NEW RESIDENCE HALL

PROGRAMMING STUDY

SBC # 540/000-01-2019

NOVEMBER 27, 2023

HED

THE UNIVERSITY OF TENNESSEE
CHATTANOOGA

Contents

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Overview
Vision and Intent of Study

EXECUTIVE SUMMARY

HED was tasked with the programming and planning of a new 600-900-bed student residence hall for the University of Tennessee Chattanooga (UTC). The original 2020 RFQ statement parameters (as defined by UT) were as such:

- Phased construction of two 450-bed residence halls with the possibility of a single-phased approach
- An integral parking deck supporting 600 +/- cars, with a possible exploration of a phased approach to match a two-phased option
- Programming and planning of the entire site to accommodate all potential phasing, utilities, hardscape, green-scape, and other logistical requirements
- Consideration of the topographical change between Oak Street and McCallie Ave
- Consideration of the connection between the project site and the existing, adjacent Metropolitan Building. This includes an understanding of utility services, fire protection and access, and the potential for building entry alternatives
- The site has known flooding issues, and this is an important item that may eventually require on-site detention and/or stormwater improvement designs
- There is a potential for retail on the site and this could be studied at both Oak Street and McCallie Avenue, based on preferences requested by UTC
- The original 2020 anticipated budget was as follows:
  - Student residence - $53 M
  - Parking Garage - $18M
  - Market Study for retail – To be determined

In 2023, HED was tasked with updating the original 2021 programming study and associated project cost. The updated programming study addresses current financial market pressures through "leaning" the design program while maintaining overall bed count.

The project team has approached the residential design with some key fundamentals in mind.

Fostering community

Community is at the center of all successful student life communities. Examples on UT Chattanooga's campus, as well as peer institutions, can act as catalysts for this new residence hall design and we have included project precedents of other relevant community spaces on similar projects. The ability for students to transform their space and 'place-make' is important and flexibility of space, above all, should be a design goal. Varied spaces for study, socialization, gaming, eating and relaxation are examples of strong 'neighborhood' programming.

This community atmosphere extends beyond the internal confines of the residence hall as well. It's crucial that the dynamics which make for a successful neighborhood approach, are also realized in the plaza and outdoor zones. The intent is to provide a multitude of options and flexibility that allow for varying levels of socialization, study, and student security.

Neighborhood zones placed at the center and ends of the building floor plans may be implemented with the following programmatic features:

- Studios offering space for independent and group assignments
- Learning rooms with digital interface and ALC (Active Learning Classroom) capability
- Group kitchens
- Laundry facilities
- Recreation & Gaming
- Security

Security is a key priority in this residential hall design. Both the upper and lower plaza levels require all residents to move through one point at the Reception area. The mail and package areas are also adjacent to the reception and office administration areas, allowing additional 'eyes' for added security. In addition to resident sequencing and circulation, spaces on the periphery of the building have been designed with security in mind. Maximizing views and enhancing sight lines are a critical part of this strategy.

Balancing Costs

HED coordinated with a cost consultant (CCS) to develop a budget strategy with itemized categories for UTC cost exercises. This strategy is represented in this document and may be referenced as needed.

Unit Design

Unit programming is based on a Suite-style configuration with Single occupancy bedroom units. Suites consist of four private bedrooms with common space consisting of one private toilet room, one vanity with two individual lavatories, and one private shower room. Individual nooks for study are also included in the common space and the total unit square footage is 863 square feet. The suite bedrooms are designed to provide for one desk, one cabinet, one wardrobe, one micro refrigerator and one single bed per resident. The target RA to student ratio is 40 students to one (1) RA.

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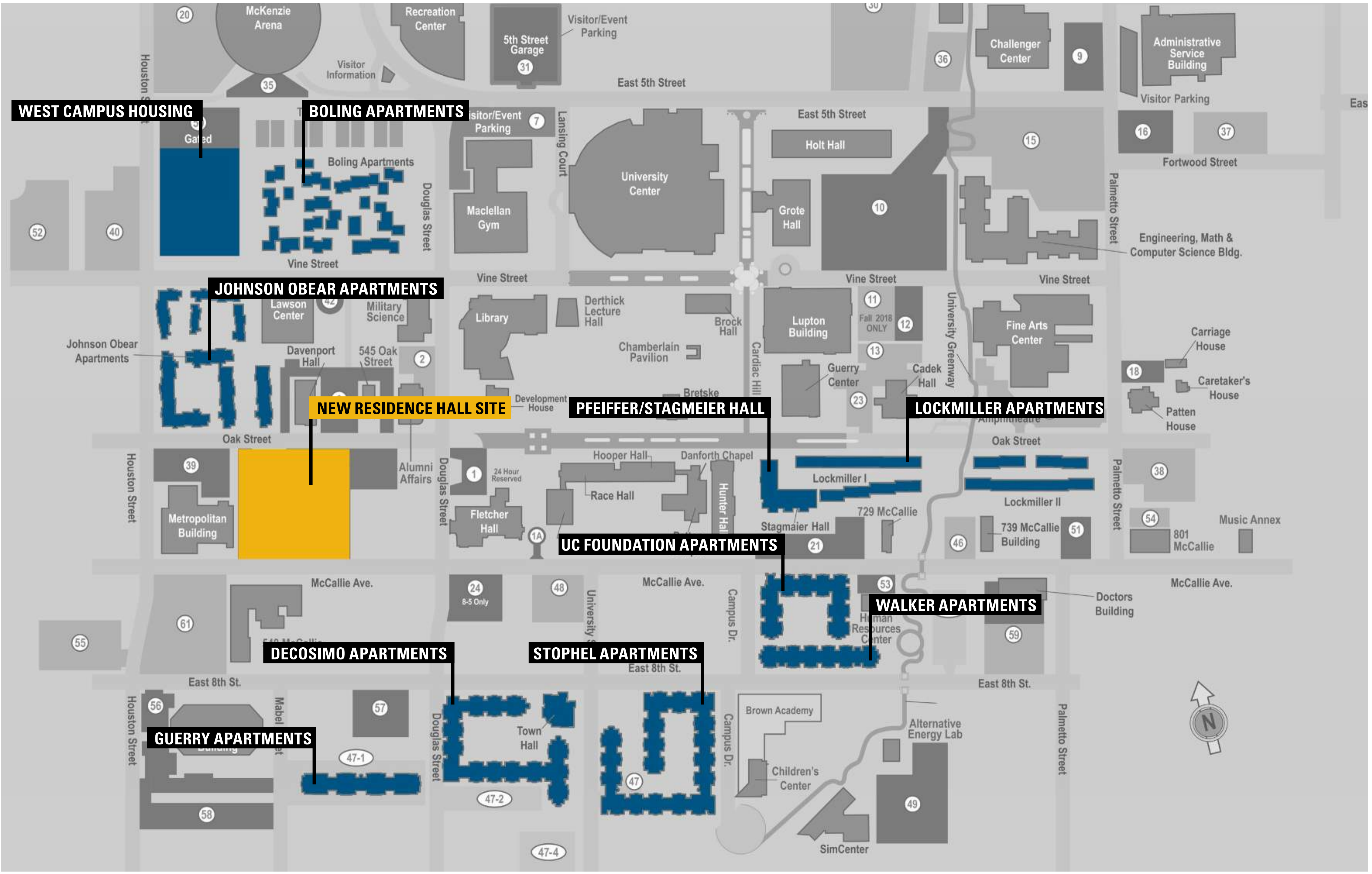
Programming Context
Process



PROCESS

The design team developed a participatory process to engage University stakeholders and ensure that all voices were heard. The programming process began with a review of the existing Residence Halls on campus, in order to familiarize the team with current resources and trends. This review, in conjunction with benchmarking of other relevant residence hall projects, allowed the team to identify needs and opportunities that influenced the direction of the programming for the New Residence Hall.

Through a series of focused programming meetings, the team evaluated different program options. The evaluation considered the philosophy and organization of different housing styles in reference to the University's housing goals, as well as the impact different strategies have on the financial outcome of the project. Throughout the process, the design team worked in a shoulder-to-shoulder manner with project stakeholders; confirming requirements, exploring ideas and reaching consensus to advance the UT Chattanooga New Residence Hall and Parking Garage Programming Study.

Design Iteration

Following the initial programming period ("Phase I"), the University directed two subsequent phases of change to the scope of the project: densifying the project site boundary ("Phase II") and separating the parking from the residential program ("Phase III"). In 2023, an update to the programming document was performed, which is the Design Program described in this document.

For original program meeting summaries (prior to 2023 program update), refer to Exhibit D in the Appendix of this document.

