARDS

General Design Conditions and Power

Conductors for feeders shall be sized to prevent a voltage drop exceeding two percent. Conductors for branch circuits shall be sized to prevent a voltage drop exceeding three percent at the farthest point of power, lighting, heating, or combination of such loads. The maximum voltage drops of both a feeder and branch circuit to the farthest point shall not exceed 5 percent.

All conductors shall be copper THWN/THHN. The minimum wire size shall be #12AWG.

All feeders and branch circuits for both normal power and emergency power systems shall be single conductors in raceway.

All branch circuits shall be provided with a dedicated neutral.

Interior raceways shall be EMT (Electrical Metallic Tubing) unless exposed to physical damage then raceways shall be RMC (Rigid Metal Conduit). The minimum raceway size shall be 3/4". All fittings and couplings for EMT shall be steel set screw. All fittings and couplings for RMC shall be threaded.

Exterior raceways above ground shall be RMC (Rigid Metal Conduit). Exterior raceways below ground shall be Schedule 40 PVC (Polyvinyl Chloride). The minimum raceway size shall be 3/4". All fittings and couplings for RMC shall be threaded.

Receptacles shall be 20A hospital grade type receptacles. Receptacles in waiting areas, corridors, and all public spaces shall be tamper resistant. Receptacles in waiting areas and break rooms shall also be receptacles with USB charging ports.

All wiring devices connected to emergency power shall be factory finished red in color.

All device coverplates shall be stainless steel and engraved with the panel name and circuit number.

All distribution equipment such as transfer switches, switchboards, panels, transformers, disconnects, and all other distribution equipment shall be provided with a self-adhesive engraved identification nameplate.

Provide concrete housekeeping pads under all new floor mounted distribution equipment.

New distribution equipment shall be manufactured by GE, Siemens, or Square-D.

All devices and equipment within resident care spaces shall be anti-ligature.

Telecommunications and low-voltage system outlets shall be provided with a backbox and 3/4" empty conduit with pull string to the accessible ceiling space.

Lighting

All interior spaces shall be provided with lighting fixtures designed to enhance the aesthetics and to provide illumination level consistent with the current standards as defined by the Illuminating Engineering Society of North America (IESNA) Handbook.

Lighting fixtures shall utilize energy efficient LED type light sources. LED sources shall have a minimum color rendering index (CRI) of 90 and a color temperature of 3,500 Kelvin. All LED lighting shall be tunable white.

Exit lights shall be internally lit LED. Exit lights shall be a decorative type edge lit exit light and shall have red colored letters.

Switches shall be provided in all spaces to control the light fixtures within that space.

Provide dimming capabilities in resident care spaces, conference rooms, meeting spaces, and any other areas required by administrative needs.

Vacancy and Occupancy sensors shall be provided in public spaces, toilet rooms, storage rooms, offices, and any other spaces as required by the International Energy Conservation Code.

Emergency life safety power lighting shall be provided in all egress paths such as corridors, stairs, etc.

All lighting in resident care spaces shall be anti-ligature.

Provide light fixtures as required to meet recommended lighting levels from the IESNA Handbook.

Descriptions of the types of fixtures in each are of the project area as follows:

Interior Specialty Areas – Specialty lighting areas include the main entry and other areas as designated by the architect and interior designer. These areas will include LED dimmable recessed down-lights, and interior designer-selected LED pendants and wall sconces.

Interior Typical Areas – Typical common space areas, offices, corridors, conference room, etc. throughout the building will be lighted with LED direct/indirect lay-in 2x2 fixtures. LED dimmable recessed down-lights will be used at nurse stations, waiting rooms, quiet rooms, consultation rooms, and other spaces where lighting levels will need to be adjusted.

Clean Room Spaces – LED direct lensed clean room gasketed lay-in 2x2 fixtures. Lenses shall be inverted to have smooth face down.

Storage Spaces – LED direct lensed lay-in 2x2 fixtures.

Restrooms – LED vanity wall mounted sconce and LED dimmable recessed down-light.

Emergency Egress – Wall/Ceiling mounted LED exit sign.

Other Equipment

Security

CCTV, card readers, wave sensors, panic stations, and automatic doors as required for access control.

Nurse Call

Restrooms, resident rooms, corridors, nurse stations, staff areas, and all other areas for a complete system as required by Code and Guidelines.

Fire Alarm

Provide new fire alarm devices as required by NFPA 72. Notification appliances shall be provided in all public spaces such as toilets, corridors, waiting areas, etc. Smoke detection shall be provided in all public spaces such as toilets, corridors, waiting areas along with storage rooms, utility rooms, etc. Provide pull stations at exit doors, nurse stations, and in corridors as required by travel distance. A remote Fire alarm annunciator shall be provided at the nurse stations. Provide devices locations per NFPA 72. The fire alarm system shall be interfaced with mechanical systems as required to shut down fans and air handling units or close smoke dampers. The fire alarm system will be interfaced with door hold open devices and the proposed horizontally sliding fire barrier doors. New fire alarm system wiring shall be concealed in EMT and rated as required by NFPA 72 and IBC. All new devices shall be connected to the existing system. All existing graphic FAAP shall be updated.

