William & Mary

West Woods Phase 2

Programming and Concept Design Report

PROJECT CODE # 204-80008 | NOVEMBER 15, 2024

Goody Clancy

WIlliam & Mary
West Woods Phase 2

Contents

November 15, 2024

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01 Executive Summary

01 Executive Summary

Background and purpose

William & Mary has a long legacy of fostering a strong residential experience. With over 70% of its undergraduate population in on-campus University housing facilities, W&M values equitable student experiences in modern amenities, diverse residential living and learning experiences outside of the classroom and sustaining a sense of community and belonging. In 2022, William & Mary developed a comprehensive Housing and Dining Comprehensive Facilities Plan (referenced as HDMP) for the first time in W&M's 330-year history. The plan anticipates demolishing, renovating, and replacing approximately 80% of W&M's on-campus student housing inventory (+4k beds). W&M is currently underway with several projects contained within Phase 1 of the HDMP, including the development of 1000 new beds and a Dining Facility in the West Woods 1 Project, currently under construction.

Phase 2 of the HDMP includes the redevelopment of the Randolph Complex, immediately south of the West Woods 1. The existing eight buildings of the Randolph Complex accommodate 335 beds but are in poor condition; their existing systems are at the end of their useful lives, and the buildings have envelope and/or water infiltration issues that would be expensive to repair. The redevelopment of this site will yield 450 beds in buildings designed to be conducive to an engaged and inclusive living environment.

For clarity and brevity, the West Woods 1 and West Woods 2 projects will be referred to as West One and West Two below.

Schedule & Process

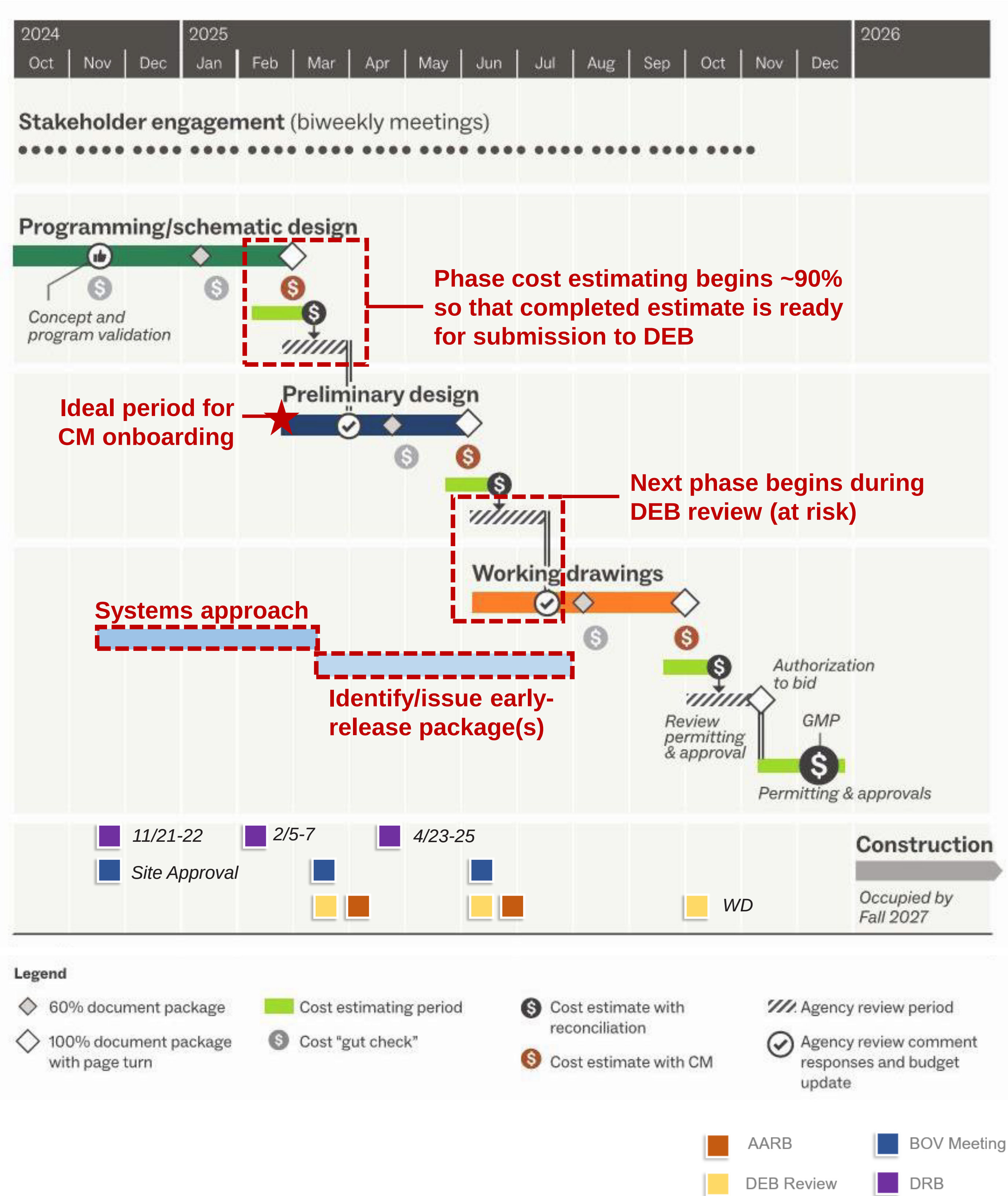
William & Mary identified an ambitious design and construction schedule for West Two, with the anticipated completion for occupancy for the Fall of 2027. On September 17, 2024, Goody Clancy began the Concept and Programming phase with a kickoff meeting with William and Mary discussing project goals, schedule, programmatic requirements, and site constraints.

Understanding the project's ambitions design and construction schedule, the team began this Concept effort two weeks ahead of schedule.

In-person biweekly meetings continued through the phase's completion, consisting of a morning topical meeting and an afternoon Building Committee meeting. The topical meetings explored a broad range of topics from sustainability paths and goal-setting charettes, to site and utility constraints and design considerations. The Building Committee group focused on building program, massing, design, and site strategies, with each meeting expanding upon the outcomes and discussions of the previous. Key William & Mary stakeholders participated in each meeting, depending on their area of expertise. Meetings have also included collaboration with Timmons Engineering, the firm responsible for documenting the demolition of the existing Randolph buildings and existing utilities.

A student representative has been a welcome member of the Building Committee, offering insight into the way that the buildings could shape student circulation paths, and what types of programmatic spaces are most successful in their contribution to the formation of community. An evening engagement with students is being planned early in the Schematic Design Phase.

In order to meet the schedule, William & Mary has accepted that the design team will need to proceed into each subsequent phase without pause for review and cost estimating—design progress will have to overlap with these efforts. See schedule graphic at right for overall design schedule.



2024
Oct
Nov
Dec
2025
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2026
Stakeholder engagement (biweekly meetings)
Programming/schematic design
Concept and program validation
Phase cost estimating begins ~90% so that completed estimate is ready for submission to DEB
Preliminary design
Ideal period for CM onboarding
Next phase begins during DEB review (at risk)
Working drawings
Systems approach
Identify/issue early-release package(s)
Authorization to bid
Review permitting & approval
GMP
Permitting & approvals
11/21-22
2/5-7
4/23-25
Site Approval
WD
Construction
Occupied by Fall 2027
Legend
60% document package
100% document package with page turn
Cost estimating period
Cost "gut check"
Cost estimate with reconciliation
Cost estimate with CM
Agency review period
Agency review comment responses and budget update
AARB
BOV Meeting
DEB Review
DRB

Concept Phase Meeting Roadmap

Mtg Week # Date	1 9/16 - 9/20	2 9/23 - 9/27	3 9/30 - 10/4	4 10/7 - 10/11	5 10/14 - 10/18
	CMTA-2rw Coord Monday 9/16/2024 10:00-11:00 (virtual)	**Site/Civil Kickoff** Tuesday 9/24/2024 9:00-10:30 (virtual)			**Site: Circulation, Features, Building Siting** Thursday 10/17/2024 10:30-12:00
			Sustainability Charette Thursday 10/3/2024 9:30-11:30		
	Design Kickoff Tuesday 9/17/2024 2:00-3:30		**Sustainability Charette & Program Update** Thursday 10/3/2024 2:00-3:30		**Massing, Program, Site** Thursday 10/17/2024 2:00-3:30
Deliverable/ Milestone					

Reviews with state agencies is anticipated at each design milestone, the first of which is to the DRB (Design Review Board) on November 20, 2024. This review is for site plan approval.

Considering the project's budget and performance goals, we anticipate preparing multiple D&Fs (Determinations and Findings) to submit for review and approval by W&M and DEB. Early items for consideration include structural and backup wall systems, mechanical system options tied to the propose geothermal well field, and electrical distribution. Prior to formally submitting the D&F, we will prepare decision-making handouts that describe options, their specific pros and cons, and how they differ from current technical standards. These handouts will be presented to W&M to make the informed decision on how to proceed.

11/5 - Closed

1/10: AARB- SD
2/5: DRB- SD

6 10/21 - 10/25	7 10/28 - 11/1	8 11/4 - 11/8	9 11/11 - 11/15	10 11/17 - 11/21
W1/W2 Site Logistics Thursday 10/24/2024 3:00-4:00 (virtual)	**Sustainability Update** Thursday 10/31/2024 10:30-11:30 (virtual)			**Student Engagement** Tuesday 11/19/2024 TBD
	Concept Update Thursday 10/31/2024 2:00-3:30 (virtual)		**Review/DRB Prep** Friday 11/15/2024 10:00-11:30	**DRB Site Selection/Design Intent** Wednesday 11/20/2024 10:00
		Concept Report DRAFT	**Concept Report & POR**	**Concept Cost Summary**

02
Program

02
Program

Goals, Trends, and Best Practices

The purpose of the project is to provide 450 beds of undergraduate housing as part of Phase 2 of William & Mary's Housing & Dining Comprehensive Master Plan (HDMP). The HDMP benchmarked William & Mary's student housing against their peer institutions', and identified area goals for such metrics as bedroom sizes and shared area per bed.

Goody Clancy developed a straw program based on the HDMP's recommendations as well as on recently designed William & Mary housing precedents. The straw program was the foundation for a series of conversations with the building committee to test room layout, size and distribution.

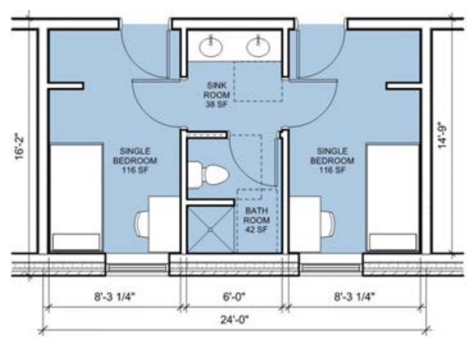
Private Residential Spaces

Within any student residence hall, the area devoted to the bedrooms and bathrooms will represent the majority of the building's area. However, it is the non-bedroom spaces and how they are distributed that build community and connect students to that community and the campus. Our aim has been to right-size the sleeping units - making them large enough to be comfortable but small enough to encourage students to participate in the social life of the building.

Singles and Doubles will be an average of 125 NSF and 225 NSF, respectively. These area targets account for the inclusion of units sized for the mobility impaired, which will represent at least 5% of the rooms, distributed across types.

Goody Clancy tested a variety of layouts for semi-suites sharing precedents from William & Mary's campus as well as from other campuses. In order to provide parity across campus, the team decided to follow the W&M precedent of a "jack & jill" style bathroom, similar to the semi-suites at Jamestown East.

Based on the feedback from residential life, the singles represent 11% of the beds, inclusive of singles reserved for RA's.



Single semi-suite 310 NSF

Double semi-suite 493 NSF

Shared Spaces

Creating an exceptional residential experience depends on optimizing the organization and characteristics of the shared spaces. Multi-function shared spaces are the places where student residents build community, connecting to one another and the campus around them.

Goody Clancy examined the programs of Jamestown East and West One to establish the straw program, and walked through each space type with the Building Committee, sharing precedent images to convey scale. The result is an assemblage of shared spaces that consider which common spaces are campus resources and which are solely for residents' use, fostering community at multiple scales:

District Community: All the residents of West One will share a Learning Commons and a pair of Program Rooms, located at the base of one of the buildings

Floor Community: each floor will have a lounge and a pair of study rooms

Building Community: each building will have a Building Commons and Common Kitchen

Campus Community: There appears to be space on the site for a use that is open to the entire campus.

The unit mix will include a target of 250 beds in traditional singles and doubles with common baths; another 200 beds will be provided in semi-suites of 2 or 4 students living in 2-bedrooms with a bath. Based on feedback from the Building Committee, we will err on the side of a greater number of traditional beds to meet the target of 450 total. There are recent precedents for the size and layout of each of these unit types on campus, such as in Jamestown East and the West One development. Using these precedents, the area of private residential space within the units is anticipated to be in the range of 59,000—62,000 NSF.

The Goody Clancy team also analyzed these campus precedents for the amount and types of social spaces provided per bed. The target of 28 nsf of shared space per bed was also validated by the HDMP in an examination of W&M's peer institutions. To the target of serve 450 beds, the anticipated common space is anticipated as approximately 10,500 NSF.

William & Mary established a total area target of 123,000 GSF for the Randolph Complex site. Applying a reasonable efficiency goal of 65%, that translates to a total net area of 80,000 NSF. The sum of the private residential and building common areas suggests that there is space available in the project for a campus amenity—a programmatic use that would be available to the entire W&M community, not just for the residents of the West Two complex. A number of potential uses have been considered during the concept phase—the idea that has emerged with the best potential is a campus bookstore. The bookstore is currently located in leased space off-campus. The bookstore occupies 4,500 NSF, but could benefit from a space as large as 6,500 NSF.

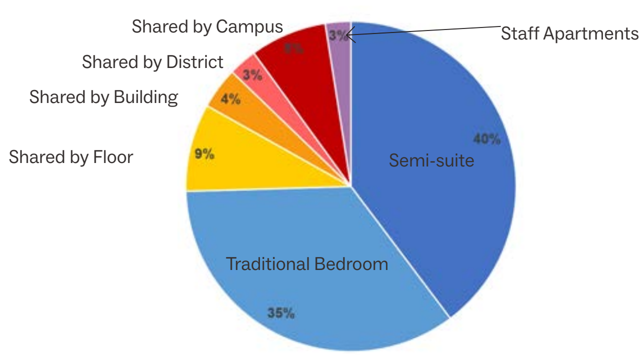
Development of community has been considered at multiple scales, offering the West Two residents places to socialize as an entire community of 450 students, or at the smaller scale of the individual building, or down to the scale of the community of the floor or wing of a building. The West Two complex will enjoy a learning commons and a pair of program rooms for their exclusive use—these will be located at the entry level at a prominent and easily-accessible location. Within each residential building, there will be a lounge and full kitchen, providing a place for those residents to connect to form building identity. Lounges and study rooms will also be provided on each floor, so that students have a place to socialize near to their bedrooms.

Program Stacking and Distribution

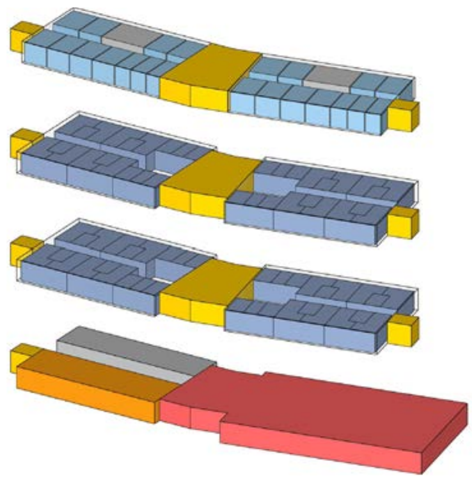
Goody Clancy tested how the program could be distributed on the site and within buildings. Options included:

- One of three buildings with traditional singles & doubles at all levels, with the other two buildings comprised of semi-suites on floors 1 through 3, with the narrower footprint of the 4th floor occupied by traditional bedrooms.
- Buildings with a heterogeneous mix of unit types on all floor levels.

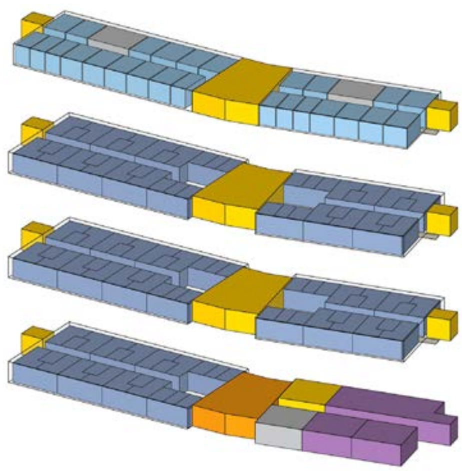
These options were developed to test how program distribution impacts building size as well as the student life experience. William & Mary's residential staff are flexible regarding unit type mix and their relationships to one another—they are confident that many configurations would support their approach to residential curriculum and programming as long as each building would maintain a minimum of 100 students.



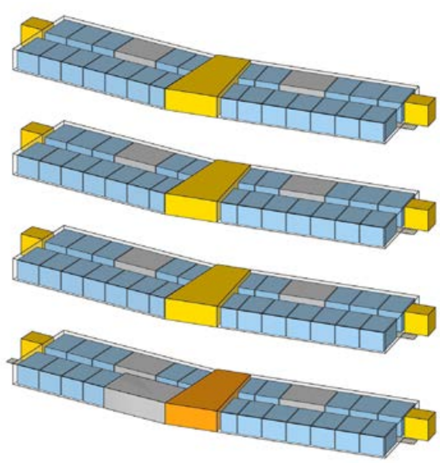
The Pie Chart above shows the distribution of program area.



Blocking and Stacking diagram of hybrid building with shared uses at first floor, semi-suites at floors 2-3 and traditional rooms at top floor



Blocking and Stacking diagram of hybrid building - semi-suites at floors 1-3 with traditional rooms at top floor



Blocking and Stacking diagram of building with traditional units at all floors

Key Legend

- *Traditional Bedroom*
- *Semi-suite*
- *Shared Residential*
- *Building Common Areas*
- *District Amenity*
- *Staff Apartments*
- *Campus Amenity*

Private Residential	Qty.	Unit NASF	NASF	BEDS/ UNIT	BEDS	% Dist
RA Single in Traditional Wing	10	125	1,250	1	10	2%
Traditional Single	20	125	2,500	1	20	4%
Traditional Double	110	225	24,750	2	220	49%
Common Baths (NSF/Bed)	13		3,250			
2 Singles Semi-suite	12	345	4,140	2	24	5%
2 Singles Semi-suite Accessible	2	400	800	2	4	1%
2 Doubles Semi-suite	39	525	20,475	4	156	35%
2 Doubles Semi-suite Accessible	4	600	2,400	4	16	4%
Subtotal			59,565		450	100%
Shared Residential				NSF/BED		
Bench	6	16	96	0.21		
Lounge	12	330	3960	8.80		
Kitchenette	12	160	1920	4.27		
Study	12	75	900	2.00		
Subtotal			6,876	15		
Building Common Areas				NSF/BED		
Laundry	3	170	510	1.13		
Social Lounge	3	430	1290	2.90		
Kitchen	3	165	495	1.12		
Study	6	130	780	1.78		
Booth	12	15	180	0.48		
Subtotal			3,255	7		
District Amenity						
Learning Commons	1	900	900	2.00		
Large Program Room	1	750	750	1.67		
Small Program Room	1	570	570	1.27		
Subtotal			2220	4.93		
Campus Amenity						
TBD			6000	13.33		
- Multipurpose Room						
- Bookstore						
- Auditorium						
Subtotal			6,000			
Staff Apartments						
2 BR Apartment	1	1100	1,100			
Staff Studio	2	450	900			
Subtotal			2,000			
		Net Area	79,916			
		Efficiency	65.00%			
		Gross	**122,948**			

Conceptual Program

03

Site and Architecture

03
Site and Architecture

The Sir Christopher Wren Building

Context and Analysis

William & Mary's campus is the proud home of the oldest college building in the country, the Sir Christopher Wren building. Its stately, Georgian aesthetic has informed the design of the campus buildings, resulting in a cohesive assembly of stylistically and materially similar buildings, particularly on the Old Campus. The West Two site is separated some distance from the Old Campus by the West Woods. The buildings in this area of campus have departed stylistically from the Georgian tradition, however the majority have brick facades in keeping with the older buildings. There are no significant buildings on the opposite side of Ukrop Way. Dupont Hall is the closest, but it is set back from the street and at a higher elevation than the Randolph site, making it feel both visually and physically disconnected.