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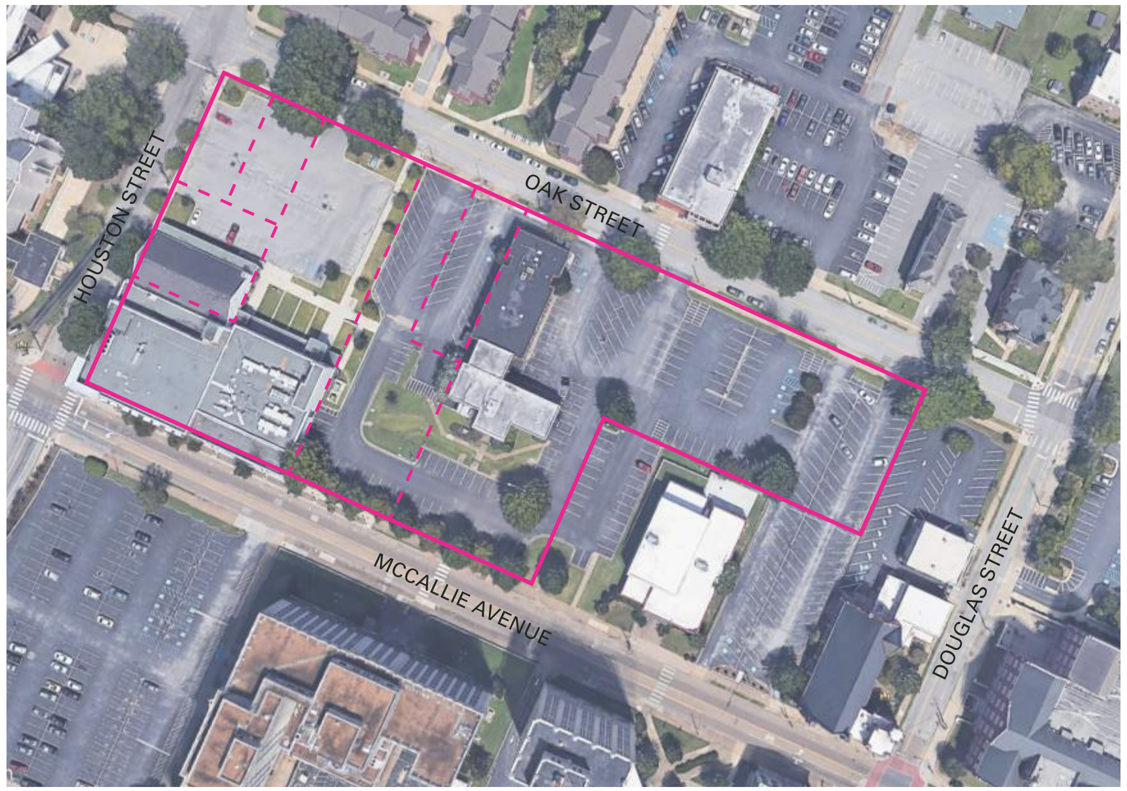
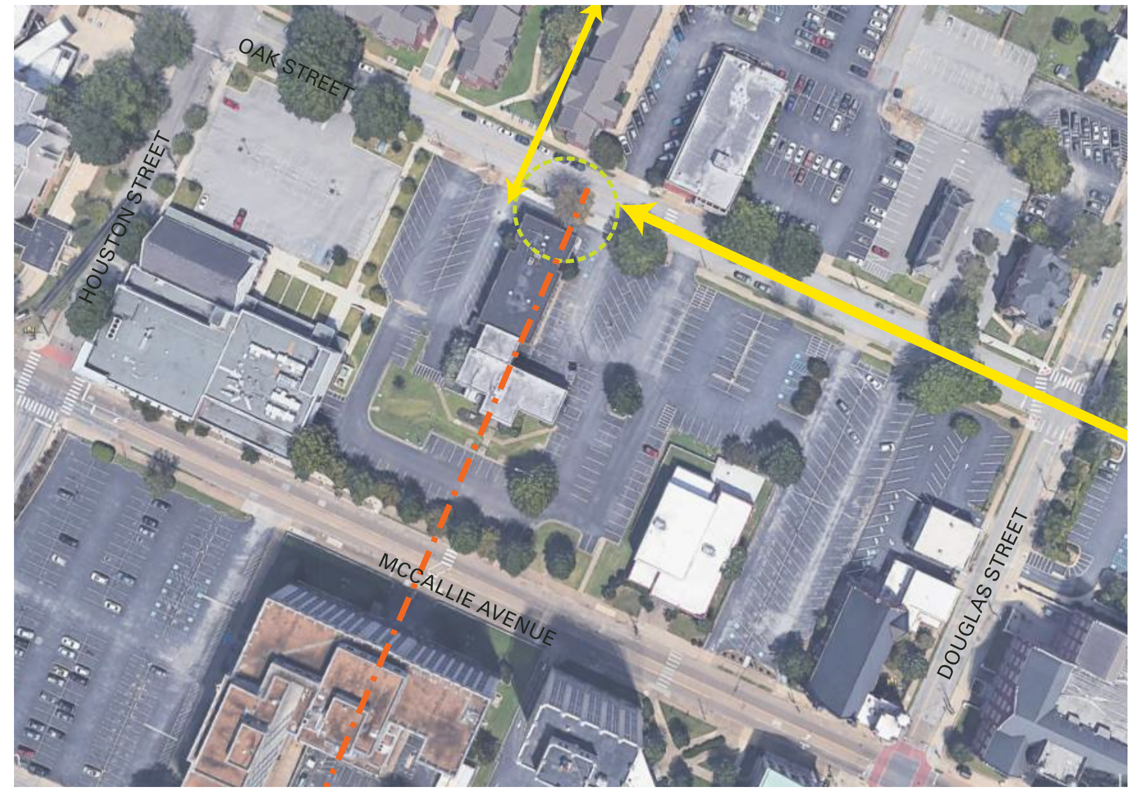
Site Considerations
Organizing Concepts



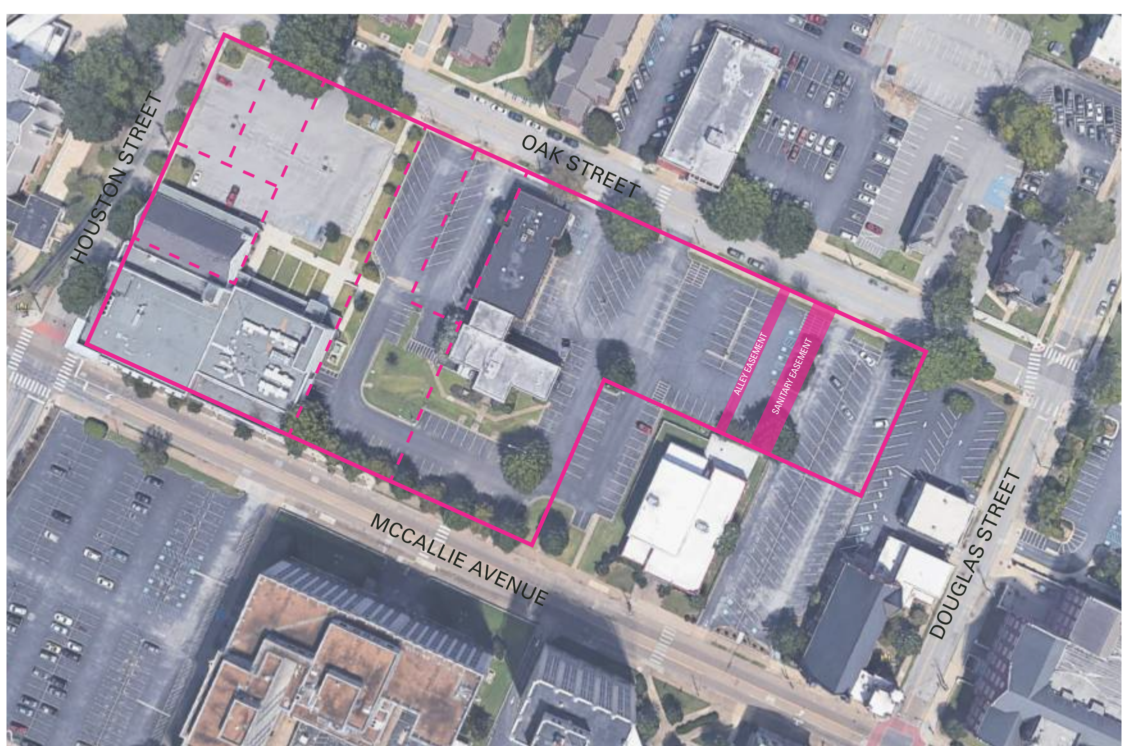


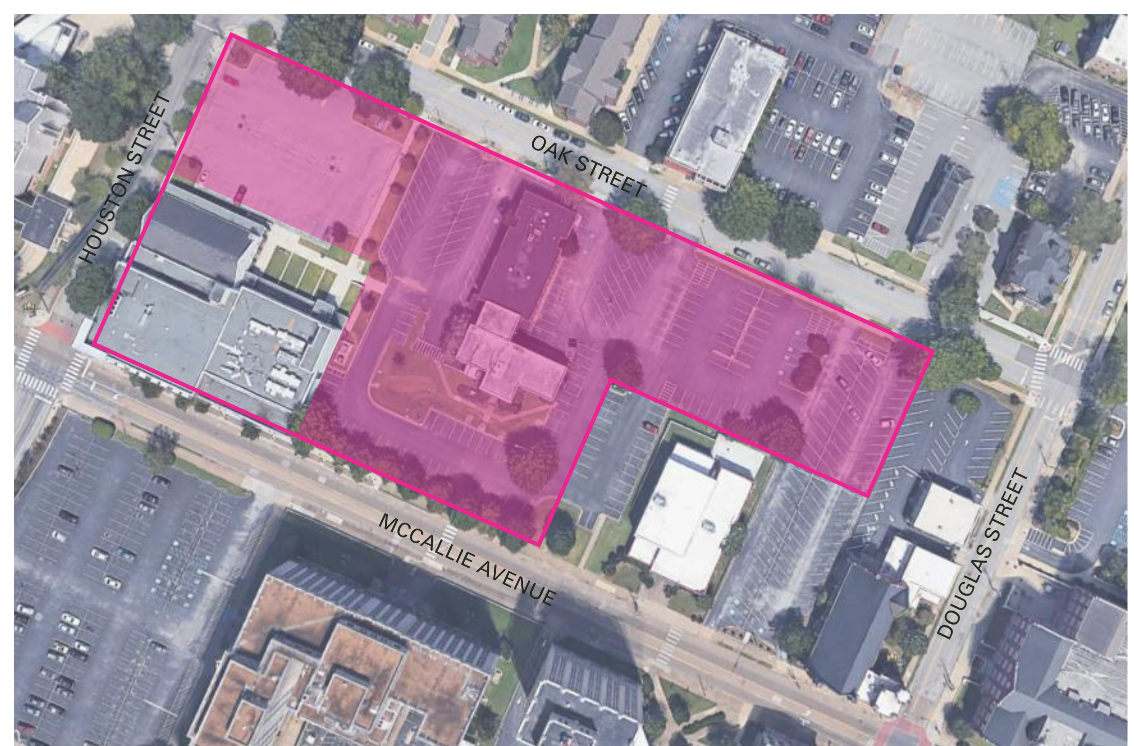
SITE DESCRIPTION

The new Residence Hall site sits at the current edge of campus and has the opportunity to act as a gateway for UTC. With its relationship to the classroom building on McCallie and the border of campus on Houston Street, the residence hall can provide both a passage into and a passage through campus.

To the east of the site, Oak Street is planned to be converted to a pedestrian only street that allows for the flow of students throughout the day. With this in mind, site use has been carefully considered to provide for future opportunity to transition Oak Street to pedestrian along this block as well.

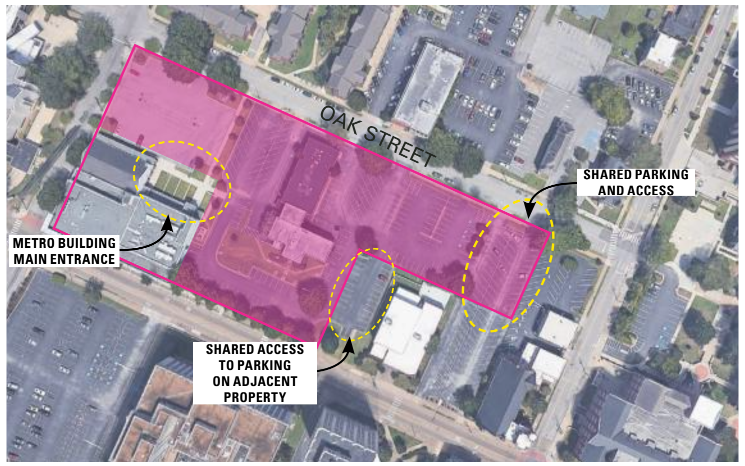
With the classroom building on McCallie, there is a natural axis established through which pedestrian flow might occur. With a twenty-foot grade difference from the north to the south side of the site, this axis creates an opportunity for procession through monumental stairs, terracing, or other grade change strategies.