Lightning Protection

Modify and reconfigure the lightning protection system to accommodate any new buildings or rooftop equipment and recertify in accordance with NFPA 78 and UL 96.

SITE UTILITY SYSTEMS

Option A

Building 15

Provide new site lighting for the parking lot. Poles shall be approximately 30’ in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of 1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

New Building with Connector to Building 17

Provide new site lighting for the parking lot. Poles shall be approximately 30’ in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of

1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

New Building with Connector to Building 15

Provide new site lighting for the parking lot. Poles shall be approximately 30' in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of 1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

Option B

Building 15

Provide new site lighting for the parking lot. Poles shall be approximately 30' in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of 1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

Building 22

Provide new site lighting for the parking lot. Poles shall be approximately 30' in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of 1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

New Building with Connector to Building 17

Provide new site lighting for the parking lot. Poles shall be approximately 30' in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of 1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

New Building with Connector to Building 15

Provide new site lighting for the parking lot. Poles shall be approximately 30' in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of 1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

Option C

Building 15

Provide new site lighting for the parking lot. Poles shall be approximately 30' in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of 1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

Building 22

Provide new site lighting for the parking lot. Poles shall be approximately 30' in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of

1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

New Building with Connector to Building 17

Provide new site lighting for the parking lot. Poles shall be approximately 30' in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of 1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

New Building with Connector to Building 15

Provide new site lighting for the parking lot. Poles shall be approximately 30' in height mounted to a concrete base. Site lighting shall be provided to allow for an average footcandle level of 1fc. Provide central timeclock and photocell control. Provide motion sensor control at each fixture.

CENTRAL PLANT

The heating and cooling plants for the new Adult Behavioral and Outpatient Education and Research buildings shall be stand-alone and adjacent to the Adult Behavioral building. The two plants shall be included in a single structure and separated by a floor-to-deck wall. Both heating and cooling plants shall be no less than 3,000 square feet each.

Option A

Chiller plant:

Day One Configuration: Three 350-ton centrifugal chillers

Final configuration after expansion: Five 350-ton centrifugal chillers

Variable speed primary pumps

Variable speed secondary pumps in each facility with chilled water

Evaporative cooling towers with variable speed fans matching the noted water-cooled chiller sizes

Variable speed condenser water pumps

Hot Water Plant

Day one Configuration: Two (3) 2500 MBH condensing boilers

Final Load after Expansion: Five 2500 MBH condensing boilers

Variable speed primary heating water pumps

Option B

Chiller plant:

Day One Configuration: Three 375- ton centrifugal chillers

Final configuration after expansion: Five 375- ton centrifugal chillers

Variable speed primary pumps

Variable speed secondary pumps in each facility with chilled water

Evaporative cooling towers with variable speed fans matching the noted water-cooled chiller sizes

Variable speed condenser water pumps

Hot Water Plant

Day one Configuration: Two (3) 3500 MBH condensing boilers

Final Load after Expansion: Five 3500 MBH condensing boilers

Variable speed primary heating water pumps

Option C

Chiller plant:

Day One Configuration: Three 600- ton centrifugal chillers

Final configuration after expansion: 600- ton centrifugal chillers

Variable speed primary pumps

Variable speed secondary pumps in each facility with chilled water

Evaporative cooling towers with variable speed fans matching the noted water-cooled chiller sizes

Variable speed condenser water pumps

Hot Water Plant

Day one Configuration: Two (3) 5000 MBH condensing boilers

Final Load after Expansion: Five 5000 MBH condensing boilers

Variable speed primary heating water pumps

Plumbing

Existing Structures

BUILDING 15

Building 15 is served by a 4" ductile iron domestic cold-water pipe. A backflow preventer is present, but is not in working order, nor has it been recently inspected. Incoming water pressures was read at 87 psi, and 80 psi downstream of the backflow preventer. Domestic water distribution piping is a combination of galvanized threaded piping and copper.

Domestic hot water service is provided by two steam to hot water shell and tube heat exchangers. Each heat exchanger has its own thermostatic mixing valve. These manual valves are scheduled to be swapped out with electronic automatic actuated ASSE 1017 mixing valves (per discussions with maintenance staff). The heaters output 150°F to 160°F water, and the mixing valves blend the domestic hot water distribution down to 120°F.

Domestic hot water recirculation is present in this building via a single in-line pump, which is relatively new. Multiple sets of domestic water, sanitary, and vent risers extend from the basement, behind the stacked bathrooms in accessible chases to serve fixtures on all 8 floors.

There is a commercial water softening system that serves the domestic hot water heating system.

Sanitary service is threaded iron piping. Some sanitary piping in plumbing chases has been replaced with PVC during past projects.

Storm drainage is achieved via piped roof drains as primary, and overflow scuppers as secondary.

A new air compressor in the basement provides compressed air to for pneumatic HVAC system controls. The compressor is less than 1 year old. Additionally, there is an old backup compressor not currently in use.

Each resident floor has multiple resident rooms, and staff toilet rooms. The resident toilets have wall mounted porcelain water closets with external flush valves, with enclosed flush valve covers intended for ligature resistance. Lavatories are solid surface or porcelain and ligature resistant type fixtures. Showers fixtures are tile in place or pre-manufactured shower pans with ligature resistant stainless-steel panels with safety controls and outlets.