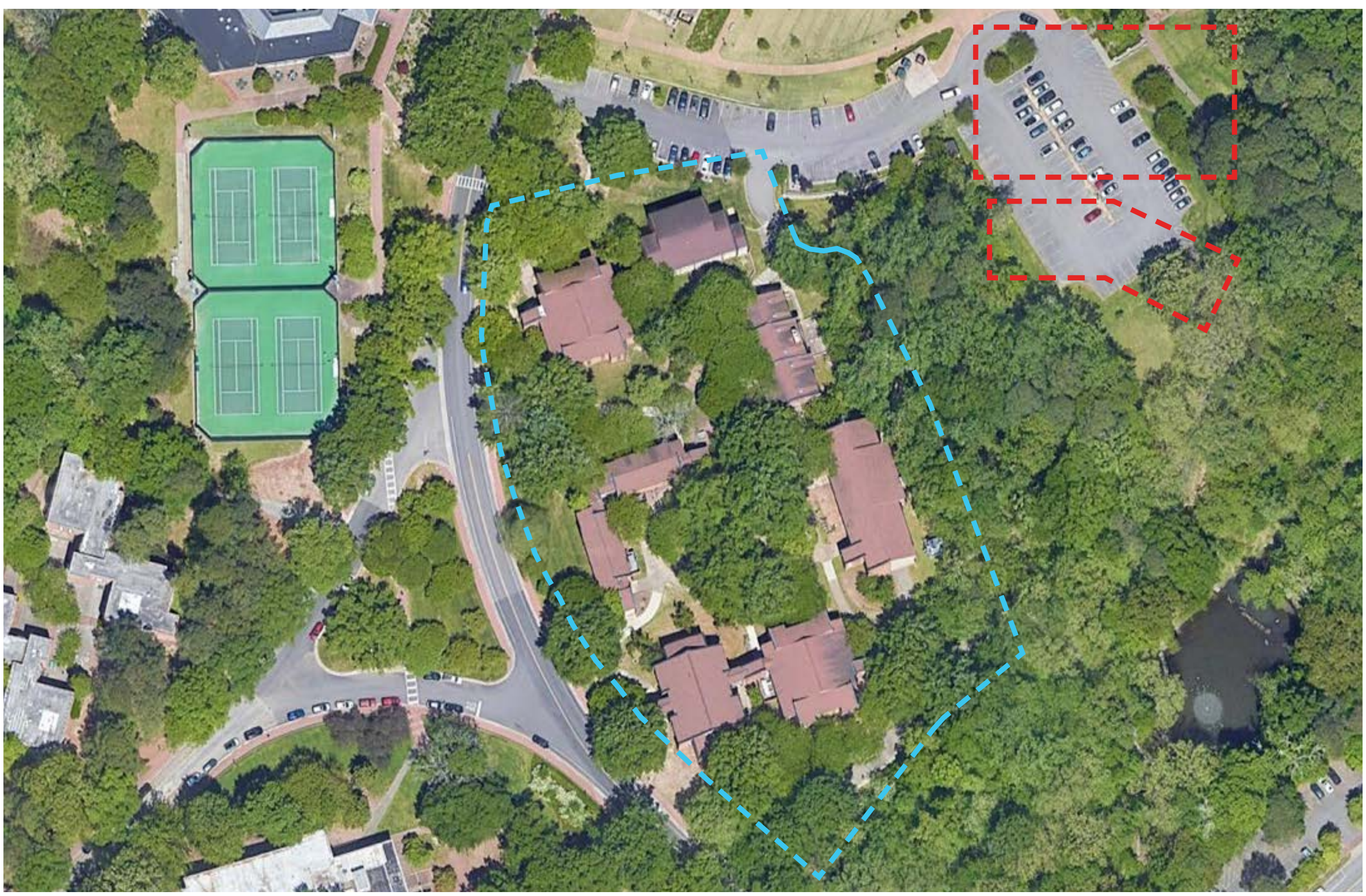
The site is characterized by densely spaced mature trees—some are as large as 36" caliper. The area east of the site is also heavily forested and is used by faculty as an ecological, outdoor classroom. There are pedestrian paths connecting the site through the woods to the center of campus, a walk that provides a lovely respite from the pressures of academic life. The preservation of as many healthy, mature trees as possible has been a driver in establishing the footprints for the new buildings.

The West One project established a broad, pedestrian promenade that forms the northern border of the West Two site. The West Two site is sloped from the high point where it meets the promenade to the low point at its southern edge. The slope and sidewalk along Ukrop Way on the site's western edge is gentle, very nearly meeting an accessible grade of 5%. Within the site, however, there are areas of steep contours, originally formed to create plateaus for the siting of the existing Randolph buildings.

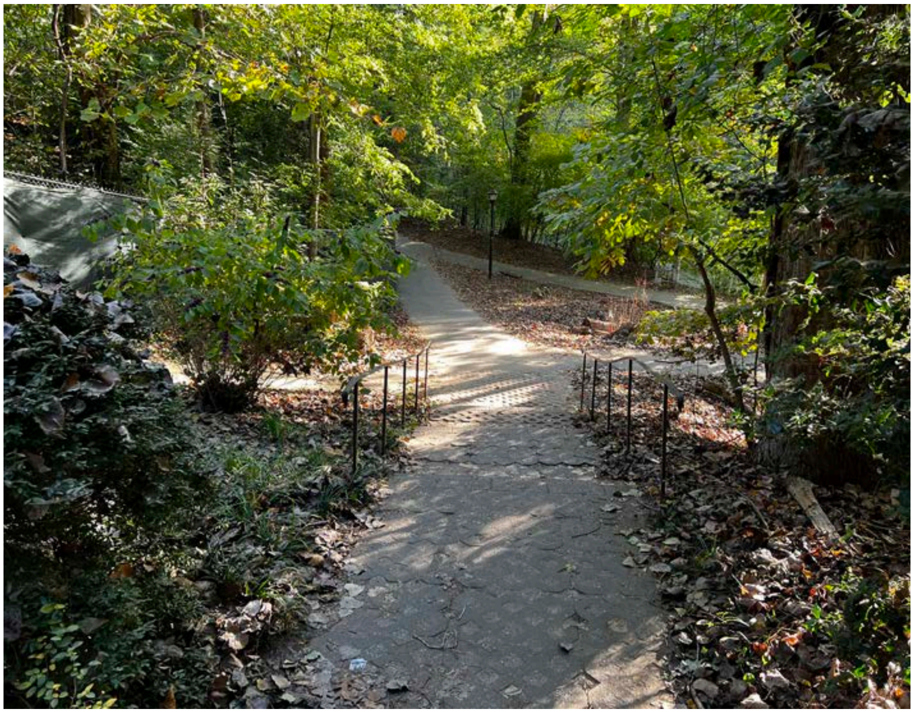
Image of fountain within West Woods

The existing Nicholas and Tazewell buildings of the Randolph Complex site

Tyler Hall on Old Campus, demonstrating characteristic Georgian composition and detailing



Aerial of existing site, showing the 8 existing buildings of the Randolph Complex and dense roof canopy. Outlines of the dining facility and Building 3 of West One are outlined in red and West Two site outlined in blue.



Existing Randolph Complex Pedestrian Paths

Existing Randolph Complex Pedestrian Paths

Site Design

William & Mary is currently endeavoring to certify their campus as an arboretum and has been classifying and assessing the site's trees to guide the design team as to their health and desirability. To fit with the character and density of the neighboring campus, the design team established a minimum setback from Ukrop Way of 50'-0" with a possible exception to the bookstore, which could have more of a presence on Ukrop. This zone includes many mature trees and existing-to-remain campus utilities, so it is also a practical approach. The other zone which the design has prioritized for tree preservation is a copse central to the site, which is characterized by a variety of species, a desirable inventory of an arboretum.

To maximize tree retention, the best approach is to limit re-grading, as well as to utilize the existing building footprints for new construction. Organizing new buildings around a single, central courtyard provides a cohesive sense of the West Two as a single community. The development of a patio or lawn is possible at the northern end of the courtyard, where it is relatively flat.

Designing how the site will be served by fire trucks and for trash removal is still being studied. At the south end of the site, there is an existing service road that is also used by students as a path to Ukrop Way when they emerge from the cut through the woods. Intentional design of service roads that can serve the dual-purpose for pedestrians is important for student safety.

Building Design

As Goody Clancy has learned more about the site from the survey and the tree identification effort, we developed and refined a series of massing options. These massing options were guided by four principles that were developed and expanded upon in concert with the Building Committee

- Reinforce the East-West Promenade
- Design for the Campus and the District
- Concentrate for Community
- Celebrate Natural Features

Reinforce the East-West Promenade

This urban design gesture creates a broad connection along Ukrop Way, with its eastern terminus anchored by a new dining facility, which will serve the students of the entire West Woods District. The relationships of the West Two buildings to the promenade and to Ukrop Way should strengthen the promenade's aspiration as the heart of the neighborhood.

Design for the Campus and the District

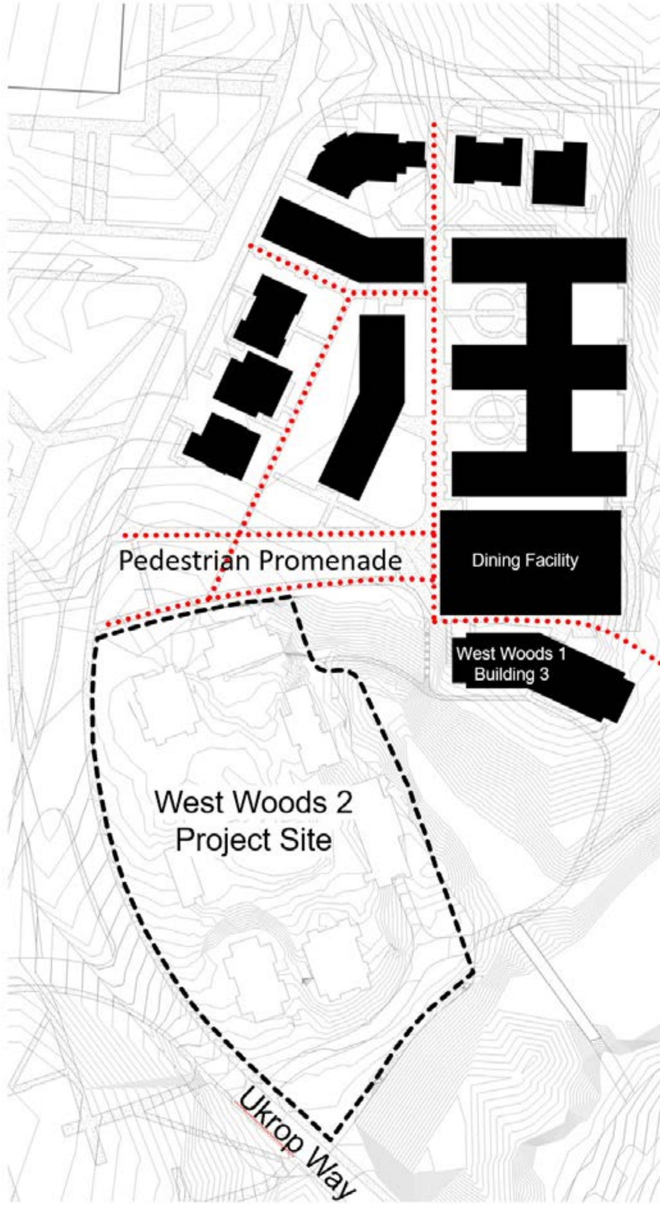
Goody Clancy has studied the way that the new buildings on the Randolph Complex site can form a cohesive neighborhood with West One, as well as fit within the larger campus context. This principle has guided the design team's approach to setbacks and building form.

Concentrate for Community

To encourage the formation of a strong residential community, Goody Clancy believes that it is important to put students in contact with one another during the course of their natural circulation to and through the site. This principle will guide design decisions such as the location of building entrances relative to one another, as well as the position of buildings on the site. This principle will also guide future design decisions such as entry sequence and building organization.

Celebrate Natural Features

As previously stated, the West Two site is characterized by a lovely collection of mature trees, and the site's eastern edge slopes down to a dense woods. Preservation of trees as well as the framing of views to the east has been a consideration in the development of conceptual schemes.



West One Buildings shown in black, and pedestrian circulation shown in red.

For a complex of 450 beds, a three-building scheme results in optimal-sized residential communities of approximately 150 students, similar to other W&M residence halls. Schemes of three buildings also demonstrate the best options for the reuse of existing building footprints and tree preservation. For the purposes of discussion, the three buildings are referred to as "North, West and East". Schemes that cluster these buildings at the north end of the site have emerged as the most desirable, since the result is a compact student community, where residents will be more likely to engage with one another going to and from their residence halls. Clustering the buildings north also avoids the lowest area of the site, which can be reserved for geothermal wells and stormwater structures.

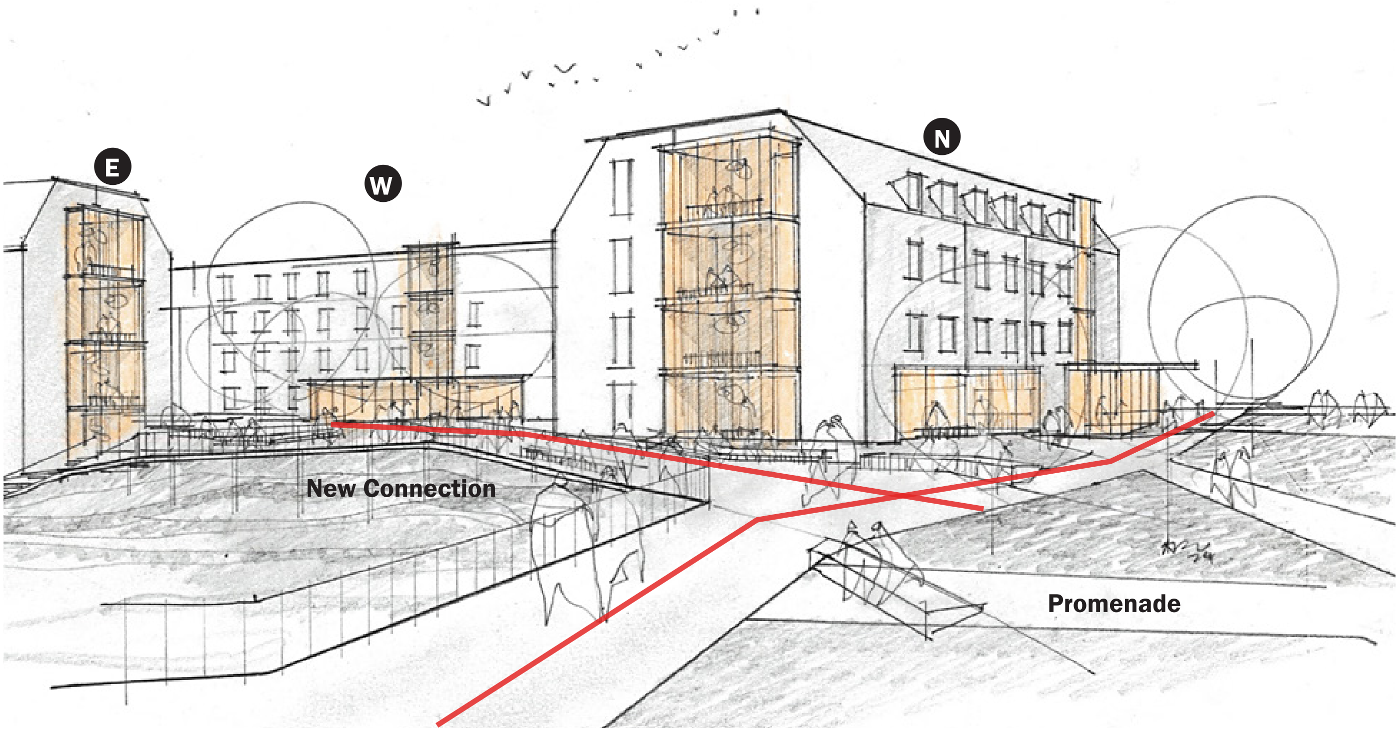
Early site plan diagrams studying two, three and four-building solutions

View of pedestrian promenade from Ukrop Way, North Building at right shows active ground floor program

The pedestrian promenade at the northern end of the site connects the new dining facility at West One to Ukrop Way. Goody Clancy has endeavored to strengthen the pedestrian experience of the promenade by locating common spaces alongside it, and in particular by anchoring the corner of the promenade and Ukrop with the campus bookstore. Transparency in the façade of the bookstore and other spaces facing the promenade will create an active see-and-be-seen atmosphere and provide visual interest to reduce the perceived length of the walk from Ukrop to the dining facility. The proposed shape of the North Building bends away from the promenade at its eastern end in order to open up views to West One's dining facility and Building 3.

Massing Option 1 *Massing Option 2* *Massing Option 3*

Continued study of three-building schemes - Massing Option 1 was preferred for its relationship to the street as well as its creation of a single unified courtyard for West One

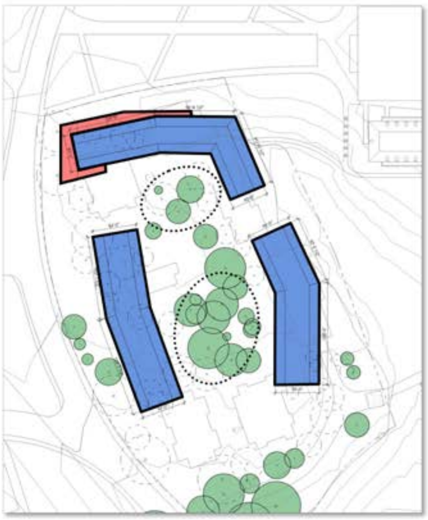


View looking South West from the Dining Hall towards West Two

The West Building will run parallel to Ukrop Way. The space between the North and West buildings along the sidewalk has been examined for appropriateness to the W&M campus, as well as how its scale can be large enough to feel inviting, but not so large as to compete with the promenade's relationship to Ukrop. The space between the North and East buildings has been similarly examined for how well it can provide a visual connection to the West One development, and in particular to the dining facility. A physical connection through this gap may also be desirable, since the residents of the West Two site will go to the dining facility daily as shown in the image above. A pedestrian connection at this corner will be a challenge to develop, since it is the steepest location on the site, forming a bowl down into the woods east of the site. A connection through the North building has also been discussed, security concerns notwithstanding.

The architectural expression of the buildings will be developed in accordance with William & Mary's Design Guidelines. The Guidelines outline how new buildings should reinforce the strong identity of the Georgian campus, while also allow for more modern expression depending on a site's distance from Old Campus.