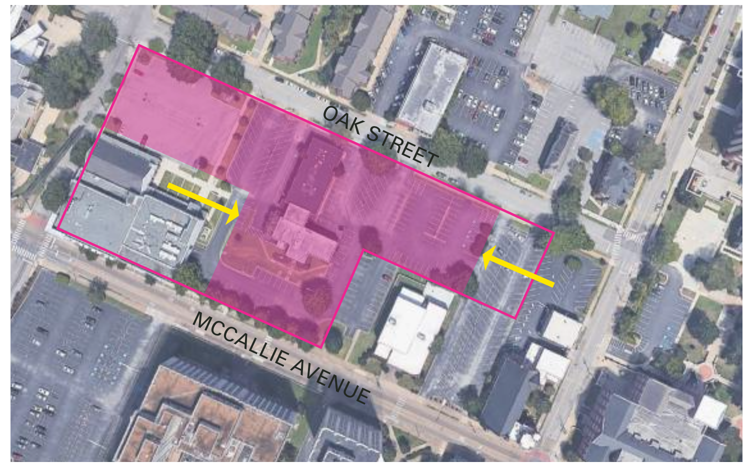


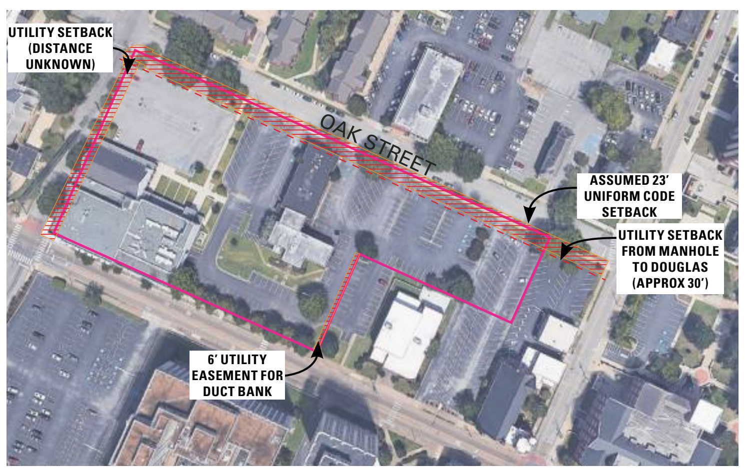


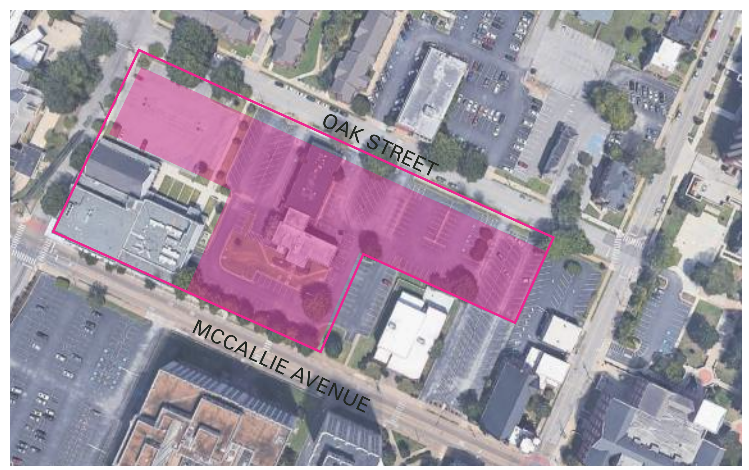
Site Considerations

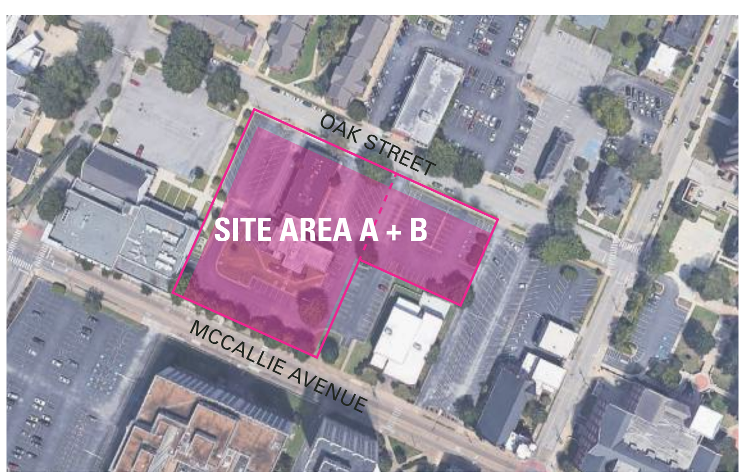
Site Use Development











PRELIMINARY SITE ANALYSIS

The provided site consists of roughly 140,000 GSF within the University of Tennessee Chattanooga SP with no required site setbacks or height restrictions.

Early analysis revealed site easements that included a 9' private alley easement and a 20' private sanitary easement for the Presbyterian Student Center. Additionally, current configuration of the property presents some site challenges that needed to be addressed. At the west side, the Metro Building main entrance faces toward the site. On the east side, the shared parking and access to adjacent properties presented challenges that led to a reduced "assumed buildable area."

UTILITY AND SETBACK IMPACTS

Through analysis of current and planned site utilities, as well as adherence to adjacent property setback requirements from the city of Chattanooga, the buildable area of the site became further constrained.

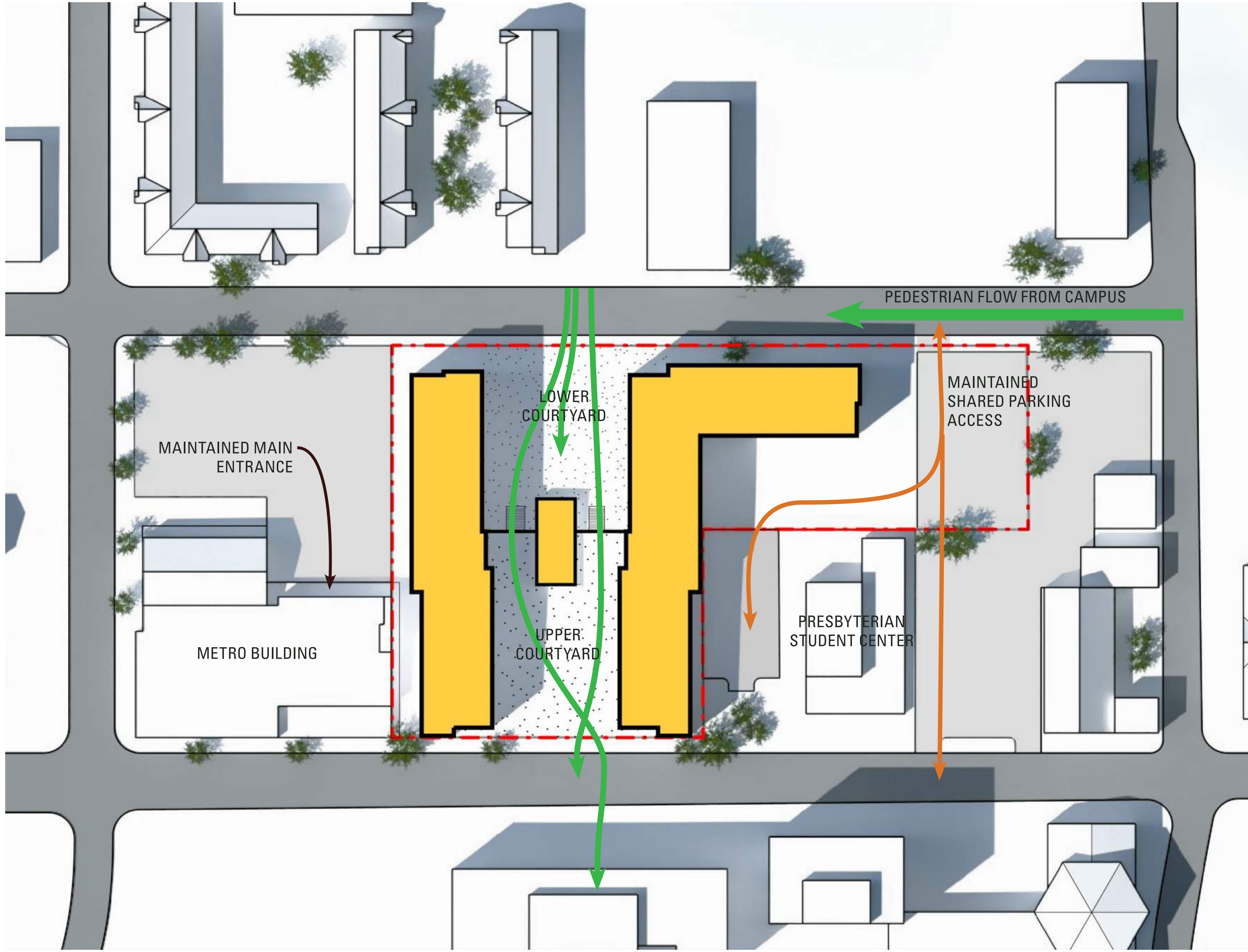
On Oak Street there is an assumed 23' uniform code setback, as well as an additional 7' to provide for future utility access.

At the southeast, there should be a 6' utility easement for future duct bank needs.

BUDGET AND MASTER PLANNING CONSIDERATIONS

Further study of the site with future master plan opportunities and appropriate budget allocation led to the reduced footprint of Site Areas A and B, with the central building footprint to be housed in Site Area A.

Site Considerations
Illustrative Site Plan



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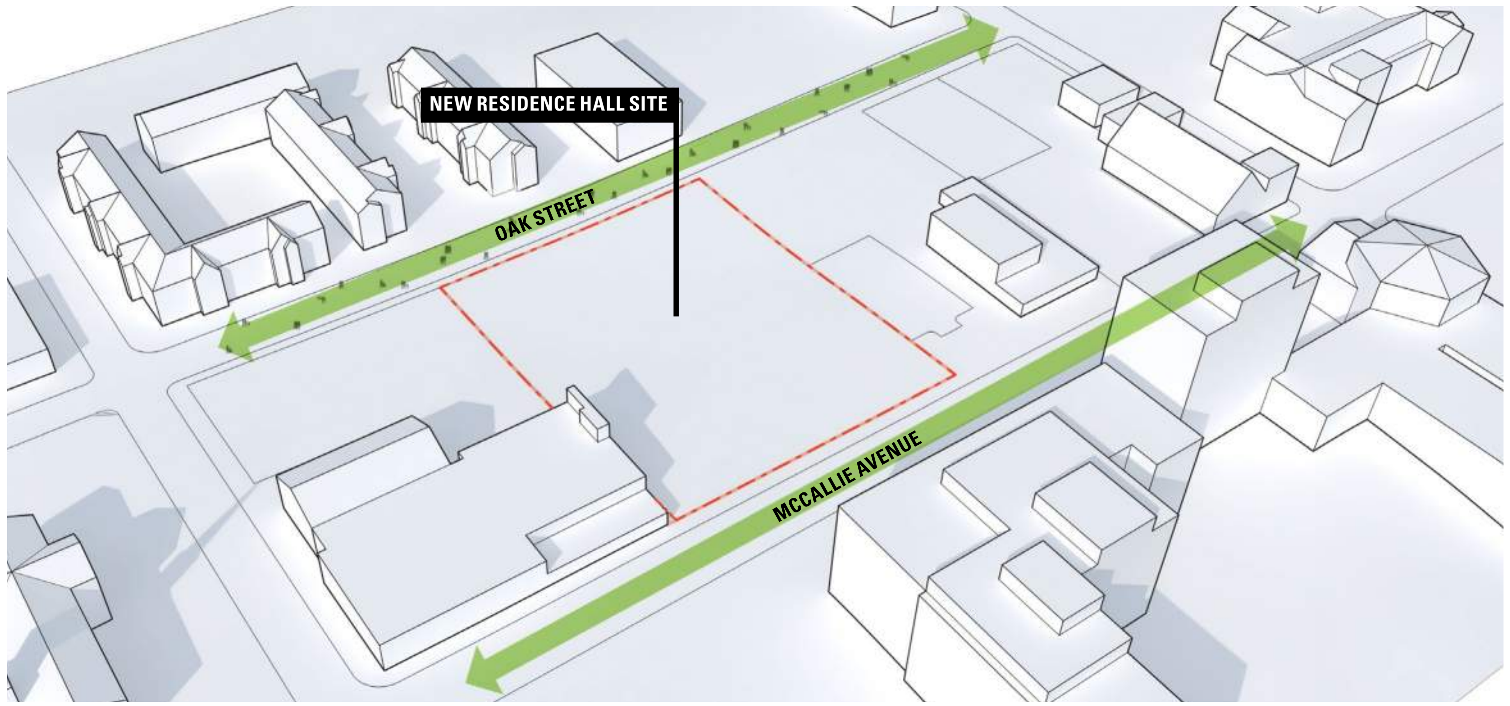
Programming: Residence Hall