The staff toilet room fixtures are wall mounted porcelain. Toilets have exposed flush valves. Lavatories are wall mounted with exposed manual gooseneck faucets. Staff break room areas have stainless-steel drop-in sinks with single handle faucets, consistent with residential type kitchens.

The plumbing systems in Building 15 are in working order, but show significant signs of aging, wear and tear, and exterior corrosion. Piping within the plumbing chases is of various quality and life and is recommended for replacement with any significant renovation to the building.

The domestic hot water heat exchangers are of sufficient size and show similar signs of aging. The domestic hot water recirculation pump, while like new, is undersized and insufficient for an 8-floor building recirculation loop. The entire domestic hot water system should be rebalanced to ensure 109°F water is achievable for public handwashing on the top floor.

The domestic cold water backflow preventer is recommended for replacement entirely as it is currently not in function and is not protecting the campus water distribution from backflow. A second parallel backflow preventer should be provided to ensure water service is not interrupted during backflow inspection or maintenance.

Some plumbing fixtures on the resident floors are like new condition, while others are old and are recommended for replacement as a part of any future projects.

BUILDING 17

Building 17 is served by a 2" domestic cold-water feed. No backflow preventer is present. An electric tank water heater serves the building. Domestic hot water recirculation is present in this building. No master mixing valve was observed. Sanitary service is a combination of PVC DWV and threaded iron piping. Domestic water piping is a combination of threaded galvanized piping and copper. The roof is drained via gutters and external downspouts. Plumbing fixtures in resident areas are ligature resistant type consistent with those found in building 15. Staff areas have wall hung porcelain fixtures that are not ligature resistant. The condition of the existing plumbing systems is poor, including pipe corrosion, missing or damaged insulation, and hard water deposits.

BUILDING 22

Building 22 is used for storage only. All utilities to this building are shut off and will require new plumbing services entirely extended from site utilities.

New Design Concepts

OPTION A

Building 15

Floors 1, 2, and 3 – light renovation – 37,500 ft^2. Plumbing fixtures will be replaced, and piping in plumbing chases will be replaced with new piping.

Floors 6 and 7 – Residential treatment / transitions – 25,000 ft^2.

Anticipated floor plan changes – all plumbing piping and risers in conflict with the new floor plan will be removed and reinstalled in coordination with new work.

Plumbing fixtures and piping on the renovated floors will be removed and replaced with new.

Domestic hot water rebalancing will be performed to ensure any renovated space is receiving 109°F water adequate for handwashing.

Building 17
Floors 1 and 2 – interior and light exterior renovations. Plumbing fixtures will be replaced, and piping in poor condition will be replaced. The water heater in the basement will be replaced. A backflow preventer will be added to protect the site from backflow.

Building 22
No new work anticipated in this option.

New Building with Connector to Building 17
Single-story, I-2 occupancy, 64 Beds, 42,000 ft^2

New 6" sanitary connection to site utilities.

New storm water connection to site, sized per IPC and local rainfall rates.

New 4" domestic cold water main to serve the new building with redundant backflow preventers.

Propane fired condensing boilers will provide domestic hot water, with dedicated recirculation pump(s).

A central water softening system.

New resident areas will have ligature resistant safety type fixtures.

Staff areas will have standard commercial type healthcare plumbing fixtures.

New Building with Connector to Building 15
3-story, business occupancy, 48,000 ft^2

New 6" sanitary connection to site utilities.

New storm water connection to site, sized per IPC and local rainfall rates.

New 3" domestic cold water main to serve the new building with redundant backflow preventers.

A central water softening system.

Propane fired condensing boilers will provide domestic hot water, with a dedicated recirculation pump.

New resident areas will have ligature resistant safety type fixtures.

Staff areas will have standard commercial type healthcare plumbing fixtures.

OPTION B

Building 15

Floors 1 and 2 – light renovation – 25,000. Plumbing fixtures will be replaced, and piping in plumbing chases will be replaced with new piping.

Floors 3, 5, 6 and 7 – Residential treatment / transitions – 50,000 ft^2.

Anticipated floor plan changes – all plumbing piping and risers in conflict with the new floor plan will be removed and reinstalled in coordination with new work.

Plumbing fixtures and piping on the renovated floors will be removed and replaced with new.

Domestic hot water rebalancing will be performed to ensure any renovated space is receiving 109F water adequate for handwashing.

Building 17

Floors 1 and 2 – interior and light exterior renovations. Plumbing fixtures will be replaced, and piping in poor condition will be replaced. The water heater in the basement will be replaced. A backflow preventer will be added to protect the site from backflow.

Building 22

Residential Staff Housing – interior and exterior renovation – 4,300 ft^2.

All new site connections for domestic water, sanitary, and storm.

New domestic water heater(s).

New standard commercial plumbing fixtures.

New 4” sanitary connection to site.

Install new gutters/downspouts, sized per IPC and local rainfall rates.

New 2-1/2” DCW connection to site with redundant backflow preventers.

New Building with Connector to Building 17

2-story, I-2 occupancy, 96 Beds, 80,000 ft^2

New 6” sanitary connection to site utilities.

New storm water connection to site, sized per IPC and local rainfall rates.