The Building Committee identified Option 1C as their preferred option, since it best achieves the goals of the design guidelines. By clustering the buildings at the north of the site, this scheme has the added benefit of minimizing grade change over the length of the East and West Buildings. This suggests that the first floor of all three buildings will be able to be at the same, or similar finish elevation. If this can be accomplished, it will optimize the visual connection between the courtyard entries of the three buildings. This option also presents a gable end at the intersection of the promenade and Ukrop Way, reducing the perceived mass of the North building. This feels like an appropriate gesture to be compatible with the scale of the fraternity buildings on the north side of the promenade. The bookstore's location at this corner provides the additional strategy stepping down to a lower height volume at the street.



Option 1A

Option 1B

Option 1C

Further iterations of Massing Option 1, reshaping the North Building to open up views to Dining and Building 3 from West One.

It is anticipated that the buildings will be 4-stories tall, with the 4th Floor occupying a steeply sloped roof with dormers. This approach is consistent with W&M zoning, as well as the campus context. There has been some discussion of whether one of the three buildings could be a story taller, using the sloped grade to reduce visual impact. This strategy would allow the overall footprint of new construction to be reduced by approximately 3,000 SF, liberating site area to accommodate more geothermal wells, or expand the number of trees that can be preserved. For cost considerations, the team will avoid triggering high rise code requirements, and potentially also the need for a fire pump.

The architectural expression of the buildings will be developed in accordance with William & Mary's Design Guidelines. The Guidelines outline how new buildings should reinforce the strong identity of the Georgian campus, while also allowing for more modern expression depending on a site's distance from Old Campus.

The Randolph Complex site is identified as being within the transitional zone of the campus map. The website of the University Architect also suggests that, "The West Woods may accommodate the most unique design responses."It is anticipated that the buildings will be 4-stories tall, with the 4th Floor occupying a steeply sloped roof with dormers. This approach is consistent with W&M zoning, as well as the campus context.

View looking from Ukrop Way

Sustainable Design

Project Goal Setting

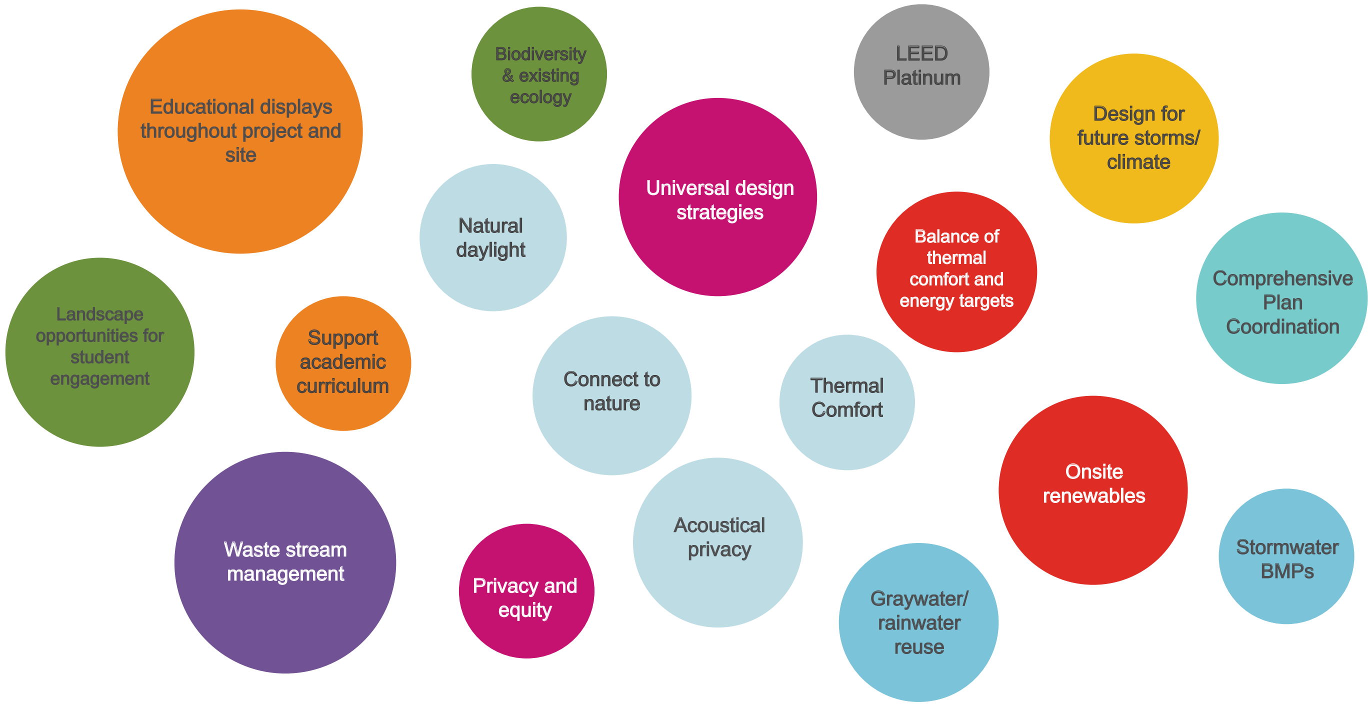
In early October the design team and Building Committee held a sustainability charrette to brainstorm initial goals project goals. The purpose of this initial charrette was to hear individual perspective on major goal opportunities at West Woods 2 to advance sustainability and align the project direction with the sustainability goals and initiatives of the College, as established in W&M's Climate Action Roadmap and Vision 2026. Establishing co-created goals at the outset of the project is a critical early step that helps guide development of design options throughout all subsequent project phases. The charrette was held in two separate sessions over the course of a day, beginning with topics focused on environmental sustainability (Water, Energy, and Ecosystems), followed by economic sustainability (Resources, Economy, and Change), and ending with social sustainability (Wellbeing, Equitable Communities, and Discovery). The brainstorming exercises resulted in over 100 discrete goal ideas. The sessions concluded with a red dot/green dot exercise to capture which ideas resonated across the group.

Achieving exemplary energy performance and operational carbon reductions, balanced with reasonable thermal comfort standards is a central project goal. The team is targeting an ambitious EUI of 19 kBTU/sf/yr. Driving down water consumption, exploring potential for graywater/ rainwater reuse, and building upon the campuswide stormwater approach are all key priorities. Creating a design that supports and enhances the existing site ecology and biodiversity is also a primary driver, particularly in terms of tree protection throughout the site. Given the scale of the site, the team is giving careful attention to balancing the potential for geothermal wells, stormwater management, and tree protection within the site boundary. In terms of social sustainability and wellbeing, key goals include establishing strong connections to nature through passive strategies and programming, providing educational displays throughout the project and site focused on sustainability, leveraging opportunities to support the academic curriculum within the site, and improving waste stream management options for building occupants.

Charrette photo

The design team then processed and organized the individual goals into commonalities and broader themes to identify which topics had the most interest and which goals have the potential to become major project drivers for West Woods 2. Wellbeing, energy, and water had the highest number of individual goals, indicating a strong interest in design strategies that support both environmental and social sustainability goals. Of the 100+ ideas that were generated, about 20 themes emerged as key topics for the project.

Charrette boards with post-its from participants



Project Goals - Size of circle indicates number of individual ideas/dots within topic, and color matches the topic to each of the ten AIA Design Excellence principles.

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Green Building Standards

The project is pursuing LEED Silver at a minimum and has also developed a path to LEED Platinum to explore the potential of becoming W&M's first LEED Platinum project. Both LEED scorecards are included in the appendix of this report.

The design team is also working with the WELL Building Standard and Passive House Standard to apply relevant criteria in support of project goals. To advance wellbeing goals, the team is comparing WELL and LEED credits related to air quality daylight, thermal comfort, acoustics, and restorative spaces. Through energy modeling in subsequent phases the team will evaluate if envelope performance standards aligned with Passive House Standard will deliver meaningful energy savings.

Preliminary project goals developed from sustainability charrette

Sustainability Next Steps

Over the course of subsequent design phases, we will continue to refine and develop design strategies and processes to support these project goals. We look forward to broader campus engagement opportunities, particularly with students, to further develop the project. We will take a performance-focused design approach, starting with refining our initial analysis of microclimate conditions of the site to identify opportunities for passive design principles both indoors and outdoors. We will also perform iterative simulation modeling for daylight, thermal comfort, and energy in addition to cost analysis to inform decision-making throughout the project.

WATER

- Meet or exceed West Woods 1 WUI Target
- **Explore potential for graywater/rainwater reuse**
- Waste water heat recovery
- Find opportunities to build on existing BMPs on campus
- Support groundwater infiltration as much as possible given soil constraints
- Control E&S during construction

ECONOMY

- Continuous commissioning w/ data driven output
- Individual metering on each building
- Factor in humidity and mold conditions for materials
- Consider costs of building services (custodial) when selecting finishes
- Balance 1st cost & maintenance costs

CHANGE

- **Design for future storms/climate**
- Coordinate with comprehensive campus plan happening concurrently
- Consider future ecology
- Support evolving sustainable lifestyle choices of students
- Manage changing needs for students

DISCOVERY

- **Leverage opportunities for support academic curriculum, including outdoor classroom**
- Lounges with windows over-looking woods
- **Provide education displays throughout project and site**
- Post-occupancy surveys @ 1 YR, 5 YR
- Document decisions that are departures from W&M standards

Preliminary Outdoor Thermal Comfort and Interior Daylight Access Analysis

Outdoor Thermal Comfort

Once the early building massings and footprints had been established, Goody Clancy began preliminary analysis of outdoor thermal comfort using the Universal Thermal Comfort Index, and the annual wind roses for Williamsburg (weather data location: Williamsburg Intl AP). The intent of these preliminary analyses was to determine what impact the site strategy of tree preservation, location of outdoor program, and building geometry had on the comfort of people as they transverse through and occupy the site.

Based on the Thermal Comfort Index and local climate data, by providing shade and exposure to wind outdoor spaces can be comfortable approximately 62% of the time in the summer. With exposure to sun and protection from wind spaces can be comfortable 44% of the time in winter, and with shade from the sun and protection from wind outdoor spaces can be comfortable approximately 75% of the time in fall and spring. Since the majority of students will be using these spaces in fall and spring, we prioritized shade and wind protection strategies in the highly-occupied areas of the site. (***refer to Figure A***).

While protection from strong wind is important for comfort, gentle breezes to improve the quality of outdoor spaces during much of the year., especially during the daytime in the warmer seasons.

The wind analysis (***shown in figure B***) compared building massing strategies, and their impact on the breezes that could be felt within the courtyard spaces given the prevailing wind direction.

This earlier building massing strategy inhibited gentle breezes within courtyard spaces between the buildings, potentially making them less comfortable at certain times of the year.

The building placement strategy (***shown in figure C***) created different zones on the site that would have different wind characteristics. Areas 1, 2, and 5 could potentially experience higher winds that could potentially be uncomfortable but mitigated by human-scale landscaping. Areas 3 and 4 would experience gentle breezes at most of the desired times of the year making these spaces comfortable. Area 6 would experience stronger breezes, but not uncomfortable wind speeds at most times of the year. This would be an ideal cooling zone during warmer times of the year.

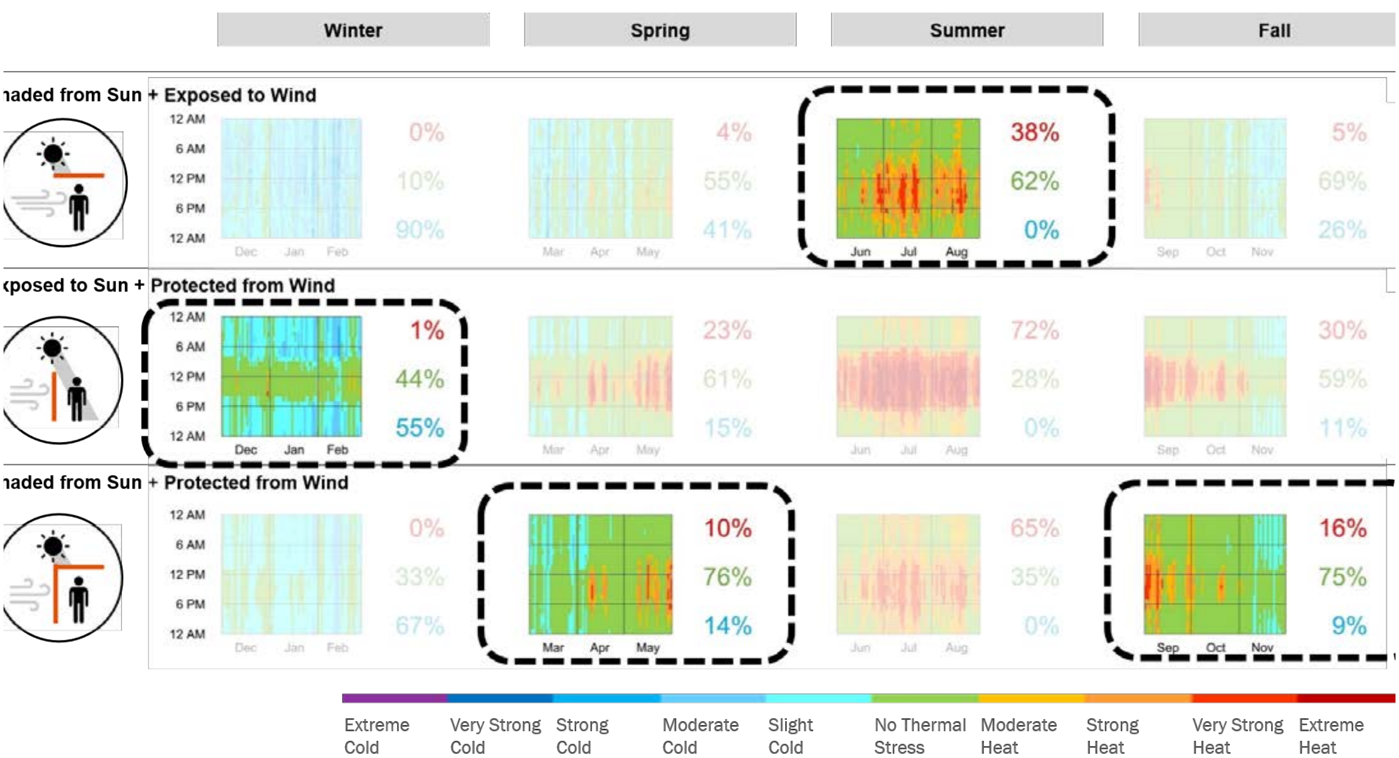


Figure A: Outdoor Thermal Comfort

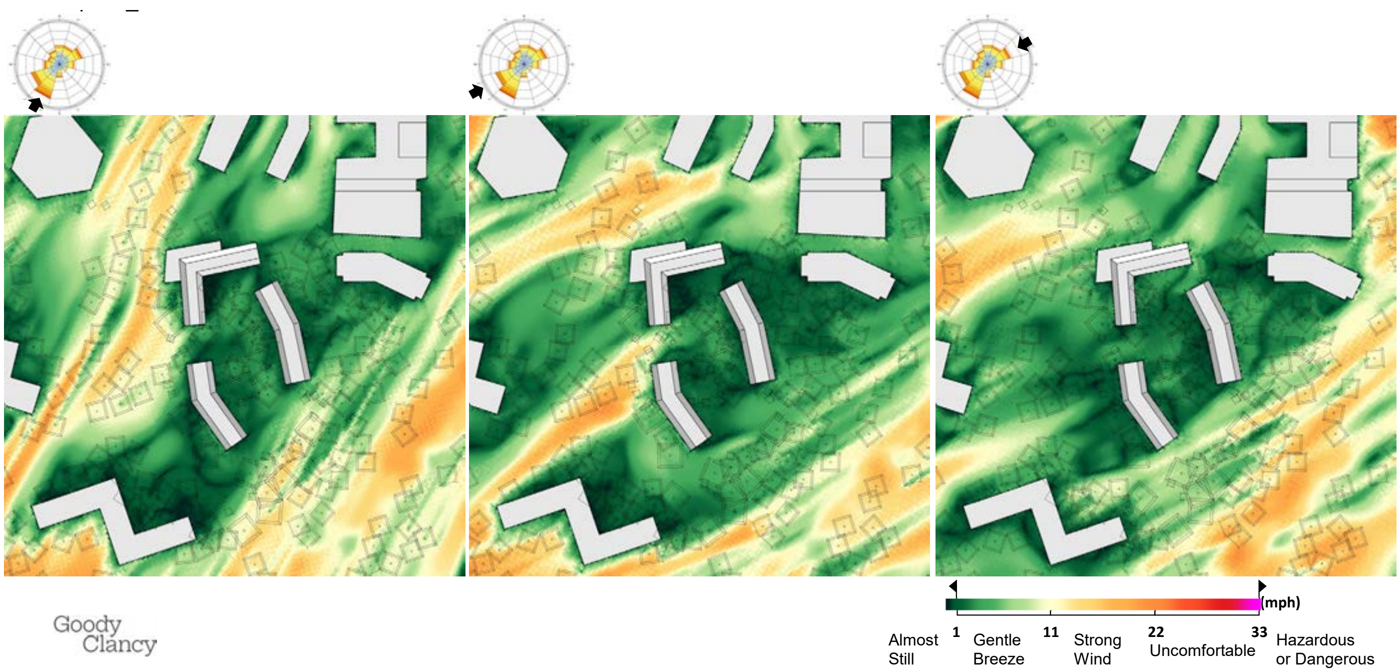


Figure B: Wind Analysis of an earlier massing study

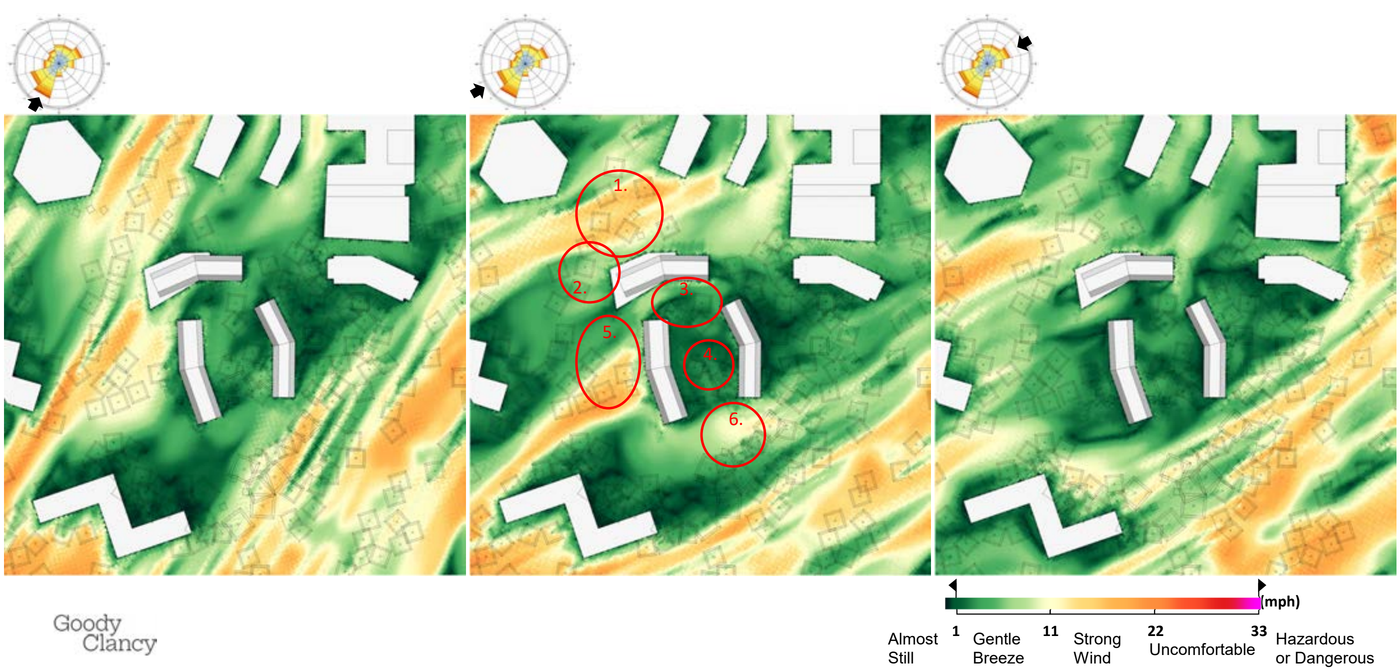


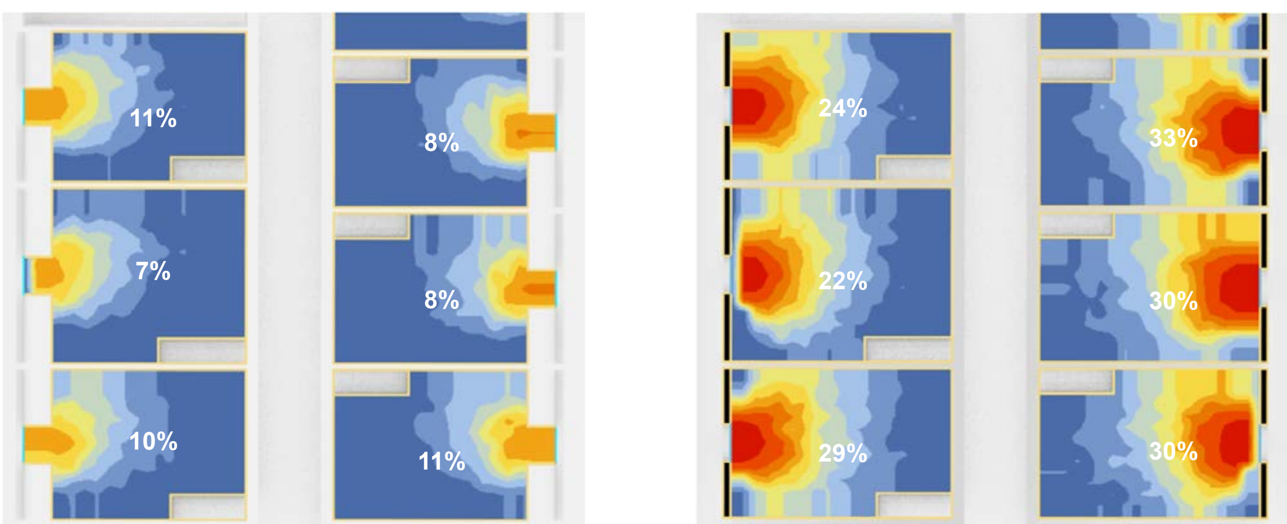
Figure C: Wind Analysis of current massing study