Organizing Concepts

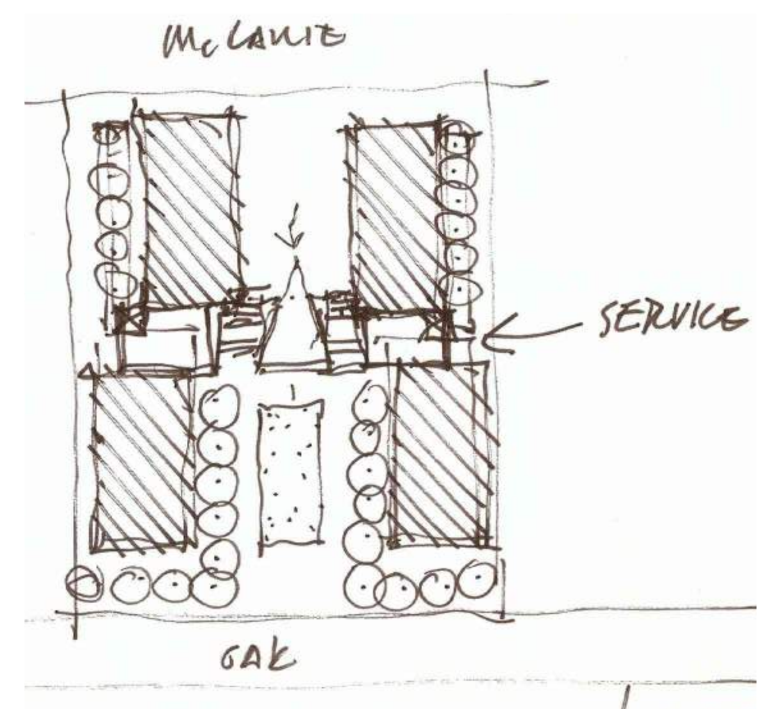


GATEWAY CAMPUS SITE

The proposed site for the New Residence Hall is framed by two major campus thoroughfares: Oak Street and McCallie Avenue. The campus updated their masterplan, dated March 6, 2023, in which Oak Street is a main thoroughfare leading to a major campus "gateway". McCallie Avenue connects the campus to downtown Chattanooga; the proposed site has the opportunity to provide a first impression of the University from this direction.

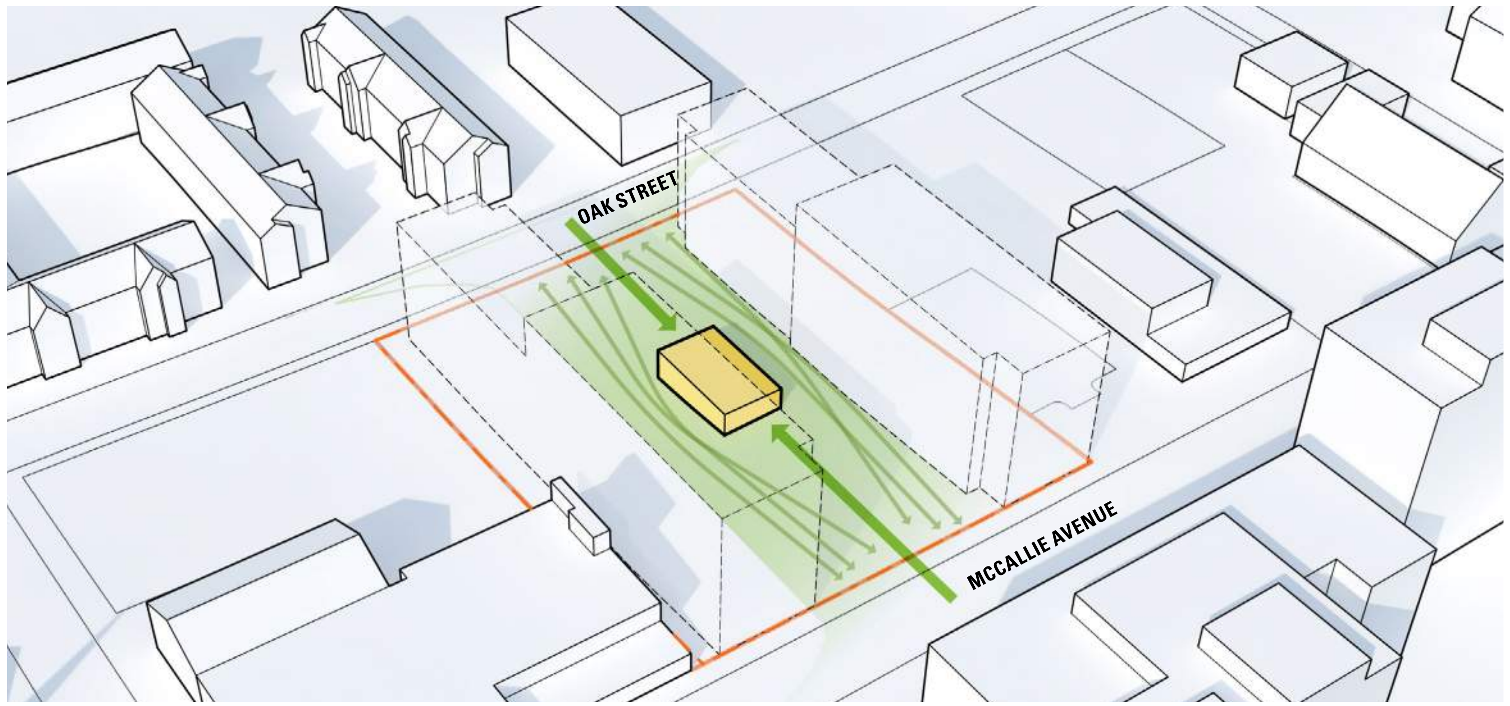
The proposed massing of the New Residence Hall symmetrically frames a new public plaza, which connects Oak Street and McCallie Avenue. The building form acts as a Gateway to not only the plaza, but also the greater campus community.

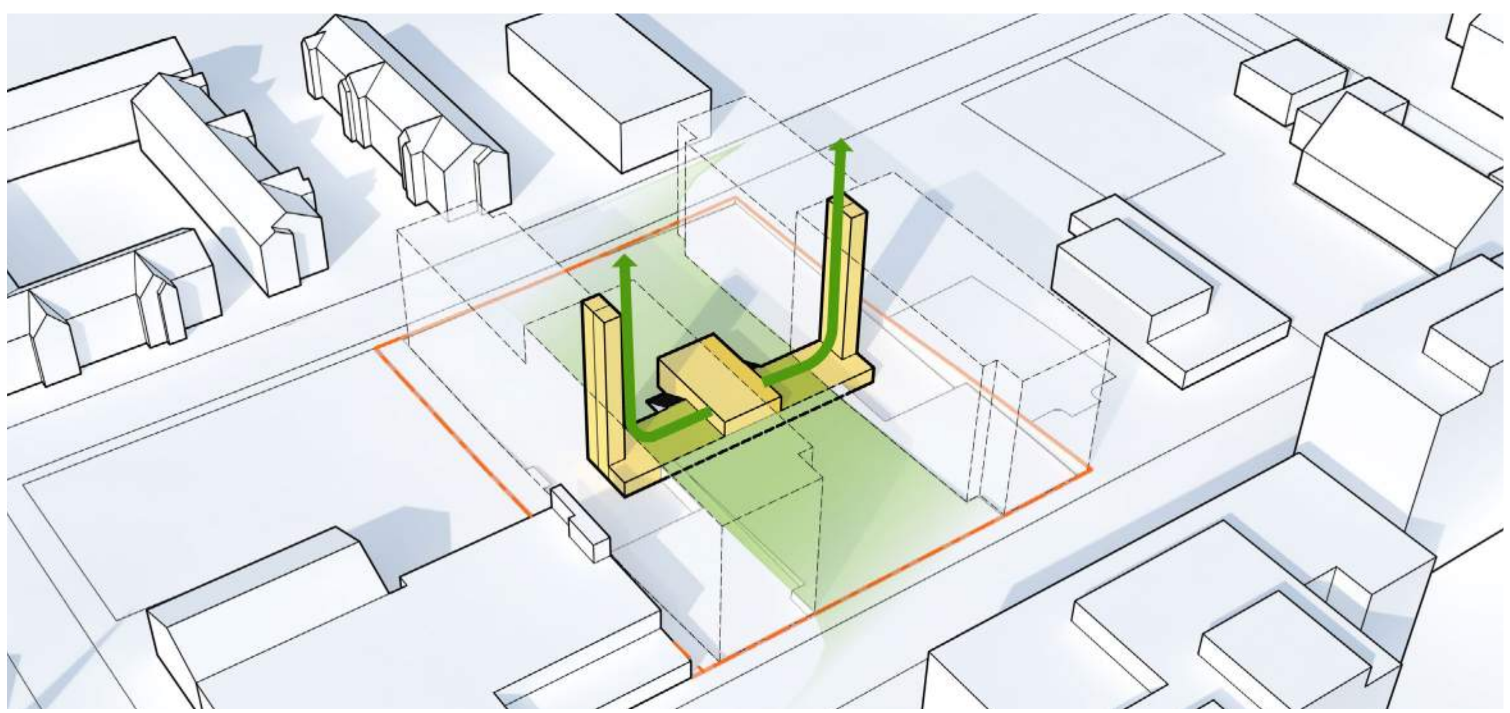
Note: Diagram for narrative purposes. The building footprint shown represents a previous design iteration; the east building wing now forms an "L" shape along Oak Street.



(above) An initial site plan concept sketch of the New Residence Hall development.