Rainwater reclamation system and water treatment system, gray water distribution system, and a bypass to the site storm.

New 4” domestic cold water main to serve the new building with redundant backflow preventers.

Propane fired condensing boilers will provide domestic hot water, with a dedicated recirculation pump(s).

A central water softening system.

New resident areas will have ligature resistant safety type fixtures.

Staff areas will have standard commercial type healthcare plumbing fixtures.

New Building with Connector to Building 15
3-story, business occupancy, 52,000 ft^2

New 6" sanitary connection to site utilities.

New storm water connection to site, sized per IPC and local rainfall rates.

Rainwater reclamation system and water treatment system, gray water distribution system, and a bypass to the site storm.

New 3" domestic cold water main to serve the new building with redundant backflow preventers.

A central water softening system.

Propane fired condensing boilers will provide domestic hot water, with a dedicated recirculation pump.

New resident areas will have ligature resistant safety type fixtures.

Staff areas will have standard commercial type healthcare plumbing fixtures.

OPTION C

Building 15
Floors 1 and 2 – light renovation – 25,000 $ft^{2.}$ Plumbing fixtures will be replaced, and piping in plumbing chases will be replaced with new piping.

Floors 3, 4, 5, 6 and 7 – Residential treatment / transitions – 62,500 ft^2.

Anticipated floor plan changes – all plumbing piping and risers in conflict with the new floor plan will be removed and reinstalled in coordination with new work.

Plumbing fixtures and piping on the renovated floors will be removed and replaced with new.

Domestic hot water rebalancing will be performed to ensure any renovated space is receiving 109F water adequate for handwashing.

Building 17
Floors 1 and 2 – interior and light exterior renovations. Plumbing fixtures will be replaced, and piping in poor condition will be replaced. The water heater in the basement will be replaced. A backflow preventer will be added to protect the site from backflow.

Building 22
Residential Staff Housing – interior and exterior renovation – 4,300 ft^2.

All new site connections for domestic water, sanitary, and storm.

New domestic water heater(s).

New standard commercial plumbing fixtures.

New 4” sanitary connection to site.

Install new gutters/downspouts, sized per IPC and local rainfall rates.

New 2-1/2” DCW connection to site with redundant backflow preventers.

New Building with Connector to Building 17
2-story, I-2 occupancy, 144 Beds, 150,000 ft^2

New 8” sanitary connection to site utilities.

New storm water connection to site, sized per IPC and local rainfall rates.

Rainwater reclamation system and water treatment system, gray water distribution system, and a bypass to the site storm.

New 4” domestic cold water main to serve the new building with redundant backflow preventers.

Propane fired condensing boilers will provide domestic hot water, with a dedicated recirculation pump(s).

A central water softening system.

New resident areas will have ligature resistant safety type fixtures.

Staff areas will have standard commercial type healthcare plumbing fixtures.

New Building with Connector to Building 15
4-story, business occupancy, 70,000 ft^2

New 6” sanitary connection to site utilities.

New storm water connection to site, sized per IPC and local rainfall rates.

Rainwater reclamation system and water treatment system, gray water distribution system, and a bypass to the site storm.

New 3” domestic cold water main to serve the new building with redundant backflow preventers.

A central water softening system.

Propane fired condensing boilers will provide domestic hot water, with a dedicated recirculation pump.

New resident areas will have ligature resistant safety type fixtures.

Staff areas will have standard commercial type healthcare plumbing fixtures.

Design Criteria
Plumbing design will conform with the design guidelines of all applicable codes and standards of the Authorities Having Jurisdiction (AHJ).

CODES, DESIGN GUIDELINES, AND MATERIAL STANDARDS

Codes
Virginia Construction Code 2018

Virginia Existing Building Code 2018

Virginia Maintenance Code 2018

Virginia Statewide Fire Prevention Code 2018

Virginia Energy Conservation Code 2018

Virginia Energy Conservation and Environmental Standards (VEES)

Major Referenced Standards

ICC International Building Code 2018

ICC International Plumbing Code 2018

ICC International Mechanical Code 2018

NFPA 70 National Electric Code 2017

ICC International Fuel Gas Code 2018

ICC International Residential Code 2018

ICC International Fire Code 2018

IECC International Energy Conservation Code 2018

Guidelines
Guidelines for Design and Construction of Hospitals 2022

Design Guide for the Built Environment of Behavioral Health Facilities 2022

SITE UTILITY SYSTEMS
Rainwater reclamation systems

NEW BUILDING WITH CONNECTOR TO 17 AND NEW BUILDING WITH CONNECTOR TO 15.
- Underwater storage tank(s) with bypass to site.

- Water treatment equipment inside the building(s).
- Gray water distribution system
- Used for toilet flushing or other code compliant gray water applications.

PLUMBING SYSTEMS MATERIALS AND SPECIFICATIONS

All new building plumbing utilities and renovated existing plumbing systems shall comply with the following standards.