Access to Daylight

The goal setting exercises during the sustainability charette yielded several comments that quality daylight in interior spaces was important not only to reduce lighting load but also as a driver for the wellbeing of all building occupants. Understanding this driver as well as the aspirations for achieving LEED Platinum, Goody Clancy completed early daylighting analysis based on the building geometry, massing, and site strategy to identify spaces with sufficient daylight and limited daylight, and then perform a more targeted daylighting design. The goal is to provide higher spatial daylight autonomy (sDA) for human-occupied spaces, including dormitories and shared areas.

The analysis studied a fourth floor “attic” level with dormer windows, and a typical third floor. The findings suggest that a typical floor, depending on orientation, could experience an sDA of 28%, while level with dormer windows would only average an sDA of 9%. This was not an unexpected result for the dormer levels given the size and shape of the dormer windows within the roofline.

As the project advances into Schematic Design, we will study potential architectural strategies that improve the sDA on the upper level of each building. This may involve increasing the size of the dormer and/or its relationship to the roofline, or adjusting the roof slope to eliminate the dormers altogether. Whatever strategy is ultimately chosen will be sensitive to William and Mary’s design requirements for a “transitional” building, as well as be sympathetic to the design of the buildings of West One.

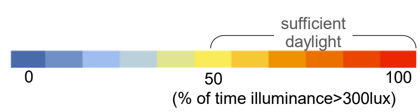


Rooms with dormers, 4th floor
Sufficient daylit area (sDA) = 9%

North

Regular rooms, 3rd floor
Sufficient daylit area (sDA) = 28%

North



Daylight diagram illustrating the amount of natural sunlight penetrating into building without window shades.

Landscape Design

Campus Landscape

- The William & Mary campus was designed with open space as an integral part of its framework. Campus development has encouraged the expansion of open space as an integral part of all projects while more clearly defining the character of each space as it contributes to the overall campus fabric, including preserving the natural topography of the campus and increasing stormwater control on-site and the incorporation of the campus's natural surroundings as potential outdoor learning / classroom space.
- The West One project contributes to these landscape initiatives. The site is a transition point between the natural topography of the ravines and plateaus that define the campus landscape. West Two's location at West Woods provides the opportunity to restructure this landscape to create a more natural connection in keeping with the original sloping site. The project brings the two together as the grade and plantings transition from the informality of the ravine to the formality of the West Two landscape and the West One landscape beyond.

Site Map of the William & Mary Campus.

Topographic map of William & Mary campus, showing areas of relative steepness: the darker the color, the steeper the grade.

Existing Site

- Equally importantly, the West Two project continues the vision for a connected open space, an integral part of all projects for William & Mary. Circulation is prioritized to retain the pedestrian character of the campus, encourage the development of safer pedestrian circulation and alleviate pedestrian / vehicular conflicts.
- Finally, the West Woods 2 project will continue to reinforce the campus landscape design standards with its walkways, materials and plant palette, all campus standards.

Design Concept

- The design of the landscape is influenced by several factors. It supports and adjusts to the building masses, coordinating gathering spaces with logical finished floor elevations that incur minimum impact on the site's resources and inherent amenities. The preservation of existing trees will be a top priority, and proposed landscape elements and grading alteration will be done to minimize the impact on existing tree root zones. Altering topography can adversely impact trees, so the design endeavors to strike a balance between minimizing topographic change to accommodate the variable and descending slopes from north to south.

Pedestrian Movement

- Major pedestrian routes will be identified that connect building entrances to perimeter walkways and the adjacent promenade to the north. The design includes a circuit path that circumvents the entire area bound by the buildings, and paths crossing the perimeter walkway will be provided. The path design aesthetic will be expressed as pre-dominantly curvilinear. To achieve the goal of universal design standards, all of the paths are intended to remain below five percent slope to allow maximum access and inclusivity. A major accessible path will be provided on the interior of the courtyard that allows for unimpeded travel in compliance with ADA guidelines from the northeast corner of the courtyard to a location on Ukrop Way at the south end of the project limits.

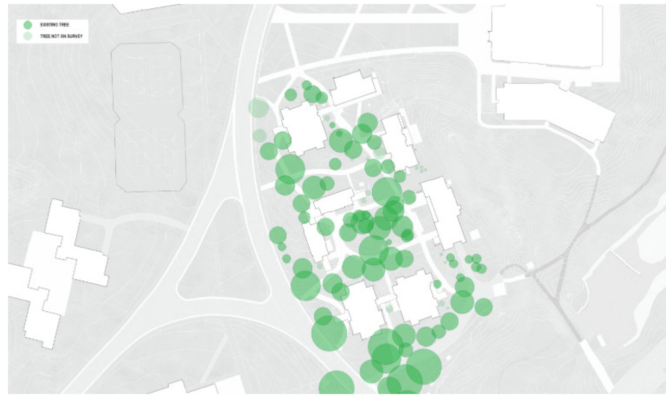
Early Concept of Site Landscape Design

Open Space

- Open space concepts work in conjunction with the landscape precedents outlined in the William & Mary Landscape Guidelines. These entail the provision of lawns between buildings that allow for spontaneous and open-program activities and uses. Such spaces are considered passive open spaces, with the land immediately adjacent to residential units being planted with shrubs to afford privacy. In contrast, active open spaces will be strategically located to encourage students to congregate with other students from within the same residence hall and/or from other residence halls—a plaza at the north of the courtyard space is currently planned. Such spaces would take the form of hardscape plazas that conform to the material selection of the architecture and design standards established by the Landscape Guidelines. Where possible, passive seating will be provided to encourage occupations.

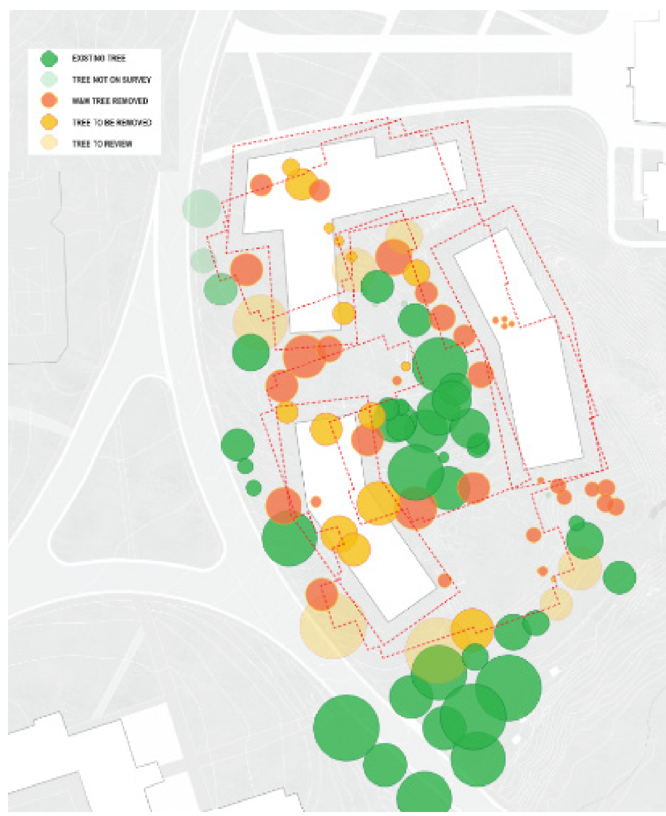
Tree Preservation

- The site contains many mature canopy trees of varying sizes, and a core tenet of the design approach is the preservation of this existing native ecology. The college has prepared a tree assessment that identifies each tree, as well as indicates the relative quality of the specimen and whether it should remain or be removed. Inevitably, a number of valuable trees will be removed due to conflicts with the building locations and unpreventable construction impacts. Unimpacted trees will be preserved and protected, and incorporated into the development of the design.



Existing Trees

Existing Trees After Demolition



Existing Trees After Construction

Initial study of pedestrian circulation within and around the site.

Vehicular Access

- While the design does not anticipate on-site parking on-site, access for necessary vehicles will be provided. Examples of required access include a route for deliveries and loading and fire truck access. Required vehicular surfaces will be combined with pedestrian paths to the greatest extent practicable, and alternate paving options that can support vehicular loads will be employed as approved by the college. Space may be provided adjacent to Ukrop Way for parking to assist with 'move-in / move-out' events.

Planting Design

- In conjunction with attaining sustainability goals as well as the ethos outlined in the Landscape Guidelines, native plant material in keeping with the natural and ecological character of the region will be used. Plant selection will be based on solar studies and siting analysis for ideal plant compositions that create amenity spaces throughout the project. The planting design plans to incorporate plants that are known to be resistant to deer browsing. Soil amendment will be included to improve and optimize the rooting medium for all installed plants. See the Sustainability section for information relating to sustainability goals for plants.

Outdoor Classrooms

- The landscape design plans to devote a portion of the exterior gathering spaces to promoting the program of outdoor classrooms. Classes could be specific in nature (such as ecology) or general classes that benefit from an alternate learning environment and connection to the natural world. Numerous landscape opportunities will be identified for these outdoor classrooms, and crafted in accordance with college-provided parameters relating to area, intended class size and subject matter.

Civil Design

Site Location

The proposed project site is located in the area of campus currently occupying the Randolph Complex of dormitory buildings. These include a total of six (6) structures; Pleasants Hall, Nicholas Hall, Tazewell Hall, Page Hall, Harrison Hall, Cabell Hall, Preston Hall, and Giles Hall. These structures will be demolished to make way for the new West Two dorms. To the north is the new West One dorms and dining hall, currently under construction. The site is bound to the west by Ukrop Drive, to the north by the West One project area, to the east by steep slopes and wooded vegetation, and to the south by the wooded area and stream leading to Lake Matoaka.

Topography

A Topographic Survey of the project site was completed in September, 2024. The final survey will be provided to the project team for design use. Topographic relief on the site is generally sloping from north to south with a high-point in the middle of the project site providing relief east to the wooded areas and west toward Ukrop Drive. The topography of the new West One area ranges from approximately elevation 77 on the north-east to 74 along Ukrop Drive. The high point and plateau in the site is approximately elevation 75-76 before dropping significantly to the south to elevation 56 along the existing service drive.

Access and Parking

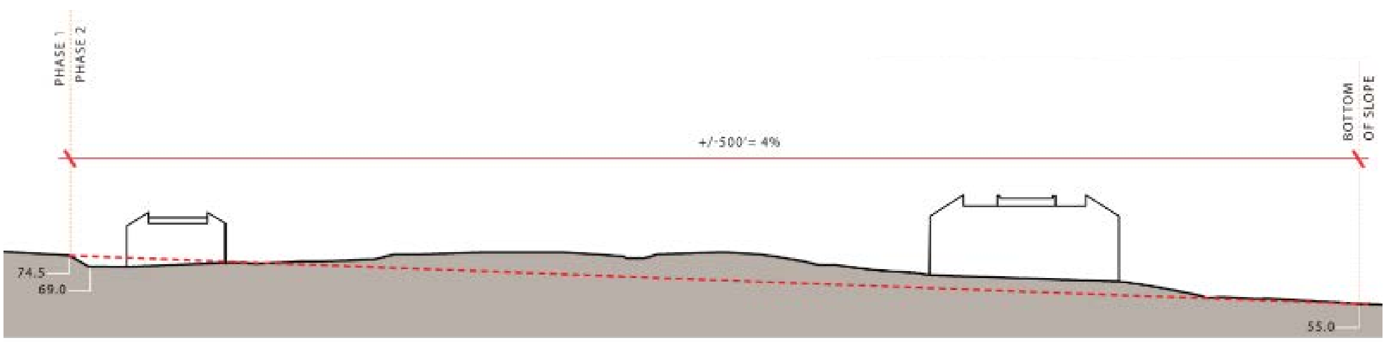
The new buildings will generally be accessed from the west from Ukrop Drive for emergency and W&M Facilities Management vehicles. No new student parking is currently proposed as part of the project improvements. While there is no new student parking being provided, it may be possible to provide one space per staff apartment within the site boundary. If parking is provided, the appropriate number will necessarily comply with ADA requirements for accessible parking provisions.The project proposes improvements to the existing service area for pedestrian, emergency, trash/recycling collection, and loading/unloading areas.

A meeting will be held with the Williamsburg Fire Department to discuss fire and emergency access to the site and new dormitory buildings. Emergency access is currently along Ukrop Drive.

Construction Traffic

The location for the construction entrance for the project site will be along Ukrop Drive. It is anticipated the existing service drive entrance will be utilized for the temporary construction entrance to the site. The contractor will surround the site with a construction and safety fence to prevent unauthorized access to the project site. Pedestrian traffic along Ukrop Drive will be diverted to the west side of the roadway. The contractor will need to be aware of pedestrians and control access to and past the site. Flag persons may need to be employed to assist and control pedestrian and vehicular traffic along Ukrop Drive.

West Woods Phase 2 Site Plan



Randolph Complex Site Section

Utilities

TRC has reviewed available drawings and mapping provided by the College, the survey information from Timmons, other available mapping, and field visits to ascertain the extent and physical locations of utilities present in the footprint of the proposed building sites. The new buildings will require existing utilities to be relocated, removed, or abandoned including but not limited to storm sewer, sanitary sewer, chilled water, water, gas, electrical, and communications/data.

Water—Domestic and Fire Protection

It is anticipated that new water services for the new buildings will connect to the existing waterline in Ukrop Drive and extend both new domestic and fire protection water lines to the respective buildings. These will be a new taps that will connect to the waterline in Ukrop Drive and existing water service lines will be removed or abandoned in place. New sub-metering and backflow prevention devices will also be located within a mechanical room in the respective buildings and no new exterior vaults are anticipated.

There is currently a hydrant located along the east side of Ukrop Drive, north and west of Harrison Hall. Other hydrants exist along the western side of Ukrop Drive. Following the schematic design phase, a meeting with the Williamsburg Fire Department will be conducted to discuss the proposed project and desired locations for any new hydrants, the Post Indicator Valves (PIV), fire department connections (FDC) to support the project improvements, and access to the site for emergency access.

Sanitary Sewer

A new sanitary sewer line is anticipated to be extended from the new buildings to the existing 8” sanitary sewer main along the southern end of the project site. Sewer lines also run parallel along the east and west sides of the site collecting sewage flows from the existing Randolph Complex and Botetourt Complex dormitory buildings. The sanitary sewer then flows to the Landrum Drive pump station to the east and across the stream. A capacity evaluation of the existing sewer system and downstream Landrum Drive pump station will be developed during the preliminary design phase to account for the flow from the new buildings.

During West One project, an investigation and condition assessment of the existing sewer system (sewer main and manholes) was conducted. The results identified significant degradation of the system and approximately 1,000 LF of sewer main north of the connecting manhole that directs flow to the pump station is being replaced. That investigation also included the line south of the Randolph Complex and it was recommended this line also be replaced to provide reliable and safe operations of the campus sewer system. Approximately 300 LF of new sewer main and manholes will be designed to improve the performance of the campus sewer system.

Stormwater Management—Erosion Control

Stormwater runoff from streets, lawns, parking lots, construction sites, industrial facilities and other impervious surfaces occurs as a result of precipitation events (for example, rainwater or melted snow). The stormwater runoff may enter surface waters directly or through natural and constructed channel systems. Activities occurring in developed and urban areas contaminate stormwater runoff with pollutants such as automobile oil, grease, metals, sediment, bacteria from animal waste, nutrients and pesticides, as well as deposits from airborne pollutants. Unmanaged stormwater can cause erosion and flooding. It also can carry excess nutrients, sediment and other contaminants into rivers and streams. Properly managed stormwater can recharge groundwater and protect land and streams from erosion, flooding and pollutants.

DEQ is the lead agency for developing and implementing statewide stormwater management and nonpoint source pollution control programs to protect the Commonwealth’s water quality and quantity. Currently, three laws apply to land disturbance activity in Virginia: the Stormwater Management Act, Erosion and Sediment Control Law, and Chesapeake Bay Preservation Act. The college is maintaining an Annual Standards and Specifications (AS&S) document for Erosion and Sediment Control and Stormwater Management.

Erosion & Sediment Control

William & Mary’s Facilities Management implements its own Erosion and Sediment Control (ESC) and Stormwater Management Programs overseen by the Virginia Department of Environmental Quality and according to the Virginia Erosion and Sediment Control Law, Regulations, and Certification Regulations. The ESC Program’s goal is to control soil erosion, sedimentation, and nonagricultural runoff from regulated “land-disturbing activities” to prevent degradation of property and natural resources. The regulations specify “Minimum Standards,” which include criteria, techniques and policies that must be followed on all regulated activities. These statutes delineate the rights and responsibilities of governments, and entities such as William & Mary, that administer an ESC program and those of property owners who must comply.

The use of silt fence, inlet protection, sediment traps, dust control, temporary and permanent seeding and a construction entrance are anticipated to be proposed to be used in accordance with the Virginia Erosion & Sediment Control Program and William & Mary Annual Standards and Specifications.

Stormwater Design and Review

The Virginia Stormwater Management Program seeks to protect properties and aquatic resources from damages caused by increased volume, frequency and peak rate of stormwater runoff. Further, the program seeks to protect those resources from increased nonpoint source pollution carried by stormwater runoff. Stormwater management strategies and design calculations will be reviewed by the W&M prior to submission to DEQ or a designated W&M SWM reviewer.