Programming: Residence Hall
Organizing Concepts



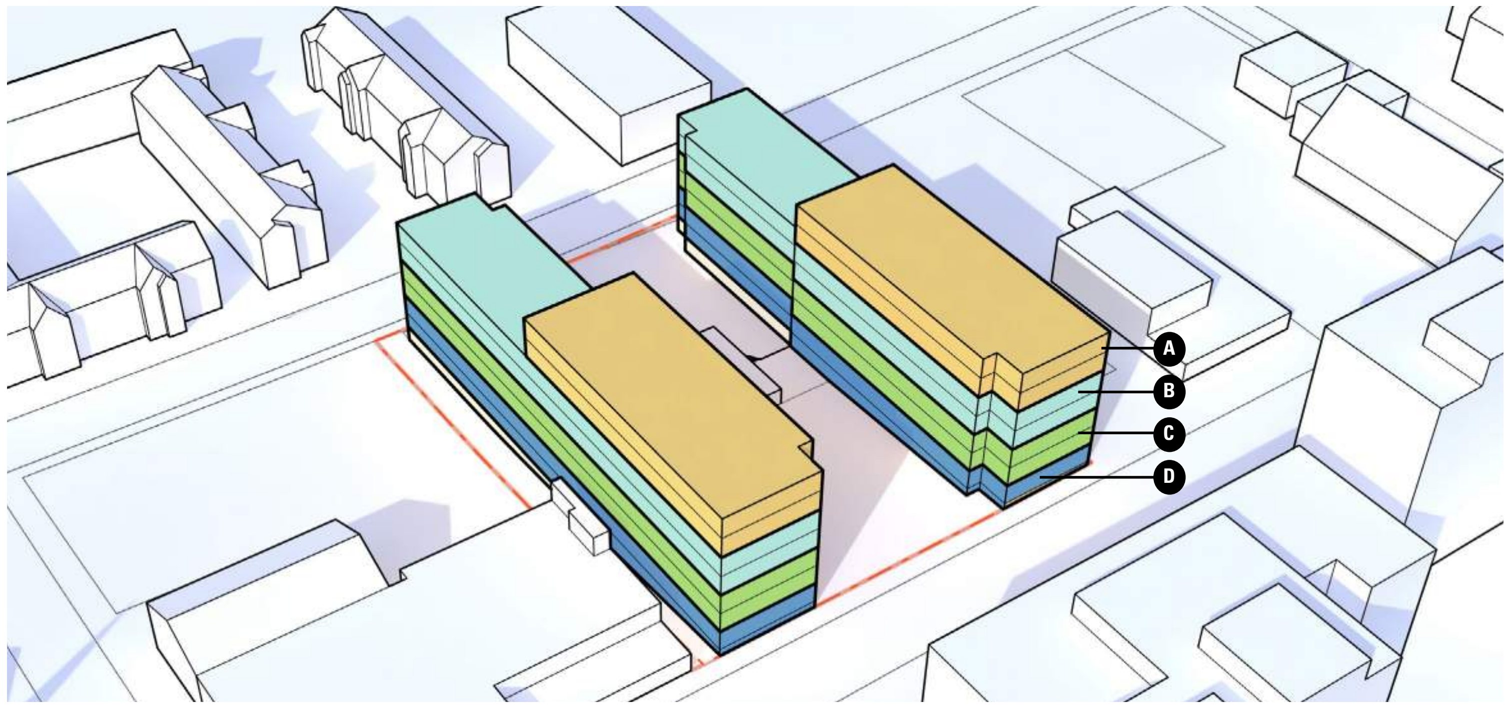


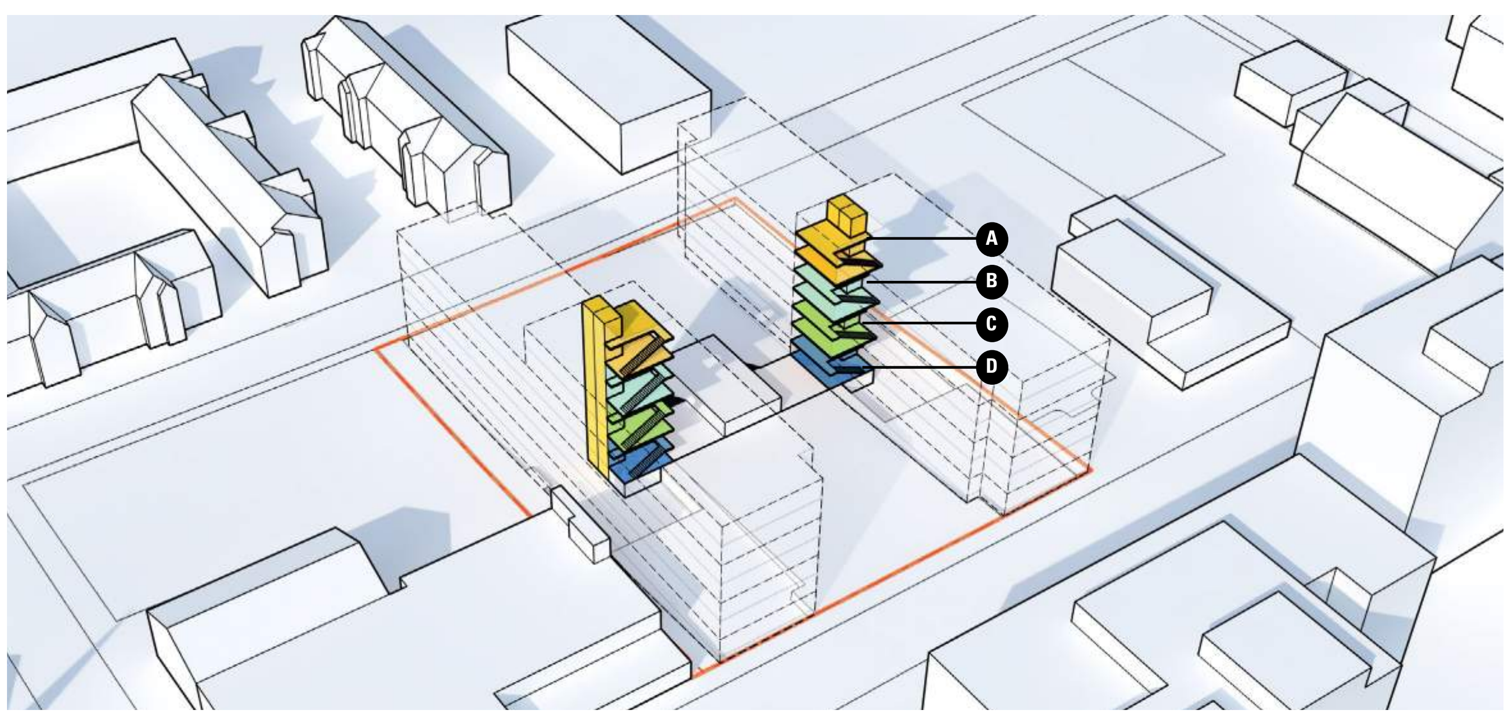
PLAZA INTEGRATED LOBBY

The main residential lobby is integrated into the public plaza; circulation freely "flows" across the space from McCallie Avenue to Oak Street. The two residential wings appear visually separate and frame the plaza in between. The location of the lobby also allows for students to access the residential wings through a single, secure entry point. Beneath the upper plaza off McCallie Avenue, physical space within the building connects the central lobby to two separate, secure residential circulation cores.

The physical separation of the residential development into two distinct wings divides the students into two smaller groups. The size of the smaller groups will allow the University to create Living Learning Communities within the larger development.

Programming: Residence Hall
Organizing Concepts





CENTRAL NEIGHBORHOODS

Each residential wing has four distinct Neighborhoods of students; each Neighborhood is composed of two residential floors. At the heart of each Neighborhood is a group of community spaces, meant to foster gathering and socialization amongst the students of the Neighborhood.

On the lower level of the central Neighborhood is the Community Living room, which is a double-height space connecting both floors. This space can host gatherings of many types - from informal meetups to organized meetings amongst the entire floor. Adjacent to this social space is the Community Kitchen, which is equipped for light cooking and group dining.

The upper level of the central Neighborhood is comprised of more social spaces. The mezzanine area contains clusters of lounge seating for informal gatherings. Adjacent to the mezzanine is an open study space, meant for either group or individual study.

On every floor, adjacent to the central Neighborhood spaces, is the Laundry. It was important to integrate the Laundry into the community spaces and give students the opportunity to socialize while waiting for their clothing to wash, rather than returning to the isolated space of their bedrooms.

Note: Diagram for narrative purposes. The building footprint shown represents a previous design iteration; the east building wing now forms an "L" shape along Oak Street, however the same internal relationships still apply to the residential community.

Programming: Residence Hall

Building Blocks

SUITE - 4 BEDS (PRIVATE)

Suite Area: 863 GSF

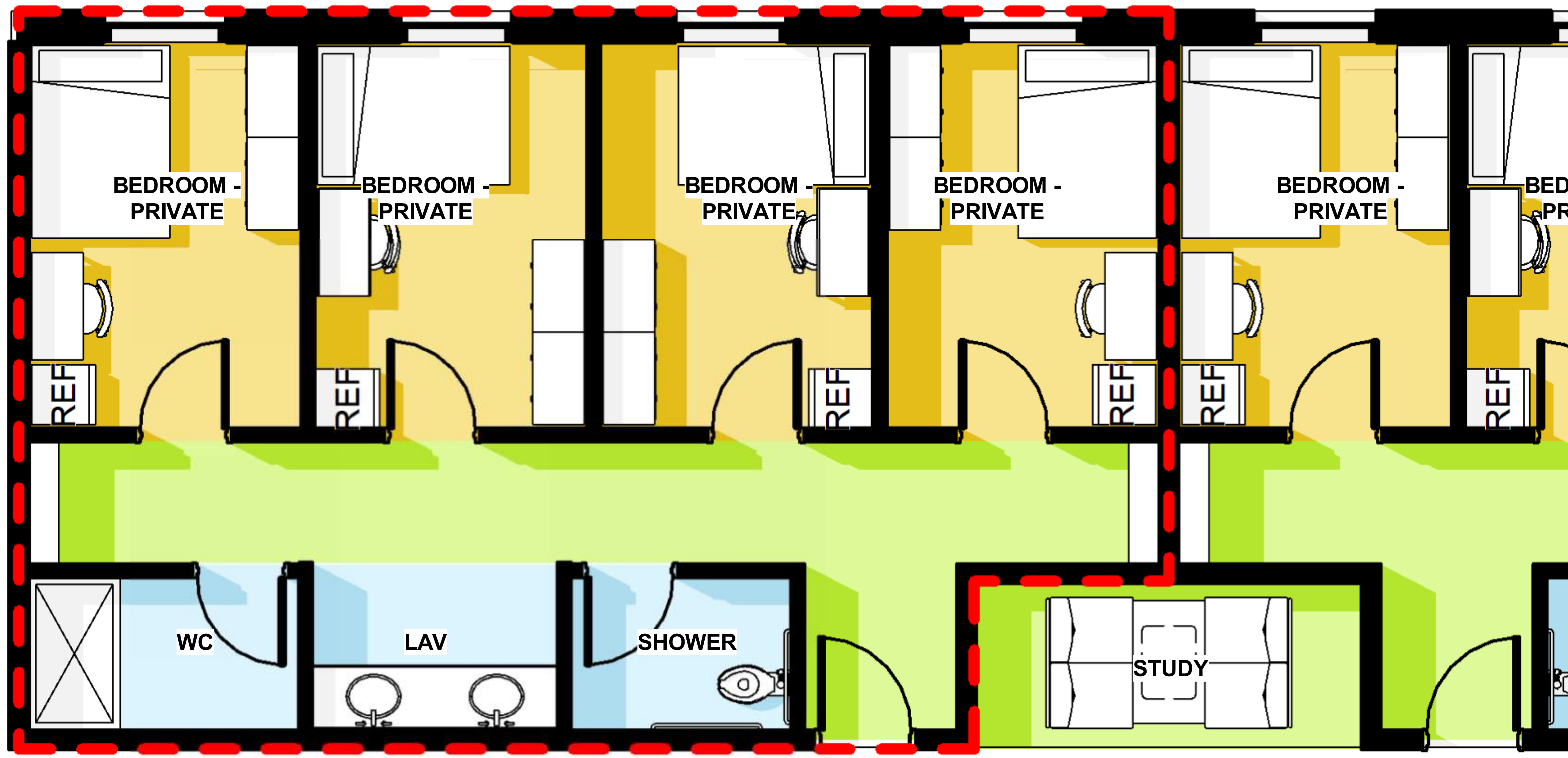
Bedroom Area: 112 NSF

SF/Bed: 216 GSF

Fixture to Student Ratios:

1:2 Lavatory; 1:4 Water Closet; 1:4 Shower

This suite configuration, with four (4) private bedrooms, represents the majority of suite units in the proposed residence hall programming study. The suite has separate compartments for each bathroom plumbing fixture to maximize privacy and flexibility. Most pairs of private suites have a study nook space outside the unit to provide students with another place to gather and study.