Domestic Cold water

- DCW main shall serve the facility from a new tap into the utility.
- Service entrance with isolation valve and protected with two parallel 4” duplex RPZ backflow preventers.
- Distribution system shall consist of ductile iron piping for sizes 4” and larger from building entry to the backflow preventer(s).
- Distribution system for brine shall consist of SCH 80 CPVC piping.
- Freeze proof hydrants will be provided every 150’ along the building perimeter for convenience and on the roof as required to service mechanical equipment.
- Provide full port lead free ball valves for pipe sizes 3” and smaller and high performance (Bray Series 41 or equivalent bubble tight shutoff) butterfly valves for piping 4” and larger.
- All components shall meet lead free requirements.
- Water Softener
- Triplex water softener to serve DCW, DHW, and mechanical makeup systems.
- External brine tanks adjacent to water softener system.

Domestic Hot Water

- DHW is to be provided by two propane fired condensing boilers.
- Water temperature will be set at or above 140F to mitigate legionella concerns within DHW generation equipment.
- Mixing valves noted below will mix down to required distribution temperatures.
- One electronic controlled master mixing valve sized for the new 120F DHW flow.
- One electronic controlled master mixing valve sized for Kitchen/Servery 140F DHW flow.
- Point of use mixing valves on all public sinks and lavatories as required by IPC.
- Distribution system shall consist of type L copper for sizes 3” and less.
- Distribution system for domestic water shall consist of Schedule 10 Stainless steel with welded joints for sizes 4” and greater.
- Provide full port ball valves for pipe sizes 3” and smaller and high performance butterfly valves for piping 4” and larger.
- Two recirculation pumps for hot water return.
- 120F loop
- 140F loop

- Automatic flow controls in hot water return system to allow balancing. Recirculated DHW sources must be available within 25' (total developed length of piping, including vertical offsets) as required by FGI, for each connected fixture.
- A floor mounted ASME rated Expansion tank.
- All components shall meet lead free requirements.

Plumbing Fixtures

Resident Areas

- Ligature-resistant safety type fixtures throughout
- Fixtures will be ADA when required.
- Bathrooms and toilets shall all meet ADA and water closets will be wall mounted wall outlet throughout.
- Fixtures and trim shall meet lead free requirements.
- Stainless steel or powder coated Water Closets
- 1.6 gpf flushometer – concealed within wall space – accessible only by staff.
- Wall mounted, wall inlet, wall outlet.
- Stainless steel, powder coated, or solid surface lavatories –automatic or manual faucets – ligature resistant.
- Single and group occupant toilets
- Showers
- Tile in place or solid surface pre-manufactured shower systems.
- ADA compliant controls
- Two shower heads, 1 at standing height and 1 at ADA compliant height
- Two sets of shower controls
- All controls, heads, and accessories will be ligature resistant.

Staff and public areas

- Bathrooms and toilets shall all meet ADA and water closets will be floor mounted back outlet throughout.
- Fixtures and trim shall meet lead free requirements.
- Vitreous China Water Closets – 1.1/1.6 gpf dual acting flushometer.
- Vitreous China Clinical Service Sinks– 1.1/1.6 gpf dual acting flushometer.
- Soiled Utility Rooms
- Floor mounted on 10" terrazzo pedestal
- Wall mounted wrist blade operated faucet
- Wall mounted spray hose with foot pedal operation
- Vitreous China Urinals – Pint flush electronic flushometer
- Vitreous China Lavatories –faucets
- Single occupant toilets
- Point of use mixing valve under each wall mount lavatory (public only)
- Public areas electronic faucets
- Clinical areas 4: wrist blade handle operation

- Faucets in public areas shall have goosenecks with 0.5 gpm non-aerating flow controls
- Faucets in clinical spaces shall utilize flow controls within the gooseneck, 1.5 gpm laminar flow plain end outlets without aerators.
- Stainless Steel drop-in Lavatories and sinks– 1.5 gpm faucets
- Exam Rooms (these may require higher flows)
- Public areas: wrist blade handle operation
- Clinical areas : wrist blade handle operation
- Staff break room sinks to include side spray
- Faucets in clinical spaces shall utilize flow control in the gooseneck, 1.5 gpm laminar flow plain end outlets without aerators.
- Mop sinks – Cast Concrete and marble with stainless steel rim
- Include faucet, hose, mop hanger
- Staff Showers (ADA roll-in style)
- 1.5 gpm handheld shower wand
- Mixing valve
- Handrails
- Eye Washes
- As required. Included mixing valves from manufacturer

Sanitary

Sanitary will be collected by a series of 6” building drains that connects to the utilities outside of the structure.

Sanitary waste and vent piping will be connected to each plumbing fixture requiring waste.

Below grade sanitary and vent piping shall consist of PVC DWV pattern.

Above grade sanitary and vent piping shall consist of no-hub cast iron.

Floor Drains with trap primers will be provided in:

Mechanical rooms (4”)

Public toilets (2”)

Individual toilets (2”)

Janitor’s / EVS closets. (3”)

Grease Waste

Only required if the new building contains a commercial kitchen.

Cast iron piping from drain connections serving 3rd floor kitchen to grease interceptor.

See Sanitary piping for 4” piping beyond interceptor.

Provide turn down boots for inlet and outlet to interceptor.

Offset below grade and route to ≈5000-gallon H20 rated interceptor below grade – location to be coordinated with site design.

Outdoor, below grade grease waste piping shall be heat traced.