1. Quality of Stormwater Runoff

DEQ oversees regulated activities undertaken on state and federal property, while localities (counties, cities, towns) have the option to establish a local Stormwater Management (labeled as SWM) Plan program to regulate these same activities on private property in their jurisdiction. Specifically, land development and land use conversion activities must prepare and seek approval of a SWM plan that describes all SWM controls to be used to control the quantity and quality of stormwater runoff from the activity. The pervious and impervious surfaces in the urbanizing landscape collect pollutants. Rainfall washes these surfaces so that the initial flush of runoff can carry high concentrations of the pollutants to nearby drinking water supplies, waterways, and properties.

The proposed West Two is located on a previously developed site. It is unknown if the project will increase the total impervious area of the project site. The project area generally drains to the south toward the stream to Lake Matoaka Landrum Drive by sheet flow and through outfalls from ranging from 6” in size to 12”. The flow from this site passes below the Wildflower Refuge BMP, and this project is not accounted for in this or any other BMP and stormwater management will be required for the proposed project improvements.

W&M has recently updated the stormwater master plan. This plan was submitted to DEQ for approval reestablishing the ‘checkbook’ for water quality credits for proposed projects and increases in impervious areas. Quality compliance for the proposed ISC4 is anticipated to be met through the system of banked credits as verified by DEQ on October 6, 2016.

2. Quantity of Stormwater Runoff

Pervious surfaces, such as meadows and woodlands, absorb and infiltrate rainfall, therefore generate little stormwater run- off. Urban landscape typically covers such areas with impervious surfaces, such as pavement and rooftops. These surfaces generate runoff every time it rains. A typical city block generates nine times more runoff than a woodland area of the same size. The quantity of runoff from these areas quickly overwhelms natural channels and streams, often causing channel erosion, localized flooding and property damage. Channel protection and flood protection shall be addressed in accordance with the minimum standards set out in section 9VAC25-870-66, Water Quantity.

It is anticipated the project will be required to utilize the “Energy Balance Method for stormwater management”. This is intended to achieve a “balance” between the hydrologic response characteristics exerted on the receiving stream by the pre- and post-developed peak discharge. This includes impervious cover, channelization and other impacts associated with the developed landscape result in an increase in the volume and peak rate of runoff. The Energy Balance utilizes the inverse relationship between the pre- and post-developed condition runoff volume to reduce to the allowable peak discharge.

Environmental Impact Report

An Environmental Impact Report (EIR) is required to satisfy the requirements given in Virginia Code § 10.1-1188, which requires state agencies to prepare and submit such a report for each major state project if it costs $500,000 or more and includes one of the following activities: the acquisition or purchase of land or rights thereto, for state facility construction, construction of a facility, or new construction of a facility. Specifically, the EIR will address a variety of environmental issues in the context of the proposed project (as specified in Virginia Code § 10.1-1188) such as the environmental impacts of the project, adverse effects that cannot be avoided if the project is undertaken, measures proposed to minimize the impact of the project, alternatives to the proposed project, irreversible environmental changes that would result from completion of the project. The EIR is in process of being prepared and upon completion will be submitted to DEQ for review and comments. DEQ will distribute the document to other state agencies for review and comment and will collect the responses from the other state agencies and submitted their recommendation of approval to the Secretary of Administration.

Resource Protection Area

The project site is not located in the Resource Protection Area (RPA) but is adjacent to the RPA that follows the stream to Lake Matoaka that is south and east of the site. At this time, it is unknown if any improvements to the stormwater outfall and discharge to the stream will be required. The existing sanitary sewer line along the southern portion of the project site is within the RPA and improvements to or replacement of the existing sanitary sewer line. These and any other RPA impacts within the site will be coordinated and approved by the Authority Having Jurisdiction, in this case, the City of Williamsburg.

Conceptual Code Summary

Applicable Codes

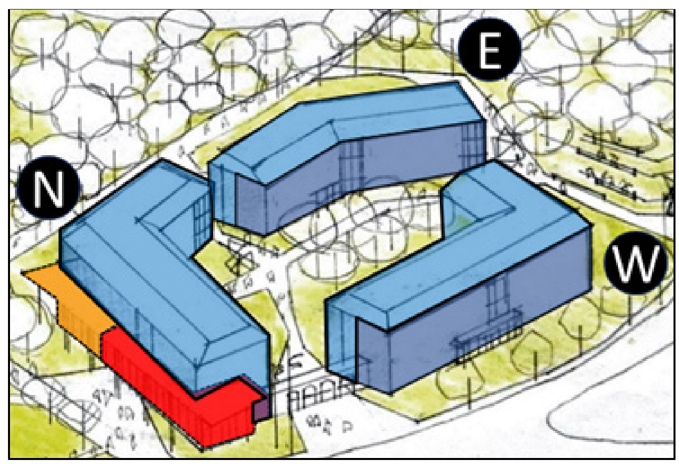
Building 2021 Virginia Uniform Statewide Building Code (USBC), which is an amended version of the 2021 International Building Code (IBC).

Fire	2021 International Fire Code (IFC) where referenced by the USBC.
Accessibility	2021 USBC Chapter 11 and Appendix E
	2017 Edition of ICC A117.1, Accessible and Usable Buildings and Facilities
Electrical	2020 Edition of NFPA 70, National Electrical Code
Mechanical	2021 Virginia Mechanical Code, which is an amended version of the 2021 International Mechanical Code (IMC)
Plumbing	2021 Virginia Plumbing Code, which is an amended version of the 2021 International Plumbing Code (IPC)
Fuel Gas	2021 Virginia Fuel Gas Code, which is an amended version of the 2021 International Fuel Gas Code (IFGC)
Energy	2021 Virginia Energy Conservation Code, which is an amended version of the 2021 International EnergyConservation Code (IECC)
Elevator	2019 ASME A17.1, Safety Code for Elevators and Escalators
Other	National Fire Protection Association (NFPA) Standards, as referenced by the above codes, including the following:
	-2018 NFPA 10: Standard for Portable Fire Extinguishers
	-2019 NFPA 13: Standard for the Installation of Sprinkler Systems
	-2019 NFPA 13: Standard for the Installation of Standpipe and Hose Systems
	-2019 NFPA 72: National Fire Alarm and Signaling Code

Project Description

The project consists of the construction of three new residential buildings herein referred to as the N, E, and W buildings as illustrated in Figure 1. The N building consists of a ground floor of amenity/public spaces with 3 stories of student dormitories above. The E/W buildings each include 4 stories of student dormitories and staff apartments. Portions of the residential floors within the building include common lounge and study spaces for students. In order to meet the schedule, William & Mary has accepted that the design team will need to proceed into each subsequent phase without pause for review and cost estimating—design progress will have to overlap with these efforts. See schedule graphic below for overall design schedule.

Reviews with state agencies is anticipated at each design milestone, the first of which is to the DEB



Site Massing Diagram

CSBC Classification	Description	Building
Group A-1, Assembly	Auditorium	N
Group A-3, Assembly	Classrooms, Multipurpose, Learning Commons	N
Group B, Business	Offices	N
Group M, Mercantile	Bookstore	N
Group R-2, Residential	Dormitory	N/E/W

Table 1: Occupancy Classifications

Occupancy Classification

The following table summarizes the occupancy classifications being considered for each building.

Small assembly spaces with an occupant load less than 50 or an area less than 750 square feet ancillary to another occupancy are permitted to be classified as Group B or as part of the assembly occupancy (USBC 303.1.2).

Construction Type/Height and Area Options

The following include construction type options to consider for the project:

- N Building—Type IIB (separated, mixed use)
- The N building is permitted to be designed using a partially separated, mixed use approach. Under this option the Ground Floor is required to be separated from the stories above with a 1-hour horizontal assembly (USBC Table 508.4).
- E / W Building—Type IIB (nonseparated, single-occupancy)
- The E and W buildings are permitted to be constructed as Type IIB and are considered single-occupancy buildings.

Table 3 outlines the height and area limitations for Type IIB buildings that are provided with sprinkler coverage throughout. Increases for open frontage are not included in the area limitations.

5 Group	Allowable Height	Allowable Footprint Area	Allowable Aggregate Area
A-1	3 stories/ 75 ft.	25,500 sf	76,500 sf
A-3	3 stories/ 75 ft.	28,500 sf	85,500 sf
B	4 stories/ 75 ft.	69,000 sf	207,000 sf
M	3 stories/ 75 ft.	37,500 sf	112,500 sf
R-2	5 stories/ 75 ft.	48,000 sf	144,000 sf

Table 2: Type IIB Height and Area Limitations

The following table summarizes the minimum ratings for Type IIB construction (USBC 601).

Building Element	Type IIB
Primary structural frame	0 Hours
Exterior bearing walls	0 Hours
Interior bearing walls	0 Hours
Nonbearing exterior walls	Based on fire separation distance
Floor construction and secondary members	0 Hours
Roof construction and secondary members	0 Hours

1. Fire rated shafts, fire barriers, and horizontal assemblies are required to be supported by structure affording the required fire-resistance rating of the supported element (USBC 707.5.1).

Exterior Walls

The tables below indicate the fire-resistance ratings required for the nonbearing exterior walls and the maximum area of unprotected exterior wall openings based on fire separation distance for each potential construction type (USBC Table 705.5, Table 705.8).

TABLE 4: FIRE RESISTANCE RATING FOR NONBEARING EXTERIOR WALLS

Construction Type	Fire Separation Distance	Fire Resistance Rating	Allowable Area
Type IIB	$0 \leq X < 3$	2 Hours	Not Permitted
	$3 \leq X < 5$	2 Hours	15%
	$5 \leq X < 10$	1 Hour	25%
	$X > 10$	0 Hours	No Limit

All buildings are provided with at least 10 feet of fire separation distance at all elevations. Exterior walls are permitted to be nonrated with unlimited openings.

Fire Protection Systems

- The following fire protection systems are required for the building:
- Automatic sprinkler system (USBC 903.2.8)
- Class I Standpipe System (USBC 905.3.1)
- Fire Extinguishers (USBC 906.1)
- Fire alarm system (USBC 907.2.9, 907.2.13)
- Smoke and CO detection (USBC 907.2.11)
- In-Building Emergency Communications Coverage (excluding within dwelling units) (USBC 918.1)

Means of Egress

The means of egress for the building is required to be designed in accordance with Chapter 10 of the USBC. The following are some of the major requirements:

- The means of egress are required to be sized using 0.2” per occupant for stairs and 0.15” per occupant for other egress components (USBC 1005.3.1 Exception 1 & 1005.3.2 Exception 1).
- Two exits or exit access doorways are also required to be provided from any space where the occupant load or common path of travel distances in the following table are exceeded (1006.2.1):

Occupancy	Maximum Occupant Load	Maximum Common Path of Travel Distance
A, M	50	75 feet
B	50	100 feet
R-2	20	125 feet

- Exit access travel distances are not permitted to exceed the maximum values specified in the following table (USBC 1017.2).

Occupancy	Maximum Exit Access Travel Distance
A, M, R-2	250 feet
B	300 feet

- Where more than one exit or exit access doorway is required, the exit access must be arranged such that any dead ends in the corridor do not exceed that specified in the following table (USBC 1020.5).

Occupancy	Maximum Dead End Length 1
A	20 feet
B, M, & R-2	50 feet

1. A dead end corridor is not limited in length where the length of the dead end corridor is less than 2.5 times the least width of the dead end corridor (780 CMR 1020.4(3)).

- Exits are required to discharge directly to the exterior (USBC 1028.1). A maximum of 50 percent of the number and capacity of exit enclosures are permitted to egress through areas on the level of exit discharge (USBC 1028.1). Where exit enclosures egress through areas on the level of exit discharge, the following are required to be met (USBC 1028.1 Exception 1):
  - Occupants are provided with a free and unobstructed path of travel to an exterior egress door and such exits are readily visible and identifiable from the point of termination of the exit enclosure.
  - The entire area of the level of exit discharge is separated from areas below by construction having a fire rating equivalent to the exit enclosure served.
  - All portions of the egress path are sprinkler-protected.

Fire Department Access Roads

Fire Department access roads are required to be provided such that any portion of an exterior wall of the first story of the building is located not more than 150 feet from fire department access roads as measured by an approved route around the exterior of the building (IFC 503.1.1). The fire official has the authority to increase this 150 ft. distance since the building is sprinklered throughout (SFPC 503.1.1 Exception 1).

Based on the preliminary site plan, a fire department access road is planned around the perimeter of the site. The travel distance from the access road to portions of the building permitter exceed 150 ft. in certain instances. Based on this, review and approval is necessary from the fire official to increase the 150 ft. dimension.

The following include other major requirements specific to the design of fire department access roads.

- Have an unobstructed width of not less than 20 feet and vertical clearance of 13 feet 6 inches (IFC 503.2.1).
- Have a minimum inside turning radius as requested by the fire official (IFC 503.2.4).
- Dead-ends in excess of 150 feet in length must be provided with approved provisions for the fire apparatus to turn around (IFC 503.2.5).
- Be capable of supporting the imposed loads of fire apparatus and provided with an all-weather driving surface (IFC 503.2.3).
- The grade of the fire apparatus access road is required to be within the limits established by the fire code official based on the fire department's apparatus (IFC 503.2.7).
- Where required by the fire code official, approved signs or other approved notices or markings that include the words NO PARKING—FIRE LANE are to be provided for fire apparatus access roads to identify such roads or prohibit the obstruction thereof (IFC 503.3).

Plumbing Fixtures

The following table outlines the plumbing factors applicable to the project (USBC 29: Table 403.1 & 419):

TABLE 8: PLUMBING FIXTURE FACTORS

Use Group	Toilets		Urinals	Lavatories Per Sex	Bathtubs/ Showers	Drinking Fountains [1]	Service Sink
	F	M					
Assembly	1 per 65	1 per 125	67% substitution	1 per 200	N/A	1 per 500	1
Business	1 per 25 for the first 50 and 1 per 50 for the remainder exceeding 50		50% substitution	1 per 40 for the first 80 and 1 per 80 for the remainder exceeding 80	N/A	1 per 100	1
Mercantile	1 per 500		50% substitution	1 per 750	N/A	1 per 1,000	1
Dormitory	1 per 10		50% substitution	1 per 10	1 per 8	1 per 100	1

1. Where three or more drinking fountains are required, water dispensers are permitted to be substituted for not more than 50% of the required drinking fountains (USBC 410.4).

The required toilet facilities are required to be located within 500 feet and no more than one story above or below the required floor the space is on (USBC 29: 403.3.3).

04
Building Systems

04 Building Systems

Structural Systems

Foundations

A geotechnical engineering study has been completed and recommends design for an allowable soil bearing capacity of 2,500 psf. Once actual foundation loads have been determined, recommendations will be made for soil improvements if column loads exceed 250 kips.

Existing fill will need to be over-excavated below shallow foundations.

Exterior basement walls will be reinforced with concrete retaining walls.

The typical slabs-on-grade will be 4” thick normal weight concrete with welded wire fabric or polypropylene microfibers. The slabs-on-grade will be poured over a vapor retarder/barrier on compacted porous fill.

Types of Construction/Structural Materials

Concrete –	ASTM-C94
Slab-on-grade	3500 PSI normal weight
Elevated Floors	3500 PSI normal weight
Foundations	4000 PSI normal weight
Exterior Basement Walls	4000 PSI normal weight
Reinforcing Steel	ASTM A615, grade 60
Structural Steel	ASTM A992, Fy = 50 KSI

New structural elements will be designed in accordance with VUSBC (2021 edition), ACI 318-20 (Concrete), SJI 110-15 (Open Web Steel Joists), AISI 100-16 (Cold-Formed Metal Framing) and AISC 360- 16 (Structural Steel).

Structural Roof System

The roof system will be 1 ½”, 22 ga. galvanized roof deck on cold-formed steel trusses spaced 48” o.c. The trusses will either bear on 6” cold-formed metal framed stud walls, 8” CMU, or steel beams, depending on the floor system used.

Structural Code and Design Loads

Building Code

Virginia Uniform Statewide Building Code (2021 Edition).

Building Occupancy Category: III

Snow Loads

Ground Snow Load	pg = 44 PSF
Exposure Factor	Ce = 1.0
Thermal factor	Ct = 1.13

Live Loads

Floor:

Private Rooms	40 PSF + 15 PSF partitions
Lobbies, Corridors, Stairs	100 PSF
Above First Floor	80 PSF (First Floor)

Roof: 20 PSF

Wind Load

Basic Wind Speed (ultimate)	Vult = 125 mph (3 sec gust)
Exposure	B

Seismic

SDS	0.12
SD1	0.061
Site Class	D

The building is expected to qualify for Seismic Design Category B based on the above.

Structural Floor Systems

There are several options to be explored for floor framing systems over residential spaces.

Option 1

The floor construction would be 4 ½" (total thickness) concrete with 6×6-W2.9xW2.9 welded wire fabric on 2", 22 gauge, galvanized composite floor deck. The deck will be supported by either W18×35 beams spaced 7'-6" o.c. and spanning 35 ft, or W12×14 beams at 7'-6" o.c. spanning 20 ft. The beams will be supported by W18×35 composite steel girders one side of the corridor and W16×31 composite steel beams at the exterior walls.

The exterior walls would be CMU to follow their standards, but suggest pursuing a D&F to change to metal studs as a time/cost saving measure.

Option 2

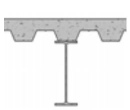
The floor structure would to be 5-ply, 6 7/8" thick, cross-laminated timber (CLT) floor panels spanning continuously from demising wall to demising wall (roughly 20'-0"). The demising walls would be 600S200-54 cold-formed metal stud walls at 16" o.c. The CLT over the corridor walls would bear on the 600S200-54 cold-formed metal stud corridor walls at 16" o.c

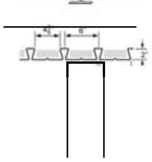
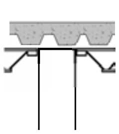
Option 3

The floor structure would to be 6" (total thickness) lightweight concrete on 3", 18 gauge, galvanized composite floor deck spanning continuously from demising wall to demising wall (roughly 20'-0"). The demising walls would be 600S200-54 cold-formed metal stud walls at 16" o.c. The slab over the corridor walls would turn and bear on the 600S200-54 cold-formed metal stud corridor walls at 16" o.c

Option 4

The floor structure would be a 3 1/2" (total thickness) concrete slab with 6×6-W2.9xW2.9 welded wire fabric on 1", 24 gauge, galvanized floor deck, supported on composite open web steel joists spaced 5'-0" o.c. The joists will bear on 6" cold-formed metal framed stud walls with a continuous HSS6×2×3/8 laid flat at the top of wall.