Programming: Residence Hall
Building Blocks

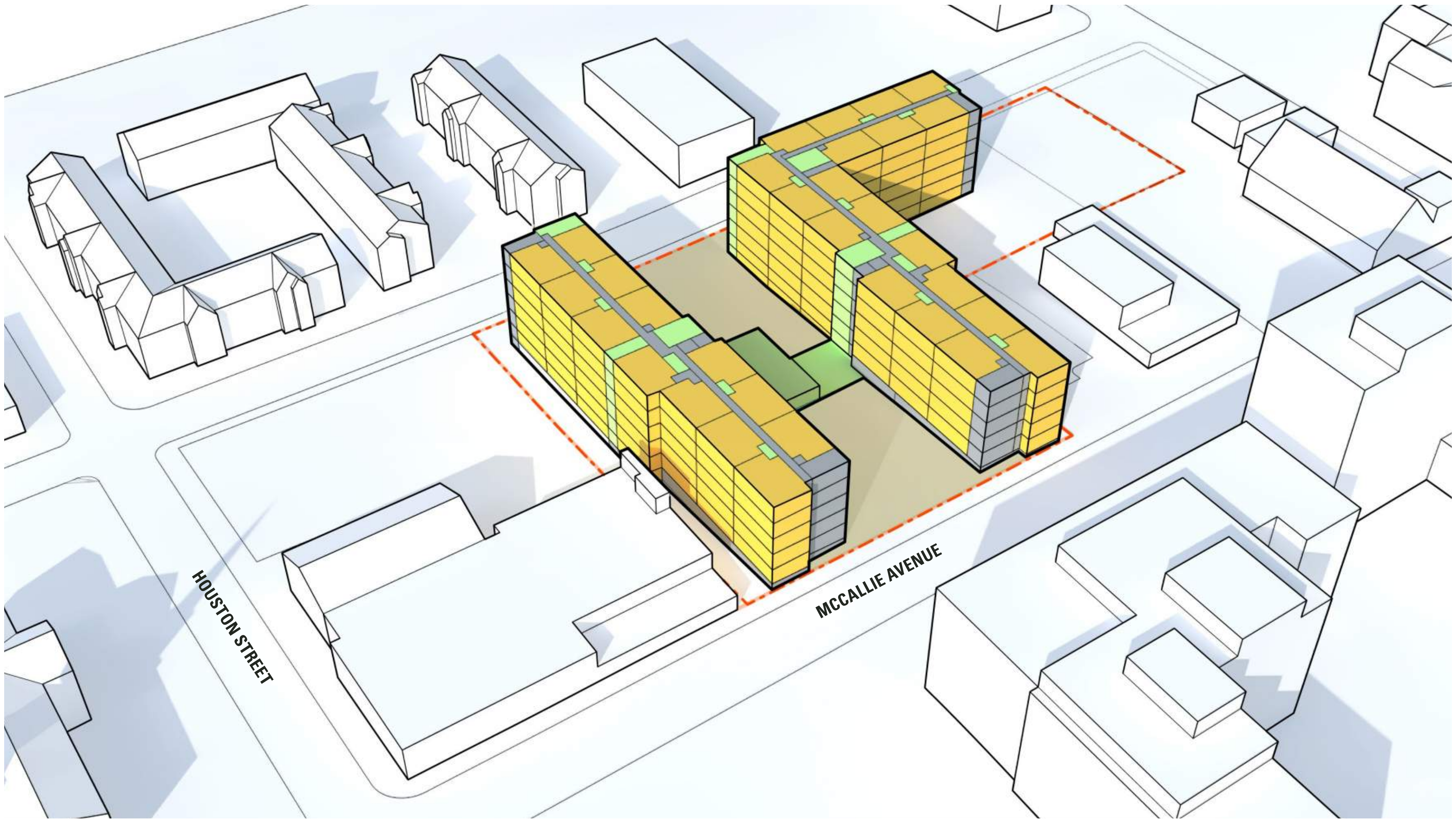
TYPICAL RESIDENTIAL BLOCK

Number of Beds: 24 (average)

The typical residential floor is composed of two or three "blocks" of suites, separated by the Central Neighborhood. Study nooks alternate along the main circulation spine, which ends in a community Studio space.

Programming: Residence Hall

Design Program | Program Axon



TOTAL BEDS: 784

PRIVATE BEDS: 784 (100%)

TOTAL AREA: 245,981 GSF

AREA/BED: 314 GSF/Bed

SUITE - PRIVATE

COMMUNITY

CIRCULATION & SUPPORT

Programming: Residence Hall

Design Program | Program Summary

		Type	Beds	NSF	QTY	Subtotal NSF
Residential	Freshman/Sophmore					
	Suite - 4 Private Bedrooms	4 bdrm/1 shower/1 WC/2 lavatories	4	791	195	154,245
		Subtotal Beds	780			
	Suite - 2 Private Bedrooms	2 bdrm/1 shower/1 WC/2 lavatories	2	528	2	1,056
		Subtotal Beds	4			
		Total Beds	784 beds			155,301
Residential Floor	52 Students (west) / 76 Students (east)	Common Programs				
		Studio - 1/floor		350	14	4,900
		Laundry - 1/floor (west), 2/floor (east); 1:20 W/D Ratio		90	19	1,710
		Study Nook - 5/floor (west), 8/floor (east)		70	80	5,600
		Support/MEP Closets - 4/floor (west), 5/floor (east)		30	54	1,620
					Subtotal	13,830
Residential Neighborhood	104 Students (west) / 152 Students (east)	Common Programs				
	2 Floors per Wing	Community Living - 1 per NH (Includes Mezzanine; space to accommodate entire wing floor gathering)		1100	6	6,600
		Community Kitchen - 1 per NH		190	6	1,140
		Study Lounge - 1 per NH (west), 3 per NH (east)		230	14	3,220
					Subtotal	10,960
Community	788 Students	Common Programs				
		Entry Lobby/Lounge - 2 stories (includes 24 Hour Desk, All Gender Restrooms, Storage)		3675	1	3,675
		Multi-Purpose Space - 50 PPL		1120	1	1,120
		Multi-Purpose Storage		215	1	215
		Office Suite - Admin Open Office		645	1	645
		Private Offices		110	3	330
		Office Lounge/Kitchenette		175	1	175
		Office Print/Storage		175	1	175
		Mail/Package (includes 1 Mailbox/Suite, Parcel Lockers, Storage)		700	1	700
		Staff Apartment - Graduate Assistant (1 BR)		555	1	555
		Staff Apartment - Residence Director and Faculty-in-Residence (2 BR)		870	2	1,740
					Subtotal	9,330
		MEP/Service				
		Main Trash - 1/wing		600	2	1,200
		MEP/Service Spaces (not yet defined)		5800	1	5,800
					Subtotal	7,000

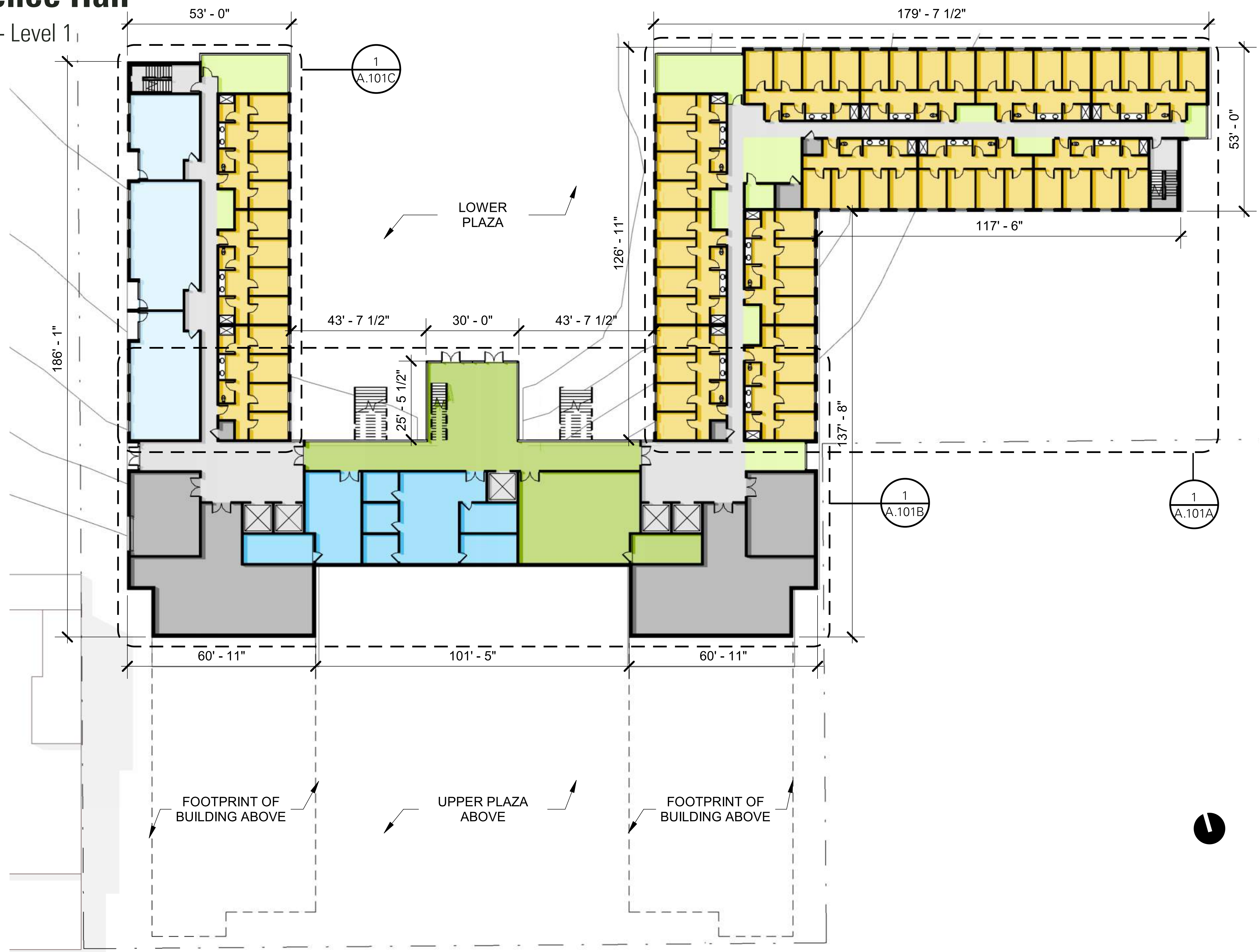
Total Building NSF	196,421
Efficiency	79.9%
Total Building GSF	245,981

Programming: Residence Hall

Design Program | Program Plans - Level 1

GROSS BUILDING AREA

LEVEL	GROSS AREA
LEVEL 1	32,018 GSF
LEVEL 2	29,998 GSF
LEVEL 3	36,793 GSF
LEVEL 4	36,793 GSF
LEVEL 5	36,793 GSF
LEVEL 6	36,793 GSF
LEVEL 7	36,793 GSF
TOTAL GROSS AREA	245,981 GSF