Storm

Storm water will be collected by roof drains and carried to building drains which exit the building and are connected to the storm water reclamation system. Emergency overflow storm water will be collected by a series of overflow drains and carried to exterior walls where they will daylight to grade. Piping systems for primary and emergency roof drains will be separate.

Roof drain piping will be routed to the closest column to avoid horizontal piping runs above ceiling wherever possible.

Overflow piping will be routed to the exterior walls and down to the first floor with individual discharge outlets approximately 24” above finished grade.

Primary and secondary storm piping shall be sized to include vertical wall loads required by IPC 1106.4.

Below grade storm piping shall consist of PVC DWV pattern.

Above grade storm and overflow piping shall consist of no-hub cast iron and will be insulated.

FIRE SUPPRESSION AND FIRE ALARM

Existing Building 15

Building 15: Residential Treatment & Transitional Spaces

Built in 1953, this existing building is a large seven-story fully sprinklered building that is also equipped with an antiquated Siemens MXL Fire Alarm System. This building will be renovated to provide residential treatment and transitional spaces for the residents. It will undergo a mix of cosmetic and invasive renovations across all three options, with additional floors being renovated with each sequential option. Below lists the renovated floors included in each option:

New Design Concepts

Option A:

- Light renovation: Floors 1, 2, and 3
- Significant renovations: Floors 6 and 7

Option B:

- Light renovation: Floors 1 and 2

- Significant renovations: Floors 3, 5, 6, and 7

Option C:

- Light renovation: Floors 1 and 2
- Significant renovations: Floors 3, 4, 5, 6, and 7

Fire Alarm System

There is another project to replace and upgrade the existing fire alarm systems in Building 15. Any existing fire alarm system deficiencies will be addressed as part of the fire alarm system replacement project. The Building 15 fire alarm system will include modifications to the new system to provide an NFPA 72 compliant analog/addressable fire alarm system in accordance with the occupancy requirements.

Fire Suppression System

The existing building is fully sprinklered (wet pipe sprinkler system with selective areas served by dry-pipe systems where the areas are not conditions and subject to freezing). The existing building is also equipped with a Class 1 standpipe system as required by the VCC, with hose valves located in each stairwell and elevator lobby enclosure. The Building 15 sprinkler systems will include modifications to the existing sprinkler/standpipe system to provide an NFPA 13 compliant sprinkler and standpipe system for the building.

Building 17: Residential Treatment

Built in 1939, this existing building is a large two-story concrete and masonry building with a partial basement. For all three options, this building will be renovated to become a residential treatment unit for the residents. It will undergo a mix of significant cosmetic and invasive renovations across all three options. The building is fully sprinklered and protected with an addressable fire alarm/detection system.

Fire Alarm System

The manufacturer of the existing fire alarm system, (Siemens MXL) has phased out the MXL product line and support so a new fire alarm system will be provided under all three options.

Fire Suppression System

The existing building is fully sprinklered (wet pipe sprinkler system with selective areas served by dry-pipe systems where the areas are not conditions and subject to freezing). The Building 17 sprinkler systems will include modifications to the existing sprinkler system to provide an NFPA 13 compliant sprinkler system for the building.

Building 22: Staff Apartments

Built in 1928, this existing building is a one-story wood-framed building with a partial basement. The wall, floor, and roof structure appear to consist of wood frame construction. The building is currently being used for bulk storage. Option A excludes this renovation work, however for Options B and C this building shall be renovated into staff housing. This building will undergo a

mix of cosmetic and invasive renovations across Options B and C. The building is not currently protected with a sprinkler system or a fire alarm/detection system.

Fire Alarm System

A new fire alarm system is required for Options B and C as the building is considered a Group R-1 Occupancy under these options. The fire alarm system shall provide not fewer than one manual fire alarm box installed at an approved location. Automatic smoke detection shall be provided throughout all interior corridors serving sleeping units, unless the building will not have interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exit or to an exterior exit access that leads directly to and exit. Smoke alarms (single and multiple station) shall be provided. Occupant notification shall be provided as required by the VCC § 907.5.

Fire Suppression System

A new sprinkler system is required for Options B and C as the building is considered a Group R-1 Occupancy under these options. A new sprinkler service and riser will be required. A standpipe system is not required.

New 3 to 4 story Business Occupancy Building
This new steel framed building is intended to serve as an outpatient education and research building for the residents. The building would also house new administrative and support spaces. Options A and B will be similar in scope and size (3 story structure); however, Option C introduces an additional top floor of shell space for future expansion (4 story structure).

Fire Alarm System

A manual fire alarm system and associated occupant notification system is required if the combined Group B occupant load of all floors is 500 or more, or the Group B occupant load is more than 100 persons above or below the lowest level of exist discharge, or if the fire area contains an ambulatory care facility. All occupants will be considered ambulatory and will not be rendered incapable of self-preservation. The occupant load factor, based upon the total facility square footage is less than 500 using an occupant load factor of 150 square foot per person IAW VCC table 1004.5. On a floor-by-floor basis, the calculated occupant load is 106 occupants per floor under the 3-story option and 100 occupants per floor under the 4-story option. Given the thresholds for all options being at or near the limit to require a new manual fire alarm system, a new fire alarm system will be required.