	Description & Construction Type	Cost (1 Low to 3 High)	Construction Complexity (1 Low to 3 High)	Floor Sandwich Depth (1 Thin to 3 Deep)	Environmental (1 Best, 3 Worst)	Future Flexibility (1 Best, 3 Worst)	Advantages & Disadvantages
1	Steel with Composite Concrete Deck	3	2	4	4	1	▪ Very Flexible ▪ Inexpensive
	Type 2						
2	Steel Beams with CLT	4	4	2	1	3	▪ Low carbon ▪ Exposed Ceiling
	Type 3						
3	Light gage metal studs with light gauge deck	1	3	1	2	4	▪ Inexpensive ▪ Easy to run systems (no dropped beams)
	Type 2B						▪ Must be shored until concrete is set
4	Composite steel joists with form deck and concrete slab	2	1	3	3	2	▪ Panelized stud walls decrease installation time ▪ Inexpensive

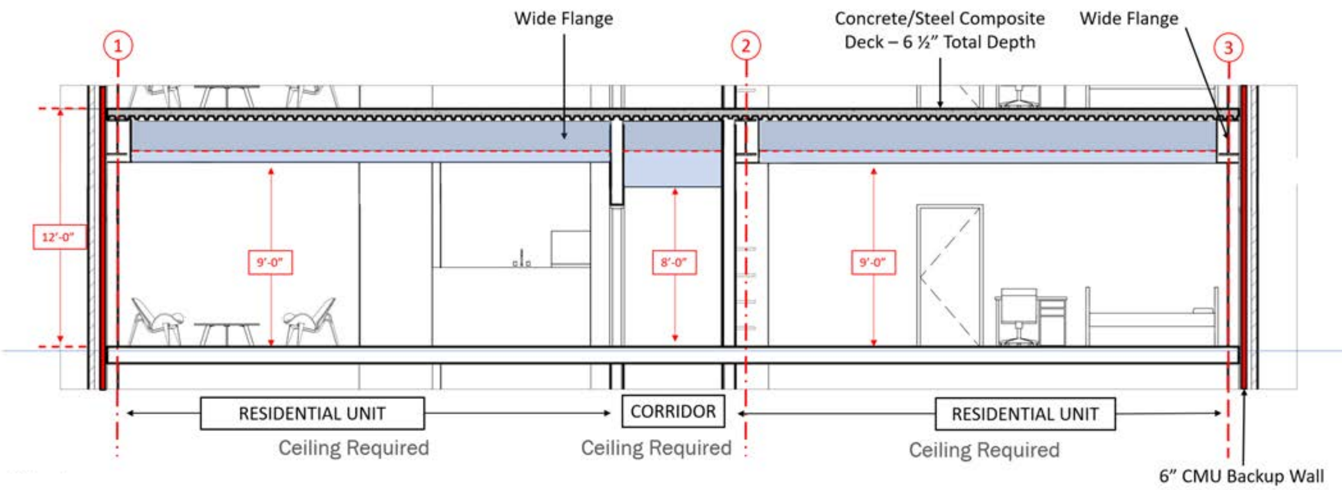
Structural Systems Matrix

Structural Option 1

Steel Framing (Columns and Beams) Concrete/Steel Decking

MECH SPACE

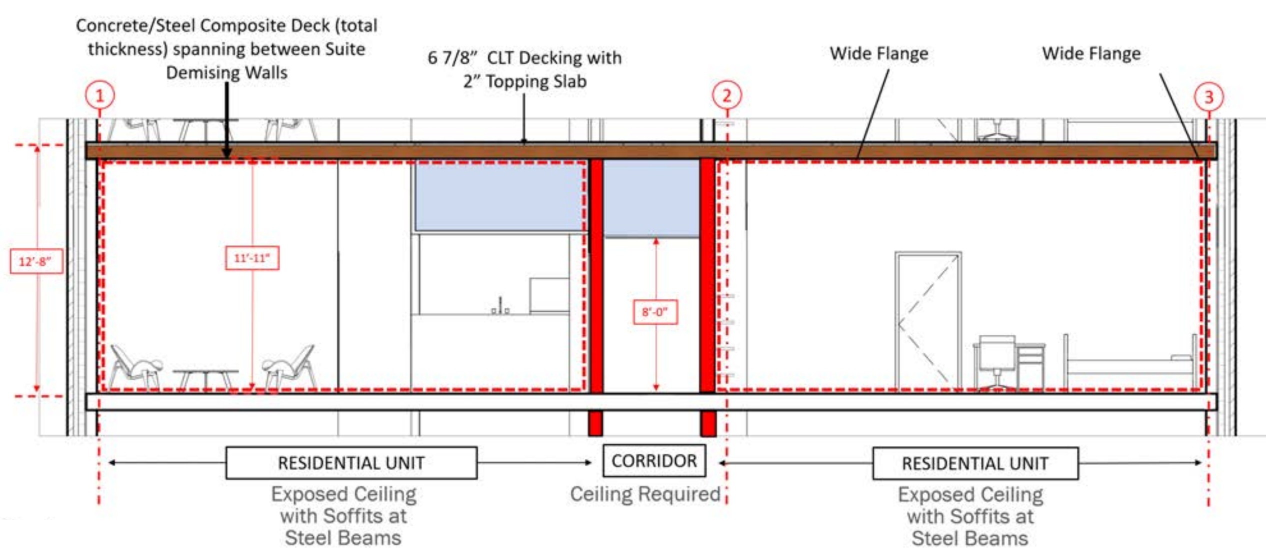
- Matches W&M Standards



Structural Option 2

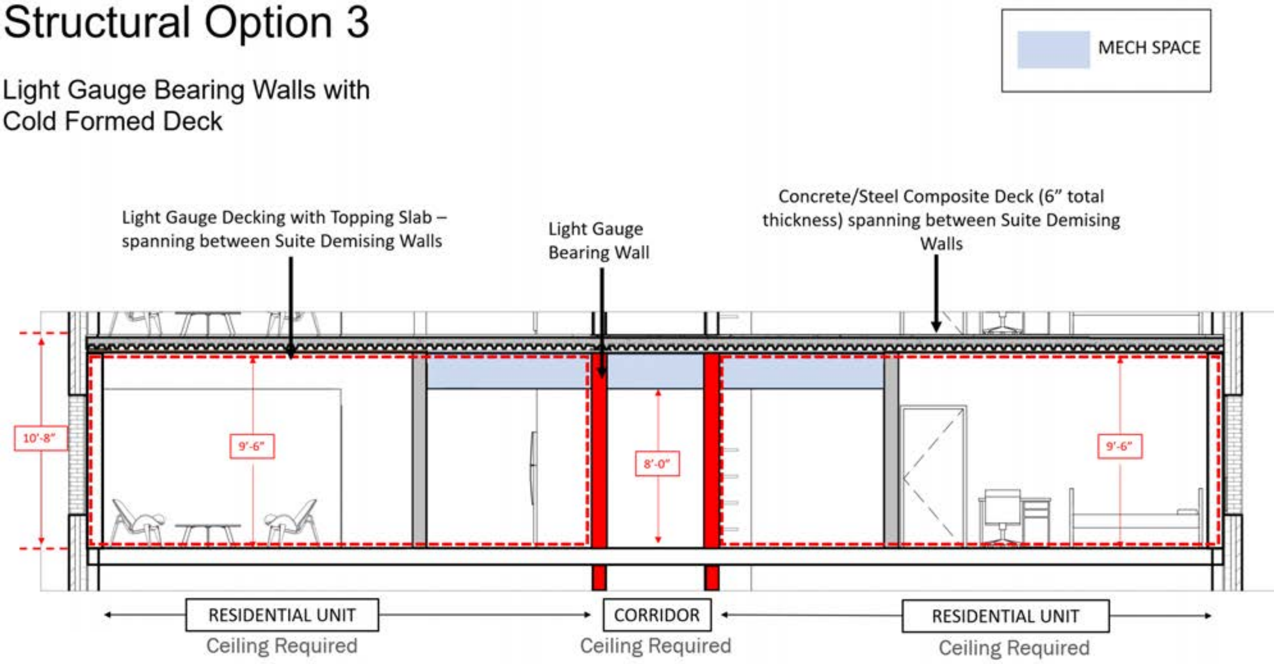
CFMF Bearing Walls, CLT Decking

MECH SPACE



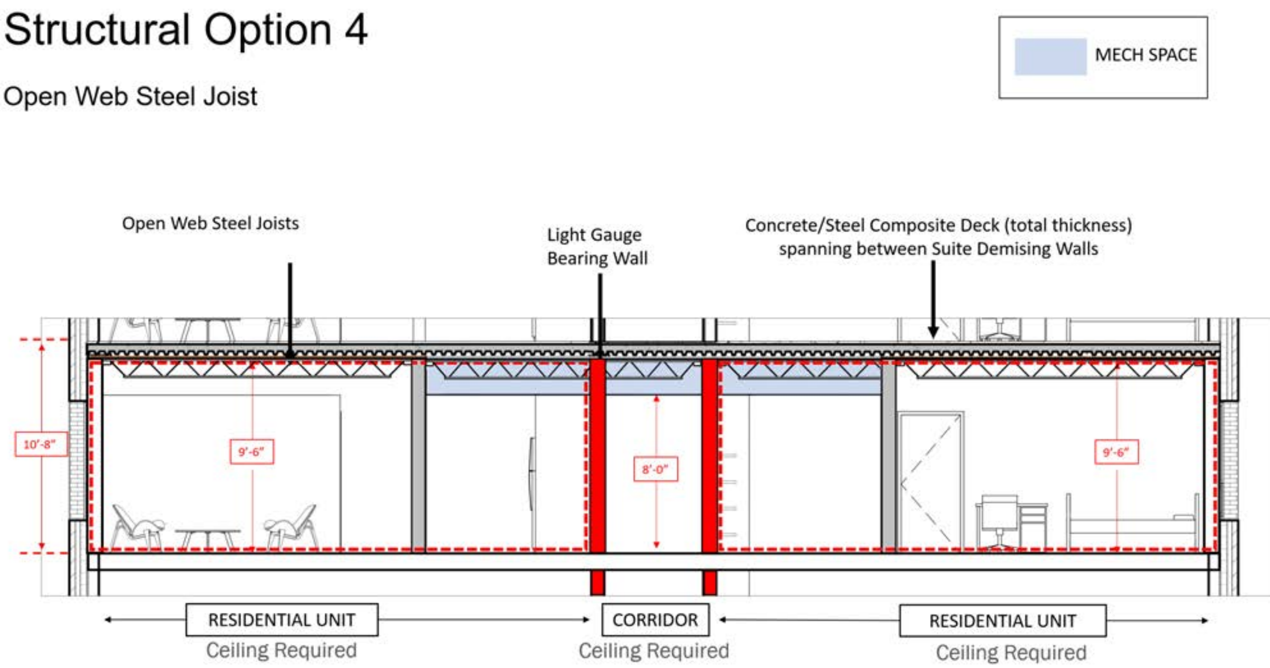
Structural Option 3

Light Gauge Bearing Walls with Cold Formed Deck



Structural Option 4

Open Web Steel Joist



Division 21 - Fire Suppression

Applicable Codes and Standards

Fire suppression systems will be designed in accordance with the following Codes and Standards:

- 2021 Virginia Uniform Statewide Building Code (USBC)
- 2021 Virginia Statewide Fire Prevention Code (SFPC)
- 2019 NFPA 13, Standard for the Installation of Sprinkler Systems
- 2019 NFPA 14, Standard for the Installation of Standpipe and Hose Systems
- 2019 NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection
- 2019 NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances
- 2019 CWM Facilities Management - Technical Standards (BSRV)
- 2019 CWM Facilities Management—Design and Construction Manual (DCM) and addenda

General

The building is required to be sprinklered throughout in accordance with NFPA 13 (USBC Table 503 and BSRV 21 05 00.1). The fire service line to the building is estimated to be 6". A backflow preventer device shall be provided. Occupied and other interior heated areas will be protected by a wet-pipe system. Unheated spaces will be protected by a dry-pipe system. Combination standpipe/sprinkler risers located within the egress stairways will feed the automatic sprinkler systems within the building. A fire department connection shall be provided.

Inclusion of an electric fire pump is recommended until actual water pressure/flow conditions can be assessed and the design progresses further.

Area	Hazard Classification	Design Density (GPM/ ft2)	Design Area (ft2)	Hose Stream Allowance (GPM)
Offices, dorms, rooms lounges/ studies	Light Hazard	***0.1***0	1,500*	100
Mechanical/ Electrical	Ordinary Hazard Group 1	0.15	1,500*	250
Storage	Ordinary Hazard Group 2	0.15	1,500*	250

21 1300—Fire Suppression Sprinklers

Wet Pipe System

Each automatic sprinkler connection to the combination riser will be provided with a control valve, a check valve, a water flow switch, inspector's test connection, a pressure gauge, and a pressure relief valve. An express drain riser will be provided adjacent to each combination riser to permit testing and draining of the individual system.

Double Interlock Pre-Action System

A double interlock pre-action sprinkler system will be provided to protect the server rooms.

Dry Pipe System

Dry pipe systems shall only be provided where the potential of freezing exists, and where the option of dry type sprinklers fed from the interior wet sprinkler system is not feasible for the affected area. Systems using anti-freeze are prohibited.

Backflow Preventer Assembly

Consisting of flanged OS&Y shut-off valves on inlet and outlet, two independently operated spring loaded cam-check valves, and required test cocks. Double check backflow preventer shall be UL listed for fire service.

Backflow Preventer Test Header

A wall mounted backflow test connection will be provided. The test header shall be rough brass finished, wall-mounted, "Y" type with two 2.5" (National Standard Thread) inlets, inlet caps with chains, and a 4" outlet. The test header will be labeled "BACKFLOW TEST HEADER". The test header will be provided with an automatic ball drip to prevent freezing of the pipe. The discharge of the ½" ball drip shall be to the exterior of the building.

Fire Department Connection

Either a wall mounted or a yard type fire department connection (FDC) will be provided, based on proximity of the closest hydrant (to be located within 100 ft from closest hydrant). The FDC shall be rough brass finished, four 2.5" (National Standard Thread) inlets, inlet caps with chains, and a 4" outlet. The FDC will be labeled "AUTO SPRK AND STANDPIPE". The FDC will be provided with an automatic ball drip to prevent freezing of the pipe. The discharge of the ½' ball drip shall be provided. Final location of the FDC will be approved by the local Fire Department.

Sprinkler Spacing

Sprinkler spacing shall meet the requirements of referenced codes for the specific hazard classification indicated. Sprinklers installed in suspended ceilings shall be located in the center of ceiling tiles in finished ceiling areas.

Sprinkler Piping

New sprinkler and standpipe system piping shall be provided throughout the building and new piping shall be as follows.

1. Piping Sizes 2 ½" inches and larger. Piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40 or Schedule 10, Type E or Type S, Grade A; black steel pipe. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only. Piping shall not be joined by welding or weld fittings.
2. Piping Sizes 2 inches and Smaller. Steel Pipe: Steel piping shall be ASTM A 795, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A, steel pipe with threaded end connections. Fittings shall be ASME B16.39, Class 150, threaded fittings. Unions shall be ASME B16.39, Class 150, unions.

Fire Suppression Design Areas and Densities

The sprinkler systems will be hydraulically calculated in accordance with NFPA 13, with the following design parameters:

21 1200—Fire-Suppression Standpipes

Standpipe System

All stairs in the building are required to be provided with a Class I standpipe system in accordance with NFPA 14 since the floor level of the highest story is more than 30 feet above the lowest level of fire department vehicle access, as well as having two or more stories (USBC 905.3.1 Exception 1 & BSRV 21 10 00.9). Hose threads for standpipe and fire department connections shall be "National Standard Threads". The Class I standpipe hose connections are required to be provided in all of the following locations (USBC 905.4 and BSRV 21 10 00):

- In every required stairway, hose connections must be located at an intermediate floor level between floors for every floor level above or below grade. Fire department hose connections shall be provided at each level.
- In every exit passageway, at the entrance from the exit passageway to other areas of the building, unless the floor areas adjacent to the exit passageway are reachable from an exit stairway hose connection by a 30-foot hose stream and 100 feet of hose.
- Where the roof has a slope less than 33.3%, a hose connection must be located to serve the roof or at the highest landing of a stairway with stair access to the roof.
- Where the most remote portion of a floor is more than 200 feet from a hose connection, the fire code official is authorized to require additional hose connections to be provided.

21 3000—Fire Pumps

Hydrant Flow Test Result

A hydrant flow test data is not available yet, but will be performed as the design progresses.

Fire Pumps

Fire pumps shall not be used unless determined by hydraulic calculations to be necessary.

Division 22 - Plumbing

Applicable Codes and Standards

Plumbing systems will be designed in accordance with the following Codes and Standards:

- 2021 Virginia Uniform Statewide Building Code (USBC)
- 2021 Virginia Construction Code (VCC)
- 2021 Virginia Energy Conservation Code (VECC)
- 2021 Virginia Plumbing Code (VPC)
- 2021 Virginia Fuel Gas Code (VFGC)
- 2019 CWM Facilities Management - Technical Standards (BSRV)
- 2019 CWM Facilities Management—Design and Construction Manual (DCM) and addenda

General

Domestic plumbing systems for the building will include water supply, natural gas, sanitary drainage and storm drainage.

Non-domestic plumbing system for the building will include non-domestic water supply. Non-domestic water systems shall be isolated from domestic water systems via duplex RPZ (reduced pressure zone) backflow preventer assemblies.

Inclusion of the following systems are recommended, until further details for the project are developed and the design progresses further:

- A sewage ejector pump at lowest level.
- Each elevator pit will have a submersible type oil-minder sump pump.
- A domestic water pressure booster pump, pending determination of actual water pressure conditions.

Service lines from the building are estimated to be as follows:

- Domestic water main service line—4”
- Natural Gas main service line—3” @ 2psi
- Main sanitary drain leader—(1) 8”
- Main storm drain leaders—(2) 8” or (1) 12”

Piping systems will consist of the following:

- Domestic cold/hot water supply/return
- Non-domestic cold water supply/return
- Sanitary waste/vent
- Stormwater drainage
- Natural gas supply piping

Domestic water heating is generally described as a central domestic system located in water service room with heat exchangers supplied with campus heating water, storage tank, recirculating pumps (one per each temperature/ service), and expansion tanks.

Plumbing fixtures will be commercial grade, manual and automatic, water conserving type.

22 0519—Meters And Gages for Plumbing Piping

- Provide dial type pressure gage at main water service entrance to the building.
- Provide solar-powered digital temperature gages on domestic hot water generation systems.
- Provide digital water meters on domestic water service to the main building and hot water main pipes to record building cold water and hot water consumptions. Water meters shall be electromagnetic or ultrasonic transit time type. Water meters shall be connected to Building Automation System to record maximum / minimum flow rates and cumulative gallons used.
- A valved bypass shall be provide around all water meters.

22 0553—Identification for Plumbing Piping and Equipment

Plastic laminate nameplates for all central plumbing equipment.

- Brass or plastic tags for all valves.
- Plastic markers for pipes.
- Detectable plastic underground warning tape for underground piping.
- Ceiling tacks for equipment and valves located above suspended acoustical ceiling tiles.

22 0719—Plumbing Piping Insulation

- Rigid fiberglass pipe insulation with all-service jacket or elastomeric foam pipe insulation shall be used for interior domestic cold / hot water piping, and horizontal / exposed interior storm drain piping.
- Storm piping leaders enclosed within interior walls shall not be insulated; those enclosed within exterior walls shall be insulated.
- PVC fitting covers for fiberglass pipe insulation.

22 1005—Plumbing Piping

- Water supply piping: Interior domestic and non-domestic hot / cold water piping shall be soft annealed Type K below slab and hard drawn Type L copper above grade. Fittings shall be soldered (below grade), and soldered or pro-press type above grade.
- Sanitary waste piping shall be cast iron below and above grade.
- Interior vent piping shall be cast iron above grade.
- Isolation valves shall be provided as appropriate for main risers and branches, and at equipment connections.
- Interior storm drain piping shall be PVC or cast iron below slab and cast-iron no-hub above grade.
- Natural gas piping shall be Schedule 40 black steel.