- CIRCULATION & SUPPORT
- COMMUNITY
- NEIGHBORHOOD
- OFFICE
- STAFF APARTMENT
- SUITE - PRIVATE
- SUPPORT

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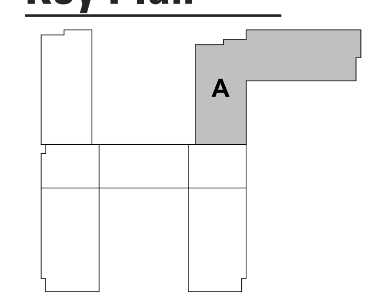
Programming: Residence Hall

Design Program | Program Plans - A-101A Level 1 Floor Plan Enlarged

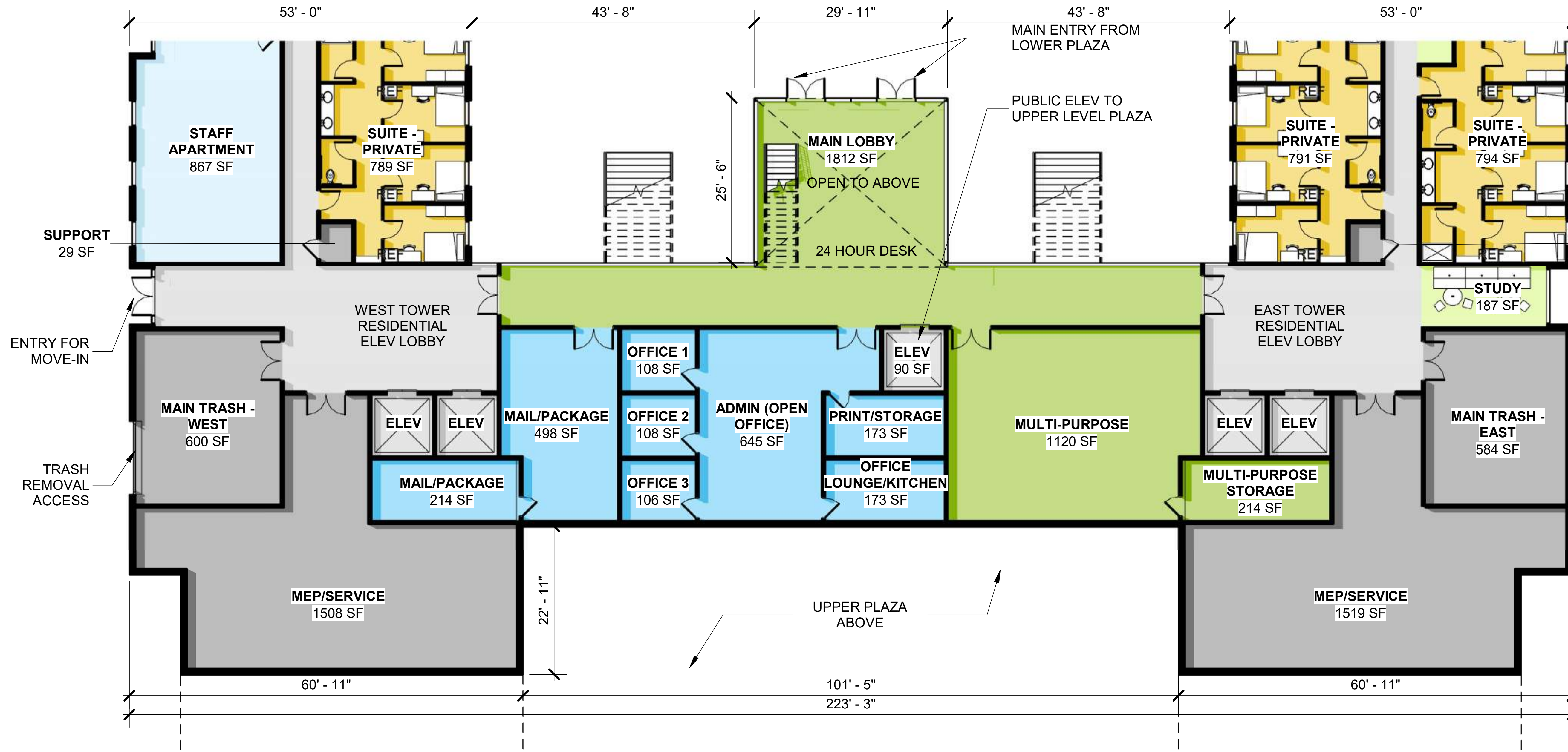
1 **Level 1 Floor Plan - Area A**

Key Plan

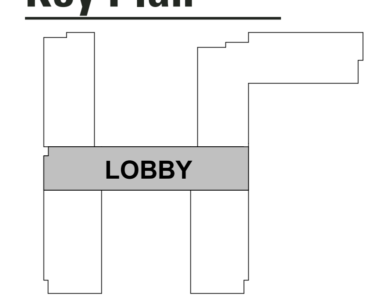


Programming: Residence Hall

Design Program | Program Plans - A-101B Level 1 Floor Plan Enlarged



Key Plan

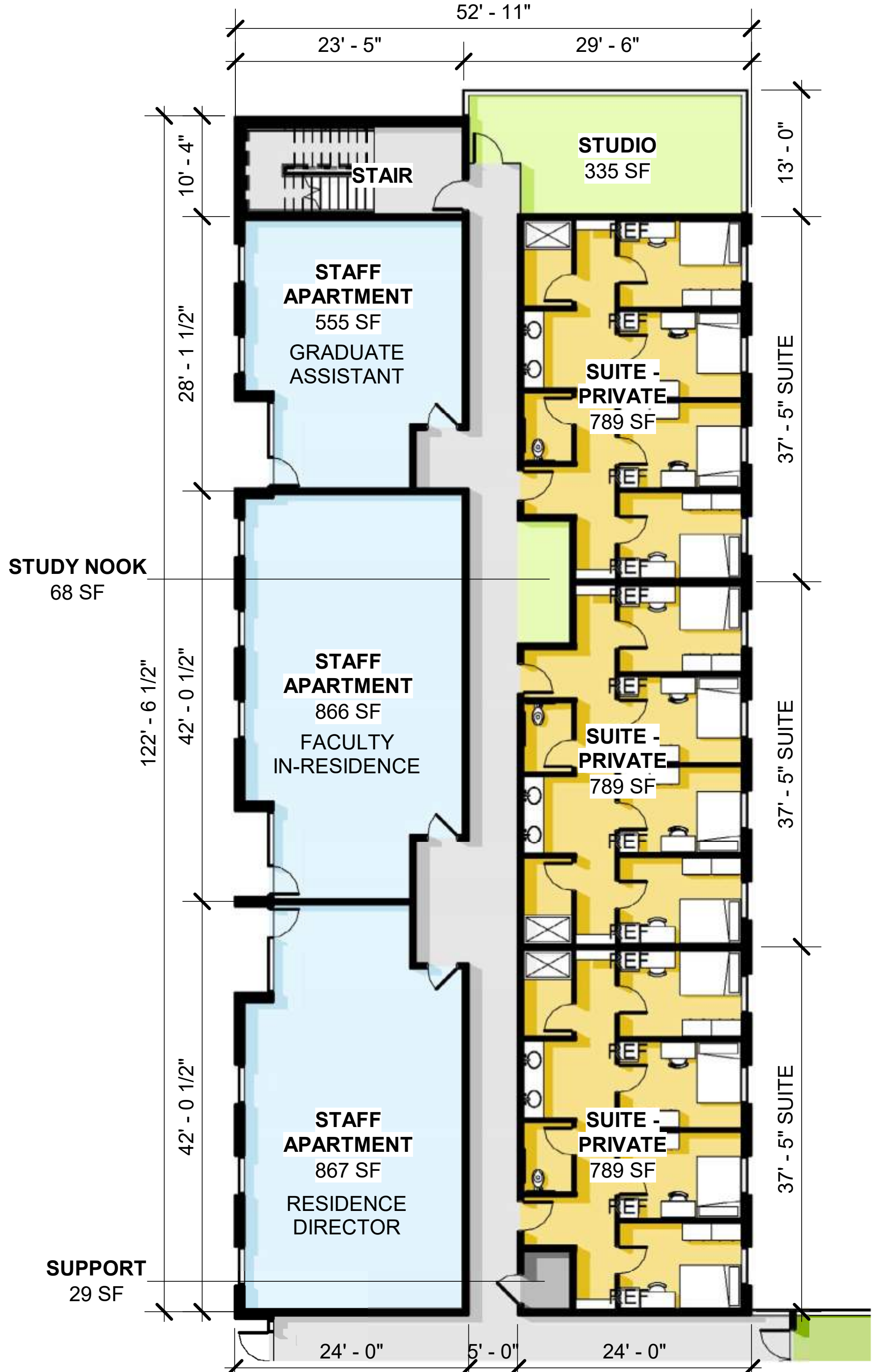


1 **Level 1 Floor Plan - Lobby**

HED

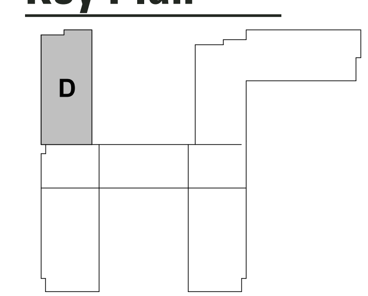
Programming: Residence Hall

Design Program | Program Plans - A-101C Level 1 Floor Plan Enlarged



1 Level 1 Floor Plan - Area D

Key Plan

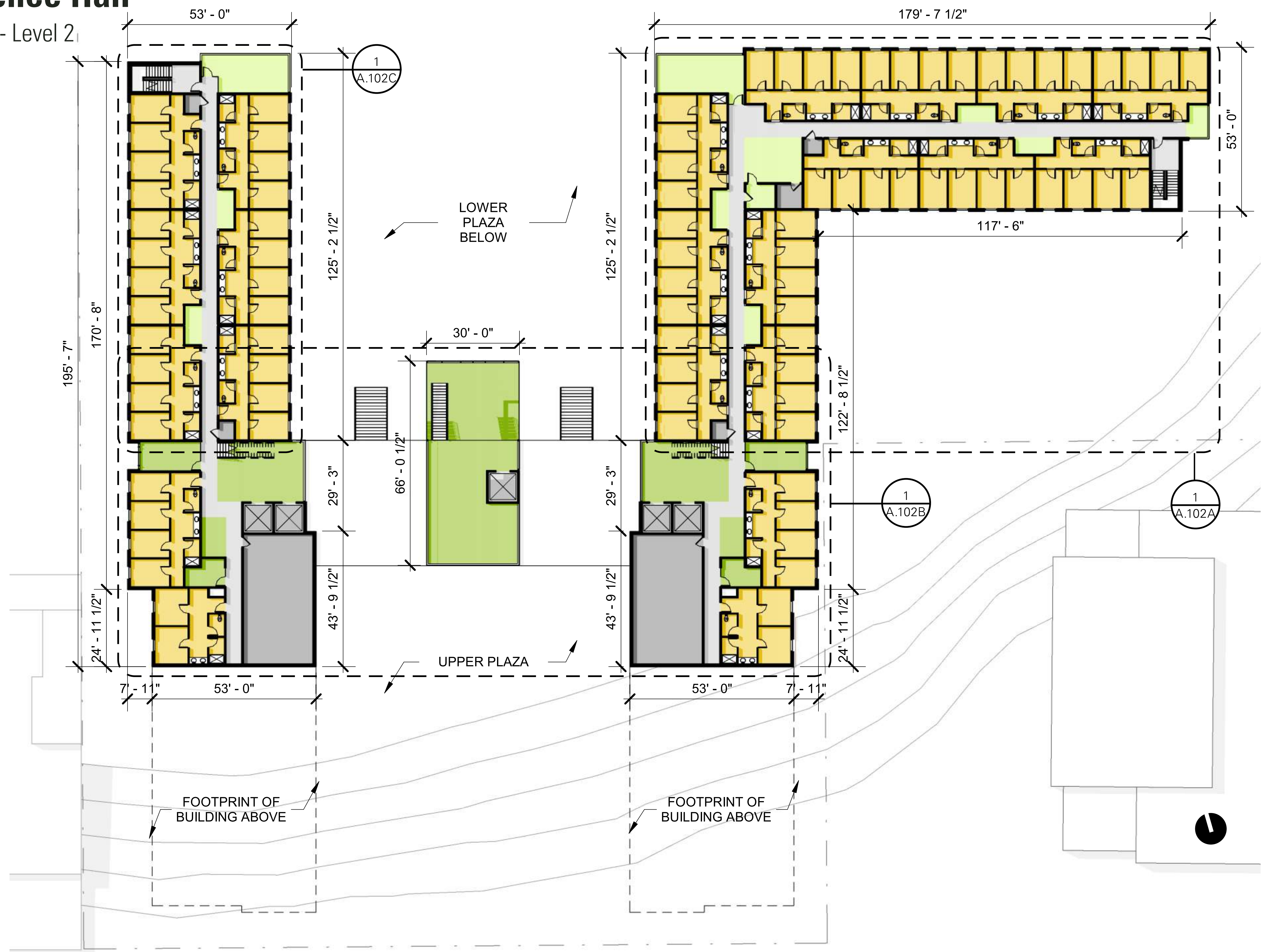


Programming: Residence Hall

Design Program | Program Plans - Level 2

GROSS BUILDING AREA