Fire Suppression System

For Options A and B, a new sprinkler system is not required. A new sprinkler system is required for Option C as the VCC requires sprinkler protection in new Business Occupancy Buildings greater than 3 stories in height. A new sprinkler service and riser will be required for Option C. In addition, for Option C, a Class 1 standpipe system is required as the building will be four or more stories above grade.

New 2 story Healthcare Occupancy Building
This new two-story steel and masonry building is intended to serve as an acute adult behavioral building for incoming residents. Option A provides two 32-bed units, with additional units being added for each sequential option. Below lists the number of units included in each option:

Option A: 2 units (32 beds each) 64 beds total

Option B: 3 units (32 beds each) 96 beds total

Option C: 4 units (32 beds each) Detox unit (16 beds) 144 beds total

Fire Alarm System: A manual fire alarm system and associated occupant notification system is required for a Group I-2 occupancy building. In addition, automatic smoke detection is required in corridors of Group I-2 occupancy buildings under Group I-2, Condition 1 and throughout in accordance with VCC § 407 for Condition 2.

Fire Suppression System: An automatic sprinkler system is required for buildings with Group I-2 occupancies regardless of building height and area. A new sprinkler service and riser will be required. A standpipe system is not required.

Design Criteria

Fire suppression and alarm systems design will conform with the design guidelines of all applicable codes and standards of the Authorities Having Jurisdiction (AHJ).

Codes, Design Guidelines and Material Standards

- 2018 Virginia Uniform Statewide Building Code (VUSBC)
- 2018 Virginia Construction Code (VCC)
- NFPA 13 – Standard for Installation of Sprinkler Systems (2016 edition)
- NFPA 14 – Standard for the Installation of Standpipe and Hose System (2016 edition)
- NFPA 70 – National Electrical Code (2017 edition)
- NFPA 72 – National Fire Alarm and Signaling Code (2016 edition)
- NFPA 101 – Life Safety Code (2018 edition)

Fire Alarm System
The project will include renovations to existing fire alarm systems (Building 15) and installation of new fire alarm systems as described above.

Where new fire alarm systems are required, the buildings will be provided with new analog/addressable fire alarm systems in accordance with the occupancy requirements. Each of the alarm devices shall transmit a unique, addressable signal to the buildings' fire alarm control panels. The control panel will send the alarm signals to the Catawba fire department to initiate fire department emergency response via new digital alarm communication transmitters via paired telephone wiring and/or via fiber network.

The fire alarm systems will interface with and monitor the sprinkler systems, HVAC systems for unit shutdown and smoke damper control, door hold-open devices for door release, elevator

systems for shunt tripping and recall functions, and other necessary supervision (e.g., life safety generators, emergency power monitoring, two-way radio fire fighter communications systems, etc.).

Occupant evacuation notification will be initiated by the fire alarm system and will be via strobes and speakers. Where occupants or patients remain overnight, smoke alarms are required in accordance with the VCC. Spacing and location of audible and visual notification will be compliant with ADA standards, NFPA 72, and state and local codes in each of the renovated spaces.

All new systems shall be compatible with the campus existing fire alarm system manufactured by Siemens.

Fire Suppression Systems
Fire Protection will be provided by fire hydrant systems and automatic sprinkler systems where noted above as applicable for each building in the project scope. Fire pumps are not anticipated given the water supply capabilities and limited height of the buildings being protected.

Backflow prevention will be required on the fire water supply lines. This will be in an external fire connection vault or inside the building if space is available and the required access can be provided.

Wet pipe automatic sprinkler systems designed and installed in accordance with NFPA 13 will be provided to protect all areas of the buildings where applicable. In areas where the building is not conditioned to provide a minimum of 40 °F year-round, dry pipe or preaction systems will be required. All building areas that provide access to behavior health patients shall be designed to include anti-ligature components (e.g., institutional type sprinkler heads) and all system piping in these areas shall be concealed.

All new and modified systems will require hydraulic calculations to indicate the water supply can provide adequate flow and pressure in accordance with NFPA 13.

Standpipe systems, where required, shall be installed in with fire hose valves located in the exit stairwells or remote sections of the buildings. The standpipe riser will be combined with the sprinkler system risers when both are provided in the same stairwells.

Where the seismic design category is C or greater, all sprinkler systems shall be seismically braced.

Concept Schedule

This study required the comparison of various options for delivering design/construction of the 3 options A, B and C concepts.

While there are various project delivery methods, for the purposes of this study, the traditional Design-Bid-Build with a CM hired during the Design phase. This approach is the delivery method used in developing the conceptual schedule for the project.

Design-Bid-Build is a methodology where an owner contracts separately and first with a design entity, and second with a construction entity that is independent of the design entity. Plans and specifications are prepared by a licensed architect/engineer (designer); construction is awarded to a general contractor (builder) through a competitive bid process during Design based on Fee and experience. This is often used form of project delivery by governments in the United States, and especially common among public owners with requirements to select the lowest bidder.

The base schedule incorporates the following principal activities:

- Designer Procurement
- Design
- Bidding and Award (Contractor Procurement)
- Construction

These principal activities incorporate many sub-activities; for example, the Design activities includes not just the actual design work by the designer, but also the standard regulatory reviews required by the Construction and Professional Services Manual.