22 1006—Plumbing Piping Specialties

- Domestic cold water service shall enter the building through a pressure reducing valve (with isolation by-pass) and duplex RPZ backflow preventers. Provide a pressure gauge at main domestic water service.
- Non-domestic cold water shall be provided with duplex RPZ backflow preventers to prevent contamination of domestic system.
- Roof drains shall be cast iron body with sump and polyethylene dome.
- Secondary drains for roof shall be provided via roof drains / piping / downspout nozzles or roof scup-pers.
- Floor drains shall be lacquered cast iron two-piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
- Floor cleanouts shall be round cast nickel bronze access frame and non-skid cover.
- Exterior hydrants shall be wall mounted, freeze resistant, self-draining type with chrome plated wall plate, hose thread spout, lockshield with removable key, and integral vacuum breaker. Hydrants shall be pro-vided at intervals not exceeding 100-ft around the building at the ground level, with a minimum of one (1) hydrant per exterior façade.
- Water hammer arrestors shall be provided in water supply branch piping to flush-valve fixtures.
- Local neutralization tanks at all laboratory fixtures, where applicable.

22 3000—Plumbing Equipment

- Domestic water heaters shall be heat exchanger(s) tied to campus HW system for domestic hot water generation.
- A diaphragm type compression tank shall be provided.
- (Pending further information / analysis) A central water pressure boosting system shall be provided for the main water supply system for the building. The pressure boosting system shall be packaged with two pumps, factory assembled, tested, and adjusted; consisting of pumps, valves, and piping, with control panel assembled on fabricated steel base with structural steel framework. Package shall include controls, instrumentation, disconnects, starters, control circuit transformer, selector switch for each pump, low limit pressure switch, low pressure alarm light, running lights, current sensing devices, minimum run timers, manual alternation, and suction and discharge pressure gages. Each pump outlet shall have a combination pressure reducing and check valve to maintain constant system pressure. Provide gate or butterfly valves on suction and discharge of each pump, and check valve on each pump discharge.
- (Pending further information / analysis) A sewage ejector pump package at lowest level of the building. Pumps shall be cast iron volute and impeller, vertical centrifugal in a duplex arrangement. Sump will have steel cover plate with steel curb frame for grouting into concrete sump with inspection opening and cover, and alarm fittings. Duplex controls will include float

operated mechanical alternator with float rod, stops, and corrosion resistant float to alternate operation of pumps, cut-in second pump on rising level or lead pump failure, separate pressure switch high level alarm with transformer, alarm bell, and stand-pipe, and emergency float switch with float rod, stops, and corrosion resistant float to operate both pumps on failure of alternator.

- Elevator sump pumps shall be submersible type, approved to UL 778 standards and include thermal and overload protection. The motor shall be rated 1/2 HP, 1 phase, 115V and capable of operating continuously or intermittently. The motor housing shall be constructed of 304 stainless steel and mechanical seats shall be housed in a separate oil-filled compartment. The control system shall function automatically and shall provide for alarms and separate LED lights for the presence of oil in the sump, high liquid in the sump and high amps or locked rotor condition.
- Rainwater harvesting system will be further studied to utilize storm water (stored in underground cisterns) for non-portable building use, such as flushing toilets. Mechanical rooms inside the buildings will be required to house water treatment equipment. Separate piping system for non-portable water will be required throughout the building. Additional regular maintenance will be required on water treatment equipment.
- Greywater recycle system will be further studied to utilize greywater water (discharged from sinks, showers) for non-portable building use, such as flushing toilets. On-site storage and mechanical rooms inside the buildings will be required to house water treatment equipment. Separate piping system for non-portable water will be required throughout the building. Additional regular maintenance will be required on water treatment equipment.
- If either rainwater harvesting or greywater recycle systems incorporated, AC condensate will also be piped into the storage tanks for non-portable building use.

22 4000—Plumbing Fixtures

- Plumbing fixtures shall be water-conserving type, Watersense labeled. Sloan, Kohler, American Standard, Zurn, Florestone, Elkay generally used as basis of design.
- Water closets in public areas shall be wall-mounted vitreous china with manual flush valve (1.1 gpf).
- Urinals in public restrooms shall be wall mounted, vitreous china, with manual low-flow flush valve (0.125 gpf).
- Water closets in dorm rooms shall be floor-mounted vitreous china with manual flush tank (1.28 gpf).
- Wall hung lavatories in public restrooms shall be vitreous china with floor carrier, grid strainers and single lever faucets (0.35 gpm).
- Counter-mounted lavatories in dorm restrooms shall be vitreous china, grid strainers and single lever faucets (0.35 gpm).
- Lounge room pantry sinks shall be single-bowl stainless steel, self-rimming, with single-lever gooseneck swing spout faucet (1.0 gpm), and removable strainer cup.
- Service sinks shall be floor-mounted, molded stone, 24×24-inch, with 5-foot rubber hose, mop hanger, and wall mounted faucet (wall brace, pail hook, vacuum breaker, lever handles, integral check stops).
- Electric water coolers shall be dual-height, stainless steel with bottle fillers and recessed compressor compartments.
- Showers shall be molded acrylic / fiberglass with pressure-balanced thermostatic mixing valves and 1.5 gpm shower heads.

Division 23 - Heating, Ventilating, And Air Conditioning (HVAC)

Applicable Codes and Standards

HVAC systems will be designed in accordance with the following Codes and Standards:

- 2021 Virginia Uniform Statewide Building Code (VUSBC)
- 2021 Virginia Construction Code (VCC)
- 2021 Virginia Mechanical Code (VMC)
- 2021 Virginia Energy Conservation Code (VECC)

Design Conditions

	Summer	Winter
Outdoor	95°F db, 78°F wb	14°F db
Indoor, general	72°F, 50% Maximum RH	72° F, No min RH
IT rooms	72°F, 50% Maximum RH	-
Entrance vestibules	-	50° F, No min RH
Mech/Elec Rooms	5° rise above ambient room	50° F, No min RH

The estimated cooling load and heating load for each of the buildings are as follows:

Building #	Cooling Load	Heating Load
Building 1	105 Tons	1725 MBH
Building 2	102 Tons	1675 MBH
Building 3	95 Tons	1550 MBH
Total:	302 Tons	4950 MBH

HVAC System Options

Three system types for heating and cooling will be compared for this project. Equipment locations will be coordinated with Architect and Owner prior to design completion. The proposed system types are as follows:

- Option 1—Geothermal Water Source Heat Pumps (WSHPs) with a Dedicated Outside Air System (DOAS).
- Option 2—Fan Coil Unit, Blower Coil Unit, and a DOAS, served by the campus utilities.
- Option 3—Geothermal Heat Recovery Chiller (HRCH) with Fan Coil Units, Blower Coil Units, and a DOAS.

Option 1—Geothermal Water Source Heat Pumps (WSHP) with a Dedicated Outside Air System (DOAS)

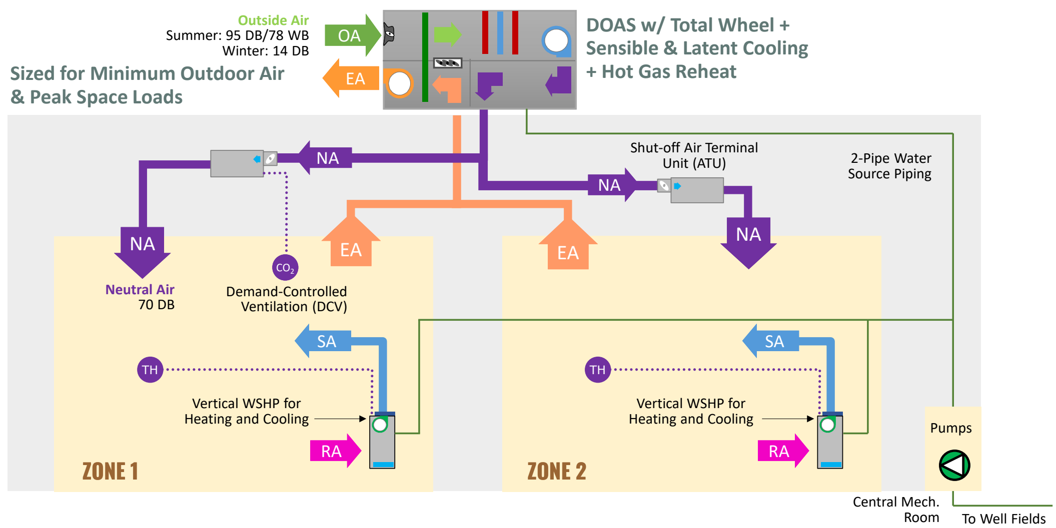
The Geothermal ground source (heat rejection/absorption) system shall use the steady state ground temperature as a heat sink to reject heat or heat source to absorb heat into the building depending on season and space demands. The system will include an estimated 150 vertical bores. Each of the three buildings will be served by 2 base mounted pumps (for a total of (6) six), piped to a ground loop manifold, located in the mechanical room, going out to the well field serving that building. These pumps shall be in operating/standby configuration for redundancy and distribute the heat rejection/source loop water to all the water source heat pumps throughout the building. Interior condenser water piping shall be black steel and/or copper, depending on size, insulated with fiberglass with ASK jacket. Exterior condenser water piping shall be PEX HDPE or other polymer type pipe uninsulated. All indoor plant equipment (Air separator, Chem feeder, etc.) shall be in the central mechanical room for the building. Distribution piping shall be routed above ceilings as much as possible only exposed where necessary, with taps for connection to all water source heat pump equipment.

New ground source refrigerant-based packaged heat-pump DOAS unit shall be provided for each building, three (3) units in total, to deliver dehumidified and conditioned outside air to occupied spaces in the building. Each DOAS unit shall be sized to supply an estimated 8,000 CFM. The units shall deliver space neutral temperature air via distribution ductwork directly to space via shut off air terminal units (ATUs). Where feasible, demand control ventilation (DCV) shall be implemented via space $CO2$ or occupancy sensors for specific zones to reduce energy consumption. The central DOAS unit shall consist of water-source heat pump direct exchange (DX) cooling/heating coil, hot gas reheat control for dehumidification and reheat, filter segments, a supply fan, a return fan, and an energy recovery wheel to pretreat outside air. The DOAS is to be located in the attic of each building.

Local water source refrigerant-based heat pump (WSHP) units, which provide space conditioning to individual zones, shall be installed throughout the building. A zone shall consist of no more than 2 dorm rooms, and each study lounge shall be its own zone. Heat pumps shall be 2-pipe condenser water type, in vertical floor mounted configuration for study rooms, and horizontal ceiling mounted configuration for dorm rooms. Vertical units shall be located in mechanical rooms or closets located within close proximity to the spaces served, horizontal units shall be located in the ceiling in the hallway adjacent to the rooms they supply. Supply and return ducts shall distribute air to each zone. Condensate drain piping with insulation shall be provided for each WSHP. Condensate pumps shall be provided as required.

The main Mechanical/Electrical room shall be ventilated mechanically via an exhaust fan with line voltage thermostat and an electric unit heaters with line voltage thermostat. Additional Mechanical/Electrical rooms on each floor will be served by a nearby WSHP serving a lounge space. Stairwells and IT closets will be supplied by their own dedicated WSHP.

DESIGN OPTION 1: HYDRONIC DEDICATED OUTDOOR AIR SYSTEM (DOAS) W/ WATER SOURCE HEAT PUMP (WSHP) (GEOTHERMAL)



Unit Tag (Location)	Unit Qty.	Est. Total Capacity (Cooling/Heating)	Est. Flow Rate Range	Remarks
Geothermal Well	150	2 tons per well	-	The closed loop Geothermal wellfield is to be reverse return piped. 450 ft @ 20 ft on-center
OAU (Attic)	3	30 tons 360 MBH	8,000 CFM 2" ESP	Dedicated Outside Air System, ground source, Total enthalpy wheel, and hot gas reheat.
VAV Air Terminal Units	150-170	n/a	200-2,000 CFM	Shut-off VAV ATU.
Water Source Heat Pumps	150-170	1-3 tons 36 MBH	500-2,000 CFM	One WSHP per thermal zone.
Ground Water Pumps	6	n/a	-	Base mounted centrifugal pumps to pump the ground water through the Geothermal loop and throughout each building to all WSHPs, and OAUs.
Mech Room Exhaust Fans	3	1/10 HP	100-500 CFM	Cabinet inline type, with line voltage thermostat.

Option 2—Fan Coil Unit, Blower Coil Unit, and a DOAS, served by the campus utilities

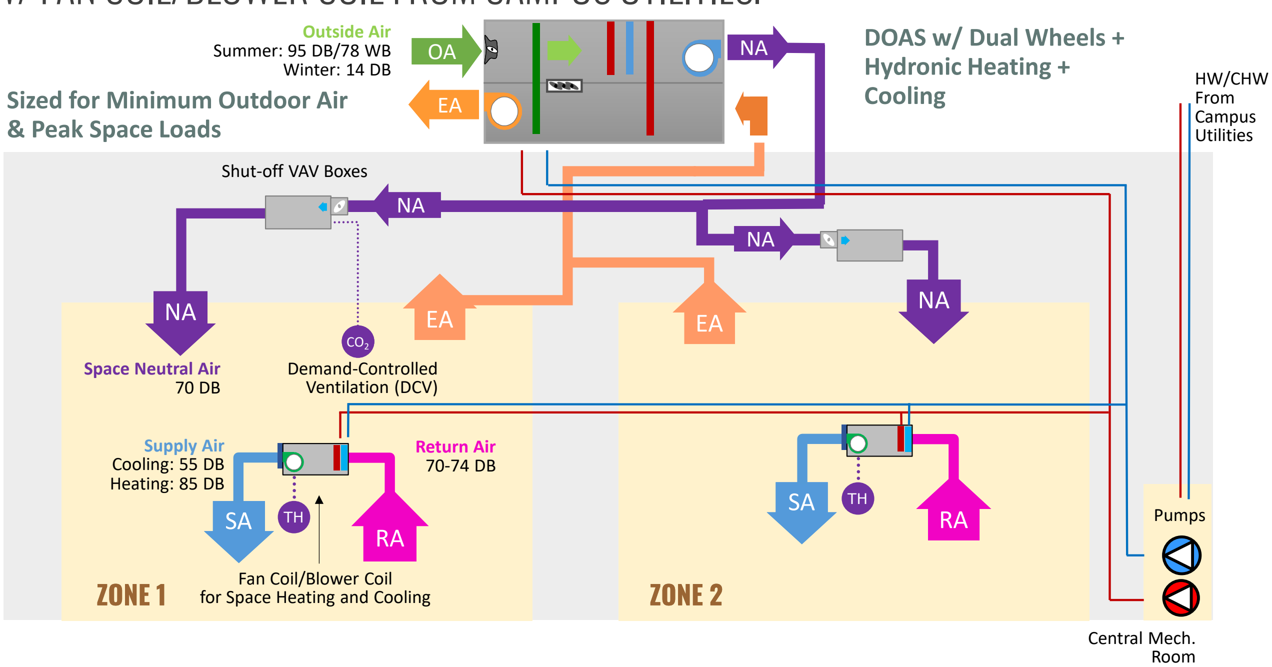
The campus thermal utilities will be brought into the mechanical rooms of each building to provide the buildings 4-pipe hydronic loops; chilled water (CHW), and heating water (HW). The 4-pipe chilled water (CHW) and heating water (HW) distribution loop system shall serve the hydronic DOAS unit FCs, and BCs. Each hydronic system shall have two (2) pumps on operating/standby for redundancy to distribute CHW and HW throughout the building. Other central heating/cooling plant accessories like expansion tanks, air separators, valves and gauges etc. shall be provided. All indoor central utilities equipment shall be located in the central mechanical room in each building. Insulated distribution piping shall be routed above ceilings (exposed where applicable), with taps for connection to all cooling coils/loop and heating coils/loop.

A new hydronic DOAS shall be provided for each building, three (3) units in total, to deliver dehumidified and conditioned outside air to occupied spaces in the building. Each DOAS unit shall be sized to supply an estimated 8,000 CFM. The unit shall deliver space neutral air via distribution ductwork directly to space via shut off Air Terminal Units (ATUs). Where feasible, demand control ventilation (DCV) shall be implemented via space CO2 or occupancy sensors for specific zones to reduce energy consumption. The central DOAS unit shall consist of chilled water-cooling coil, heating water reheat coil for heating and dehumidification, filter segments, a supply fan, a return fan, and a total enthalpy energy recovery wheel, and a sensible energy wheel to pretreat outside air. The DOAS units are to be located in the attic of each building.

Provide 4-pipe fan coil units (FC) or blower coil units (BC) for each zone to deliver local cooling and heating. A zone shall consist of no more than 2 dorm rooms, and each study lounge shall be its own zone. BCs shall be provided for study rooms, and FCs for zones comprised of dorm rooms. FC's shall be located primarily above the ceiling. BCs shall be vertical floor mounted and located within mechanical closets or rooms, adjacent to the space served by the corresponding unit. Supply and return ducts shall be provided to distribute air to and from each zone/space. Condensate drain piping with insulation shall be provided at each FC/BC, with condensate pumps as required.

The main Mechanical/Electrical room shall be ventilated mechanically via an exhaust fan with line voltage thermostat and an electric unit heaters with line voltage thermostat. Additional Mechanical/Electrical rooms on each floor will be served by a FC. Stairwells will be provided with a cooling only FC on the top floor, and a heating only FC on the bottom floor. IT closets will be supplied by their own dedicated cooling only FC.

DESIGN OPTION 2: HYDRONIC DEDICATED OUTDOOR AIR SYSTEM (DOAS) W/ FAN COIL/BLOWER COIL FROM CAMPUS UTILITIES.



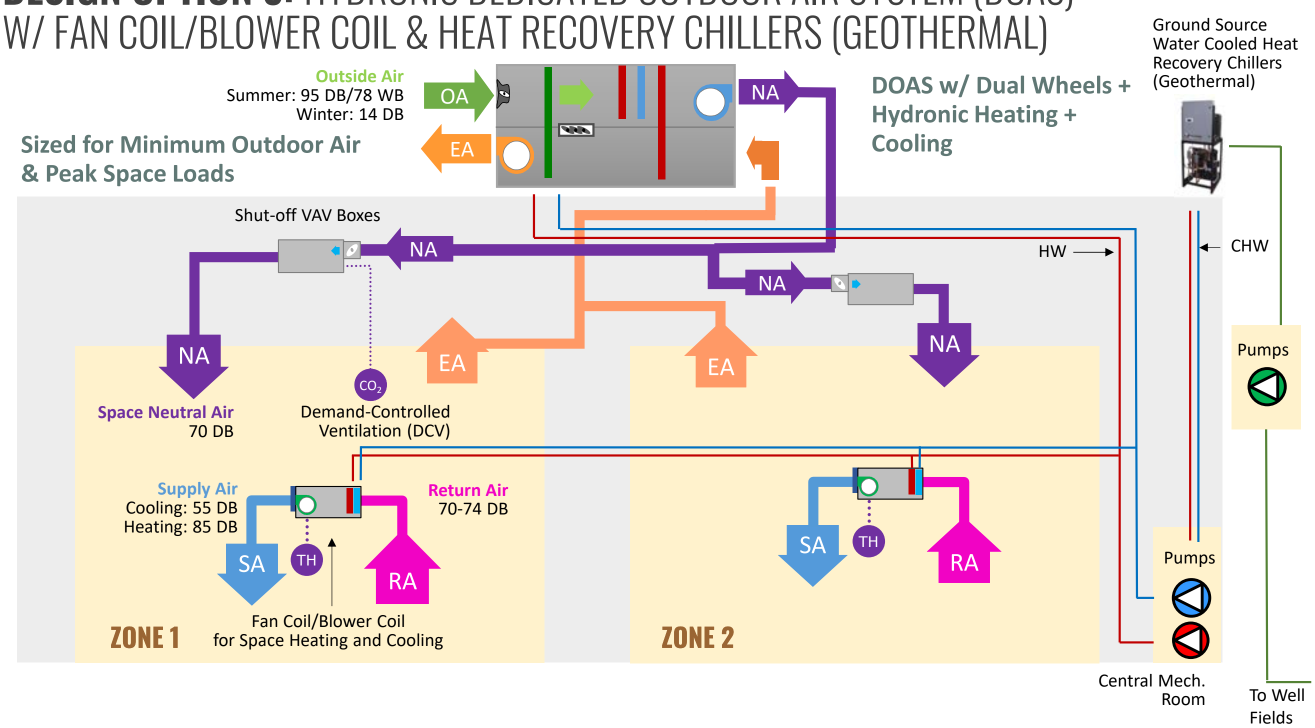
Option 3: Geothermal Heat Recovery Chiller (HRCH) with Fan Coil Units, Blower Coil Units, and a DOAS

The Geothermal ground source (heat rejection/absorption) system shall use the steady state ground temperature as a heat sink to reject heat or heat source to absorb heat into the building depending on season and space demands. The system will include an estimated 150 vertical bores. Each of the three buildings will be served by 2 base mounted pumps (for a total of six), piped to a ground loop manifold, located in the mechanical room, going out to the well field serving that building. These pumps shall be in operating/standby configuration for redundancy and pump the heat rejection/source loop water through each of the 3 heat recovery chillers serving the buildings. Interior condenser water piping shall be black steel and/or copper, depending on size, insulated with fiberglass with ASK jacket. Exterior condenser water piping shall be PEX HDPE or other polymer type pipe uninsulated. All indoor plant equipment (Air separator, Chem feeder, etc.) shall be in the central mechanical room for the building. Distribution piping shall be routed above ceilings as much as possible only exposed where necessary, with taps for connection to all water source heat pump equipment.