The primary goal here is to compare the time required to for each of the 3 options presented. Typically, Commonwealth design funding would provide for designer procurement/design start of July 1 in any given year. Accordingly, the schedules provided in this preplanning study are all predicated on the authorization of this project being provided by July 1, 2023.

Option A Project Schedule

Catawba Campus Transformation	**Option 1**			
Design Time Line:	# Months to Approval for next Phase	Start Month	End Month	Comments
Pre-Planning	3	Oct-22	Jan-23	Pre Planning not in Design Total / Current Report Scope
Design				
SD	6	Jul-23	Dec-23	Assumes one Option into SD - July 2023 Start
PD	10	Dec-23	Oct-24	
WD	10	Oct-24	Aug-25	
Total Design	**26**			
Construction				
SubContractor Bid Period	2	Aug-25	Sep-25	
Construction Phase 1	22	Sep-25	Jun-27	New construction Complete
Mid - Point of Construction			**Dec-26**	
Construction Phase 2	10	Jun-27	Apr-28	Renovation Complete / Project Complete
Total Construction	**34**			
Total Project Duration	**60**			

Option B Project Schedule

Catawba Campus Transformation	**Option 2**			
Design Time Line:	# Months to Approval for next Phase	Start Month	End Month	Comments
Pre-Planning	3	Oct-22	Jan-23	Pre Planning not in Design Total / Current Report Scope
Design Time Line:				
SD	6	Jan-23	Dec-23	Assumes one Option into SD - July 2023 Start
PD	12	Dec-23	Nov-24	
CD	12	Nov-24	Oct-25	
Sub Total Design	30			
SubContractor Bid Period	2	Oct-25	Dec-25	
Construction Phase 1	24	Dec-25	Oct-27	New construction Complete
Mid - Point of Construction			**Jun-27**	
Construction Phase 2	12	Oct-27	Sep-28	Renovation Complete / Project Complete
Total Construction	**38**			
Total Project	**68**			

Option C Project Schedule

Catawba Campus Transformation	**Option 3**			
Design Time Line:	# Months to Approval for next Phase	Start Month	End Month	Comments
Pre-Planning	3	Oct-22	Jan-23	Pre Planning not in Design Total / Current Report Scope
Design				
SD	6	Jul-23	Dec-23	Assumes one Option into SD - July 2023 Start
PD	12	Dec-23	Nov-24	
CD	12	Nov-24	Oct-25	
Total Design	**30**			
Construction				
SubContractor Bid Period	2	Oct-25	Dec-25	
Construction Phase 1	26	Dec-25	Jan-28	New construction Complete
Mid - Point of Construction			**Jun-27**	
Construction Phase 2	12	Jan-28	Nov-28	Renovation Complete / Project Complete
Total Construction	**40**			
Total Project	**70**			

Concept Estimate

A cost estimate of the proposed transformation of the Catawba Campus was performed to determine the likely cost of the selected concepts. Specifically, the concept options are:

- Option A Mini Continuum of Care Model
- Option B Base Continuum of Care Model
- Option C Enhanced Continuum of Care Model

JLL's estimate used as a basis for its estimate the conceptual diagrams, square footages generated in the programming, selected site, conceptual schematic narratives, and proposed schedules all of which are provided within this report. Project "soft costs" are 25 percent of the total project cost.

Catawba Hospital - All Options
Roanoke, VA
Conceptual Statement of Probable Cost - DRAFT

JLL
SEE A BRIGHTER WAY

01/11/23

COST SUMMARY

Description	Total Area	$ / SF	Total Cost
OPTION A			
New Building w/connector to Building #17	63,850 SF	$683.55	$43,644,387
Renovate Building #17	36,400 SF	$407.75	$14,842,275
New Building w/connector to Building #15	49,000 SF	$611.24	$29,950,608
Renovate Building #15	62,500 SF	$464.86	$29,053,661
Soft Cost Allowance for Option A	25%		$29,372,733
OPTION A PROJECT COST TOTALS	**211,750 SF**	**$693.57**	**$146,863,664**
OPTION B			
New Building w/connector to Building #17	85,650 SF	$698.63	$59,837,309
Renovate Building #17	36,400 SF	$413.16	$15,039,151
New Building w/connector to Building #15	61,000 SF	$555.38	$33,877,952
Renovate Building #15	75,000 SF	$558.18	$41,863,364
Renovate Building #22	5,000 SF	$552.15	$2,760,743
Soft Cost Allowance for Option B	25%		$38,344,629
OPTION B PROJECT COST TOTALS	**263,050 SF**	**$728.85**	**$191,723,147**
OPTION C			
New Building w/connector to Building #17	144,000 SF	$653.21	$94,062,344
Renovate Building #17	36,400 SF	$416.23	$15,150,602
New Building w/connector to Building #15	61,000 SF	$557.51	$34,008,371
Renovate Building #15	87,500 SF	$523.32	$45,790,220
Renovate Building #22	5,000 SF	$556.29	$2,781,468
Soft Cost Allowance for Option C	25%		$47,948,251
OPTION C PROJECT COST TOTALS	**333,900 SF**	**$718.00**	**$239,741,257**