A series of indoor water-cooled heat recovery chillers will produce the buildings 4-pipe hydronic loops; chilled water (CHW), and heating water (HW) and reject/absorb heat to and from the geothermal well field. The heat recovery chiller will be modular, with some modules dedicated to only producing chilled water, and some modules producing both heating and chilled water simultaneously. The 4-pipe chilled water (CHW) and heating water (HW) distribution loop system shall serve the hydronic DOAS unit FCs, and BCs. Each hydronic system shall have two (2) pumps on operating/standby for redundancy to distribute CHW and HW throughout the building. Other central heating/cooling plant accessories like expansion tanks, air separators, valves and gauges etc. shall be provided. All indoor central utilities equipment shall be located in the central mechanical room in each building. Insulated distribution piping shall be routed above ceilings (exposed where applicable), with taps for connection to all cooling coils/loop and heating coils/loop.

A new hydronic DOAS for each building, three (3) units in total, to deliver dehumidified and conditioned outside air to occupied spaces in the building. Each DOAS unit shall be sized to supply an estimated 8,000 CFM. The unit shall deliver tempered air via distribution ductwork directly to

DESIGN OPTION 3: HYDRONIC DEDICATED OUTDOOR AIR SYSTEM (DOAS) W/ FAN COIL/BLOWER COIL & HEAT RECOVERY CHILLERS (GEOTHERMAL)

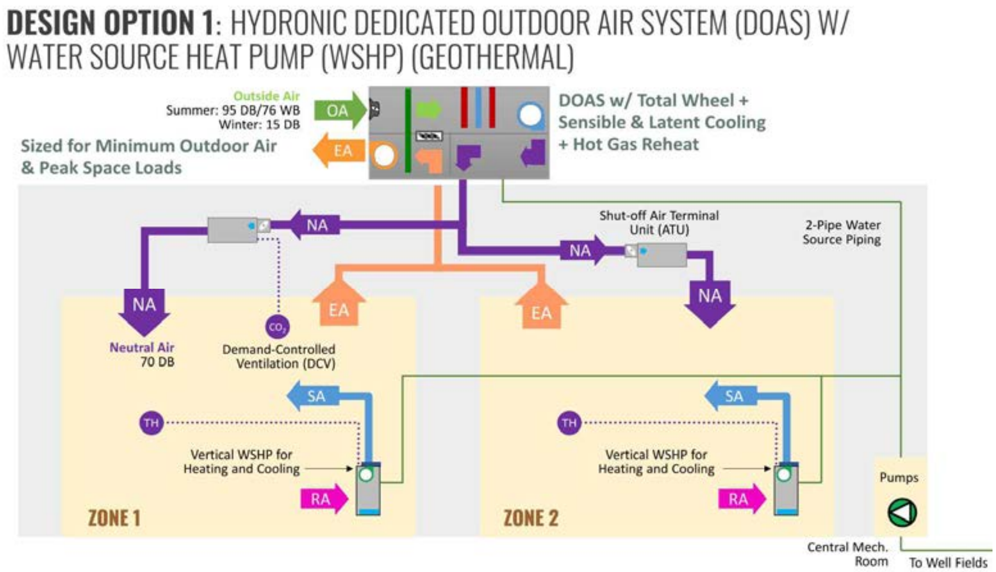


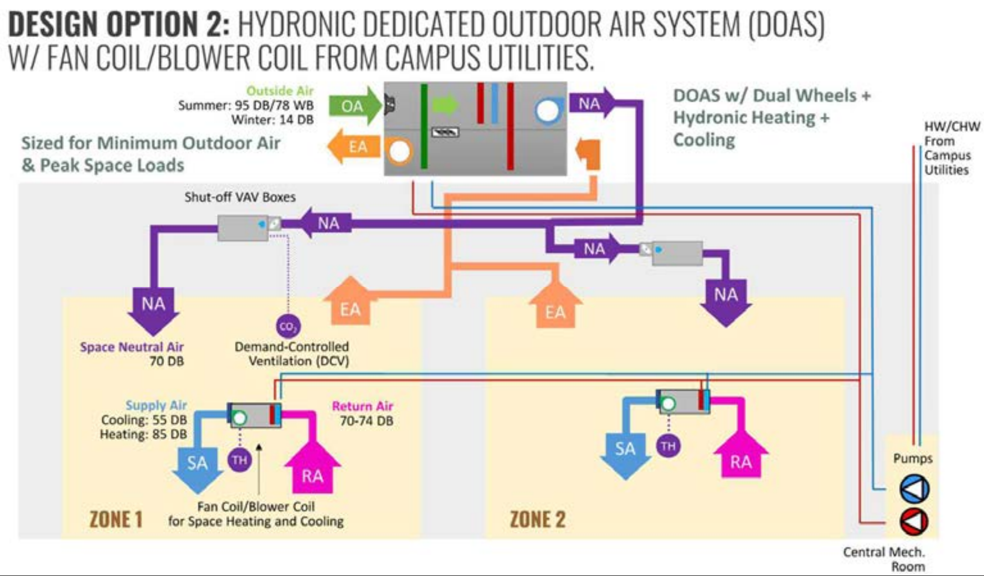
space via shut off Air Terminal Units (ATUs). Where feasible, demand control ventilation (DCV) shall be implemented via space CO2 or occupancy sensors for specific zones to reduce energy consumption. The central DOAS unit shall consist of chilled water-cooling coil, heating water reheat coil for heating and dehumidification, filter segments, a supply fan, a return fan, and a total enthalpy energy recovery wheel, and a sensible energy wheel to pretreat outside air. The DOAS units are to be located in the attic of each building.

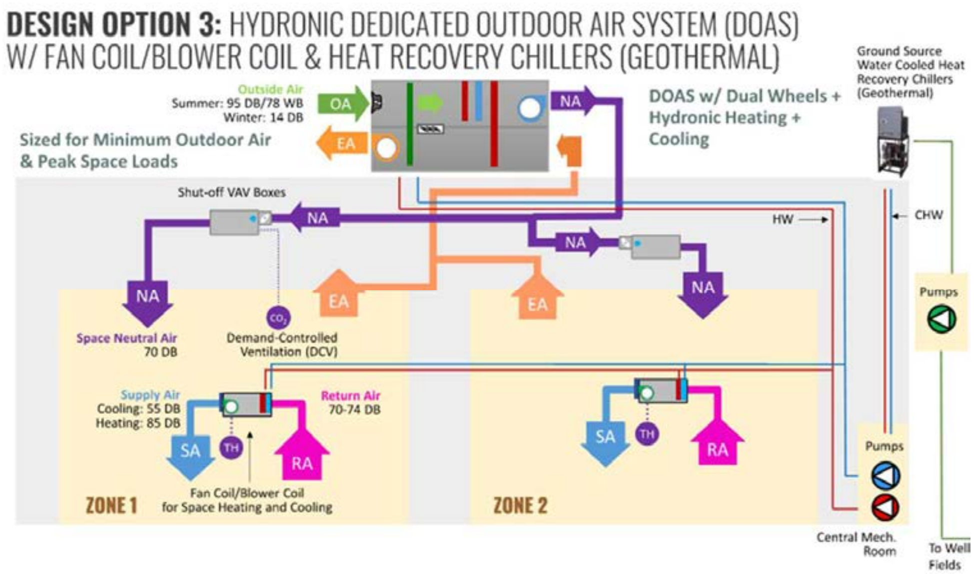
Provide 4-pipe fan coil units (FC) or blower coil units (BC) for each zone to deliver local cooling and heating. A zone shall consist of no more than 2 dorm rooms, and each study lounge shall be its own zone. BCs shall be provided for study rooms, and FCs for zones comprised of dorm rooms. FC's shall be located primarily above the ceiling. BCs shall be vertical floor mounted and located within mechanical closets or rooms, adjacent to the space served by the corresponding unit. Supply and return ducts shall be provided to distribute air to and from each zone/space. Condensate drain piping with insulation shall be provided at each FC/BC, with condensate pumps as required.

The main Mechanical/Electrical room shall be ventilated mechanically via an exhaust fan with line voltage thermostat and an electric unit heaters with line voltage thermostat. Additional Mechanical/Electrical rooms on each floor will be served by a FC. Stairwells will be provided with a cooling only FC on the top floor, and a heating only FC on the bottom floor. IT closets will be supplied by their own dedicated cooling only FC.

Space Conditioning System Options - WSHP vs. Campus Utilities Vs. HRCH

<table>
<tr><td>System Diagrams</td><td colspan="2">
</td></tr>
<tr><td>SHORTHAND NAME</td><td colspan="2">DOAS w/ Geothermal Water Source Heat Pump</td></tr>
<tr><td>NAME / TYPE</td><td colspan="2">Ground Source Variable Air Volume Dedicated Outside Air System (VAV DOAS)
Shut off VAV boxes.
Water Source Heat Pump (WSHP)
Geothermal Loop Heat Sink (2-Pipe Distribution)</td></tr>
<tr><td>PROS AND CONS FOR EACH SYSTEM</td><td>Pros:
-This system type is already used for the phase 1 buildings, and will be familiar to maintenance staff.
-Proven energy efficient system type for this building type and space usage.
-Simplified control strategies.</td><td>Cons:
-Vertical style WSHPs for larger spaces need to be located in closets for easy maintenance and sound mitigation, but this reduces programming space.
-Each WSHP has a compressor, which is an additional maintenance component and source of noise.</td></tr>
</table>

System Diagrams		
SHORTHAND NAME	**DOAS w/ Campus Utilities and Fan Coil & Blower Coils**	
NAME / TYPE	Hydronic Variable Air Volume Dedicated Outside Air System (VAV DOAS) Shut off VAV boxes Campus HW/CHW Utilities. 4 Pipe Fan coils and Blower coils	
PROS AND CONS FOR EACH SYSTEM	**Pros:** -HW/CHW systems have the better controllability for thermal comfort than WSHPs. -Lowest upfront costs, with no well fields. -Simplified Controls strategies.	**Cons:** -Less energy efficient than the geothermal options. -Campus Thermal Utilities uses fossil fuels.

System Diagrams		
SHORTHAND NAME	**DOAS w/ Geothermal Heat Recovery Chiller, Fan Coil & Blower Coils**	
NAME / TYPE	Hydronic Variable Air Volume Dedicated Outside Air System (VAV DOAS) Shut off VAV boxes Heat Recovery Chiller (HRCH) 4 Pipe Fan coils and Blower coils Geothermal Loop Heat Sink (2-Pipe Distribution)	
PROS AND CONS FOR EACH SYSTEM	**Pros:** -HW/CHW systems have the better controllability for thermal comfort than WSHPs. -Simultaneous heating and cooling needs are met through heat recovery instead of increasing geothermal source energy usage, which could reduce the size of the well field.	**Cons:** -The Heat recovery chiller has a complex controls strategy, which could be difficult for maintenance staff. -The heat recovery chiller would require a larger mechanical room.

Division 25 - Building Automation System (BAS)

Applicable Codes and Standards

BAS systems will be designed in accordance with the following Codes and Standards:

- 2021 Virginia Uniform Statewide Building Code (VUSBC)
- 2021 Virginia Construction Code (VCC)
- 2021 Virginia Mechanical Code (VMC)
- 2021 Virginia Energy Conservation Code (VECC)

The HVAC building systems will be controlled by a direct digital control (DDC) building automation system (BAS).

The building systems will be controlled by a direct digital control (DDC) building automation system (BAS) with full capabilities of scheduling, controlling, monitoring and alarming for the system. A new front-end unit will be furnished for each of the three buildings, which will tie into the campus BAS. The BAS will include demand limiting functions and an operator's workstation with full system graphics. The BAS will include electric metering sensors (current transformers) for lighting and power panelboards throughout the buildings, and an interface at the main electric switchboard.

Electronic controls will be programmable and provide for temperature control, occupied / unoccupied scheduling, etc. Control valves at terminal units will be 2-way, electric. Line voltage thermostats will control propeller exhaust fans and unit heaters.

Sequences of control will be included on the drawings.

Division 26 - Electrical

Applicable Codes and Standards

Electrical systems will be designed in accordance with the following Codes and Standards:

- 2021 Virginia Uniform Statewide Building Code (VUSBC)
- 2021 Virginia Construction Code (VCC)
- 2021 Virginia Energy Conservation Code (VECC)
- 2020 National Electrical Code (NEC), NFPA 70
- 2019 CWM Facilities Management - Technical Standards Edition 2.1
- 2024 CWM Facilities Management—Design and Construction Manual (DCM) Edition 2.2
- IESNA Lighting Handbook

General

The electrical systems will include all work associated with the power, lighting, and emergency/standby power systems.

Electric Service Entrance:

The estimated electric service ampacity is 1600-2000A 208/120V, 3 phase for each building. Service size and requirements will be refined as information regarding specific space needs and power requirements is determined. The power distribution system will be designed with ample capacity for current building use, as well as a minimum of 25% additional capacity for future growth.

Normal Power Distribution Network:

Each building will have its own main switchboard to feed 208/120V distribution equipment through the building. Distribution panels will feed lighting panel(s), mechanical equipment panel(s) and distribution panels, which shall supply power for receptacle and other equipment loads. Areas where a dedicated Panel is required for the space type and usage will be provided as needed.

Emergency Power Distribution Network:

Each building will have its own generator. Generator (size to be determined) shall have (2) main line breakers that feed separate automatic transfer switches (ATS) for life safety and equipment systems. The Switchboard shall provide normal power feeds to each ATS. Each ATS shall feed a distribution panel located in the emergency electric room, which shall distribute power to branch circuit panels either on each floor or alternating floors, depending on load requirements. Life safety system panels are expected to be located on alternating floors due to light load requirements (emergency egress lighting, fire alarm, etc). Emergency equipment system panels shall be located and sized per program equipment needs. Should a fire pump be required, a third mainline breaker in the generator will be provided to feed the fire pump ATS. If additional stand-by loads are required, an additional ATS will be provided.

Lighting:

All lighting will be designed to conform to all Code standards for normal and emergency lighting. Emergency lighting will be fed from the emergency ATS fed by the generator.

Division 28 - Electronic Safety And Security

Fire Alarm and Voice Notification System

Applicable Codes and Standards

The Building fire alarm system shall be designed according to the following codes:

- 2021 Virginia Uniform Statewide Building Code (VUSBC)
- 2021 Virginia Construction Code (VCC)
- 2021 Virginia Mechanical Code (VMC)
- 2021 Virginia Statewide Fire Prevention Code
- 2019 NFPA 72, National Fire Alarm and Signaling Code
- 2019 CWM Facilities Management - Technical Standards Edition 2.1
- 2024 CWM Facilities Management—Design and Construction Manual (DCM) Edition 2.2

General

The system will be a Simplex analog addressable multiplex system with manual alarm initiation, voice evacuation and visual notification in all occupied areas throughout the building. Automatic smoke and heat detection devices shall be provided at the locations required by the code to initiate respective general, trouble or supervisory alarms for the system. There will be sets of smoke and heat detectors for the elevator recall and power shunt trips of the elevator cabs. Automatic duct smoke detectors will be provided for the air duct system to shut down the air handling units upon detection of any smoke per the Virginia Mechanical Code.

The main fire alarm control panel shall be located in the main electric service room. The system shall consist of initiating devices, supervisory devices, and indicating devices. A remote LCD graphic annunciator shall be located at the designated main entry for the building. The new fire alarm control panel will monitor signaling line circuit (SLC) and notification appliance circuit (NAC) for integrity. This sub-panel shall signal the FACP and transmit signals to the monitoring company based on the programming. The Voice Evacuation Panel will deliver the prerecorded voice message to the building occupants upon activation of any alarm situation. The Voice Panel shall have the manual override button for guided building evacuation by the attending fire emergency personal. The Booster Power Panels located throughout the building and integrated with the sub-FACP, will trigger the notification devices and provide power to the devices. The panels will have a battery backup for 24 hours of supervisory and 15 minutes of alarm (NFPA 72-10.5.6.3.1).

System wiring

All wiring for the fire alarm/detection system shall be installed in conduit. The signaling line circuit (SLC) shall be class A and the notification appliance circuit (NAC) shall be class A (NFPA 72). The performance of initiating device circuit (IDCs) shall be class A (NFPA 72). Minimum wiring sizes shall be per manufacturer recommendation and National Electrical Code NFPA 70 requirements.

Public Notification

The speaker/strobe notification shall be provided per chapter 18 “Notification Appliances” of NFPA 72 throughout occupied spaces of the building. All devices shall be listed to withstand the environmental conditions in which they are installed.

Voice Alarm Message

All voice alarm system messages shall use the following pre-approved verbiage and voice:

a. Evacuation Message Wording:
   - 10 seconds—or current whoops) followed by;
   - (pre-recorded phrase 161—3 times) “Attention, Attention, Attention” followed by;
   - (pre-recorded phrase 163) “An emergency has been reported” followed by
   - (pre-recorded phrase 171) “You are to leave the building by the nearest exit or stairway”

b. Total Evacuation Sounds will be:
   - Whoops, message including “Attention ...... Stairway”,
   - No whoops
   - Repeat message
   - (no whoops)
   - Repeat message
   - Then whoops continually until silenced.

c. Voice: Female.

Detection And Initiation System

Smoke detectors shall be provided within five feet of the fire alarm control panel and all locations of the booster power panels. Manual pull stations will be provided within five feet of all the exits on the ground floor and by the stairs of all the other floors. Smoke detectors shall be provided in sleeping rooms and egress pathways from sleeping rooms. Smoke detectors will be provided in the elevator shaft, elevator machine room and lobby to initiate recall of the elevator to its primary and alternate location. Heat detectors will be provided in the elevator machine room, elevator shaft and pit within twenty-four inches of the fire sprinkler head to activate the power shunt trip in case of fire within these areas. Duct detectors will be installed within the ducts in accordance with the VMC to shut down the air handling units. Monitoring modules will be provided as needed throughout the building to monitor fire sprinkler flow and sprinkler tamper switch. All the devices shall be connected into a number of class A loops (number of loops will depend on the number of devices per floor). Each floor shall be isolated by zone isolation modules so that any break in the circuit of one floor will not affect the other floors.

Reporting And Monitoring

The new fire alarm control panel will transmit all alarm, supervisory and trouble conditions via fiber optic transmitter to the Central Station Service located at the College Police Station.