LEVEL	GROSS AREA
LEVEL 1	32,018 GSF
LEVEL 2	29,998 GSF
LEVEL 3	36,793 GSF
LEVEL 4	36,793 GSF
LEVEL 5	36,793 GSF
LEVEL 6	36,793 GSF
LEVEL 7	36,793 GSF
TOTAL GROSS AREA	245,981 GSF



- CIRCULATION & SUPPORT
- COMMUNITY
- NEIGHBORHOOD
- SUITE - PRIVATE
- SUPPORT

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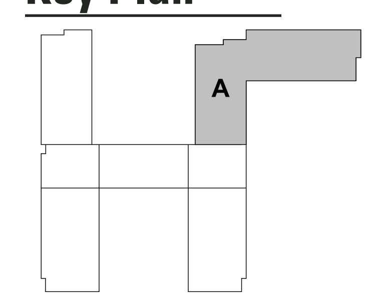
Programming: Residence Hall

Design Program | Program Plans - A-102A Level 2 Floor Plan Enlarged

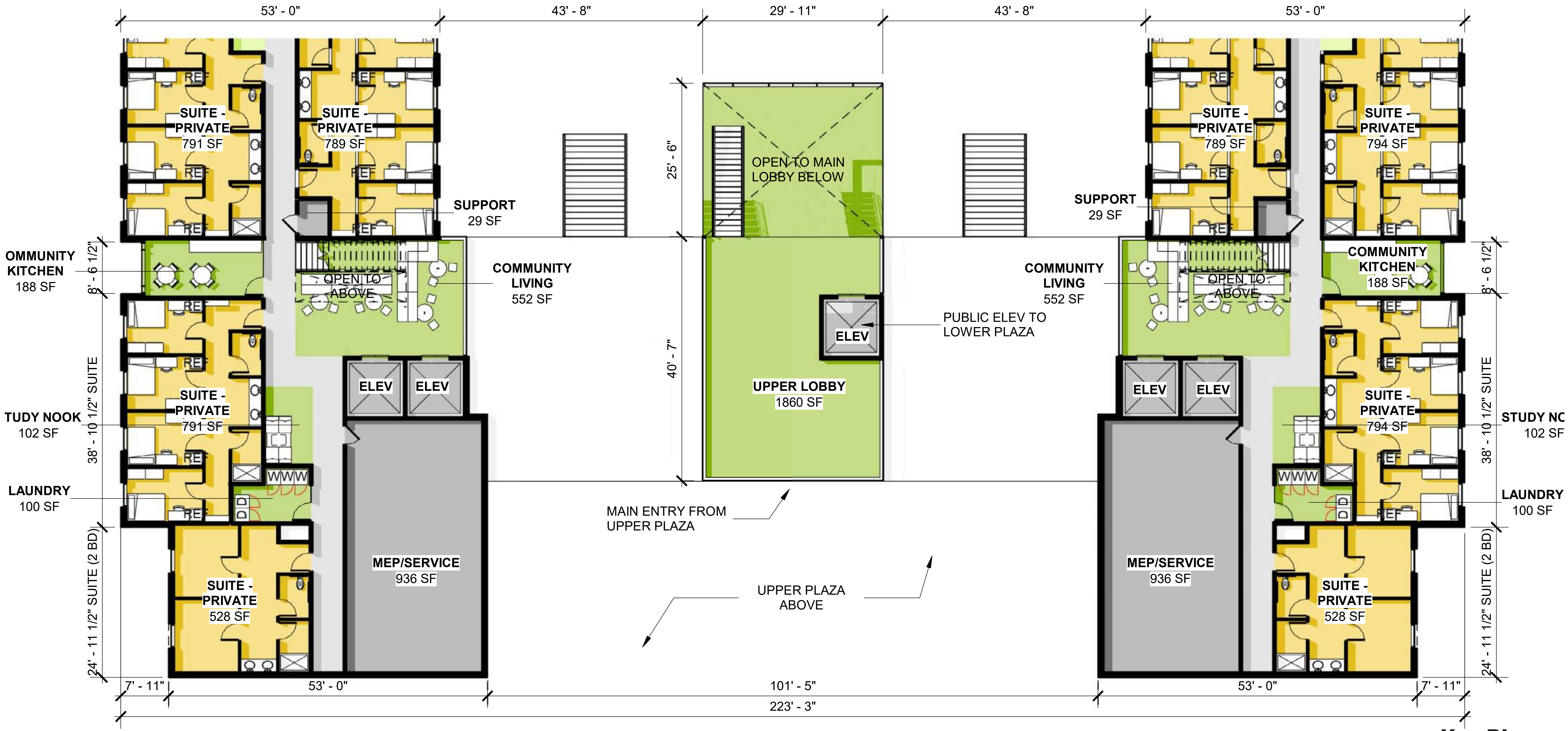
1 **Level 2 Floor Plan - Area A**

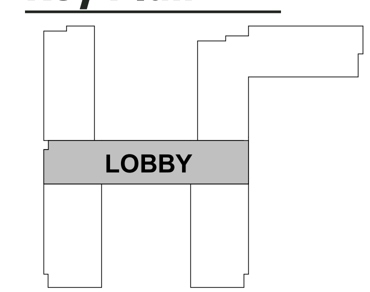
Key Plan



Programming: Residence Hall

Design Program | Program Plans - A-102B Level 2 Floor Plan Enlarged

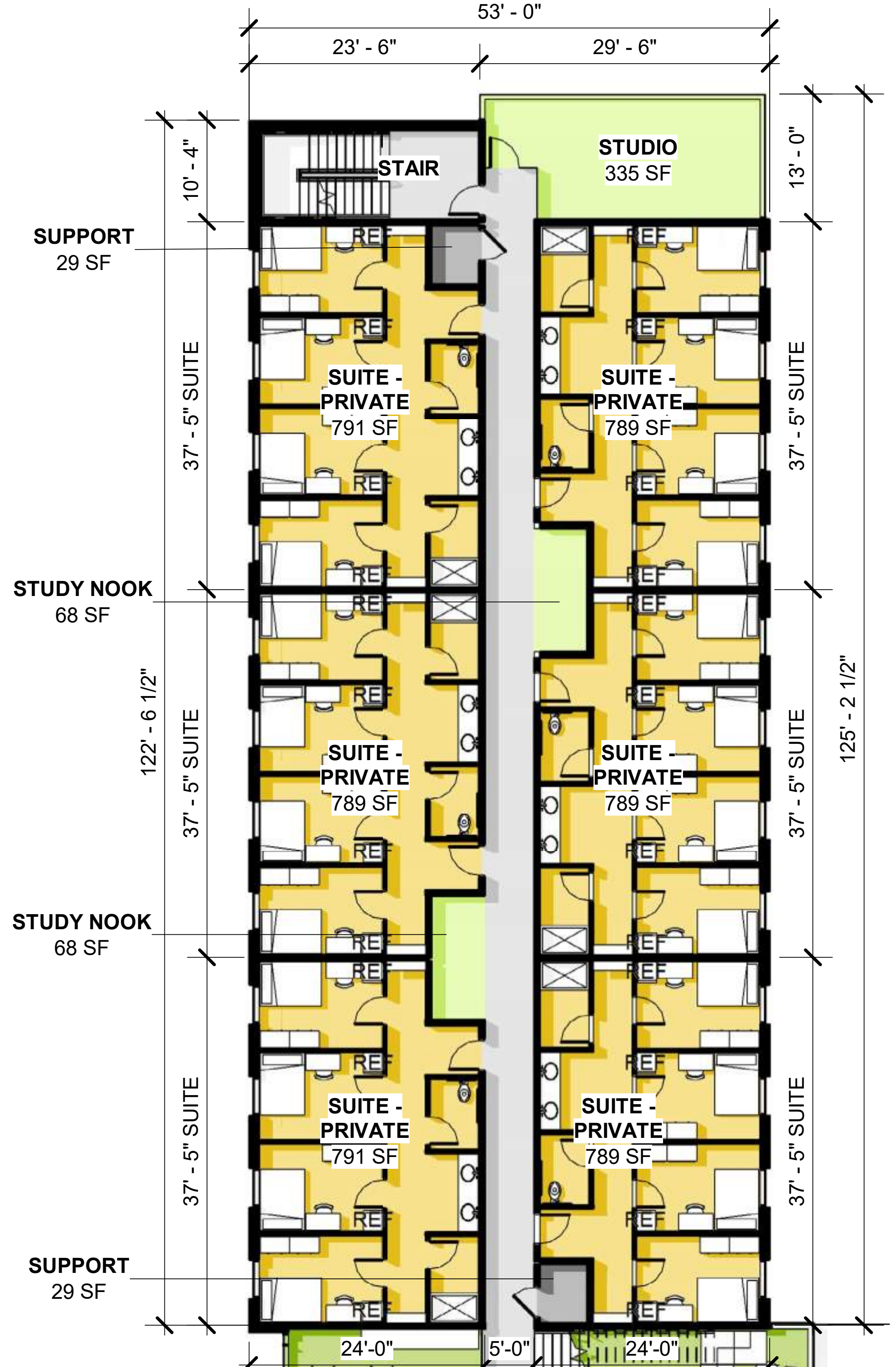




1 **Level 2 Floor Plan - Lobby**

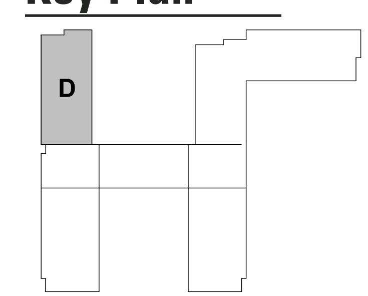
Programming: Residence Hall

Design Program | Program Plans - A-102C Level 2 Floor Plan Enlarged



1 **Level 2 Floor Plan - Area D**

Key Plan



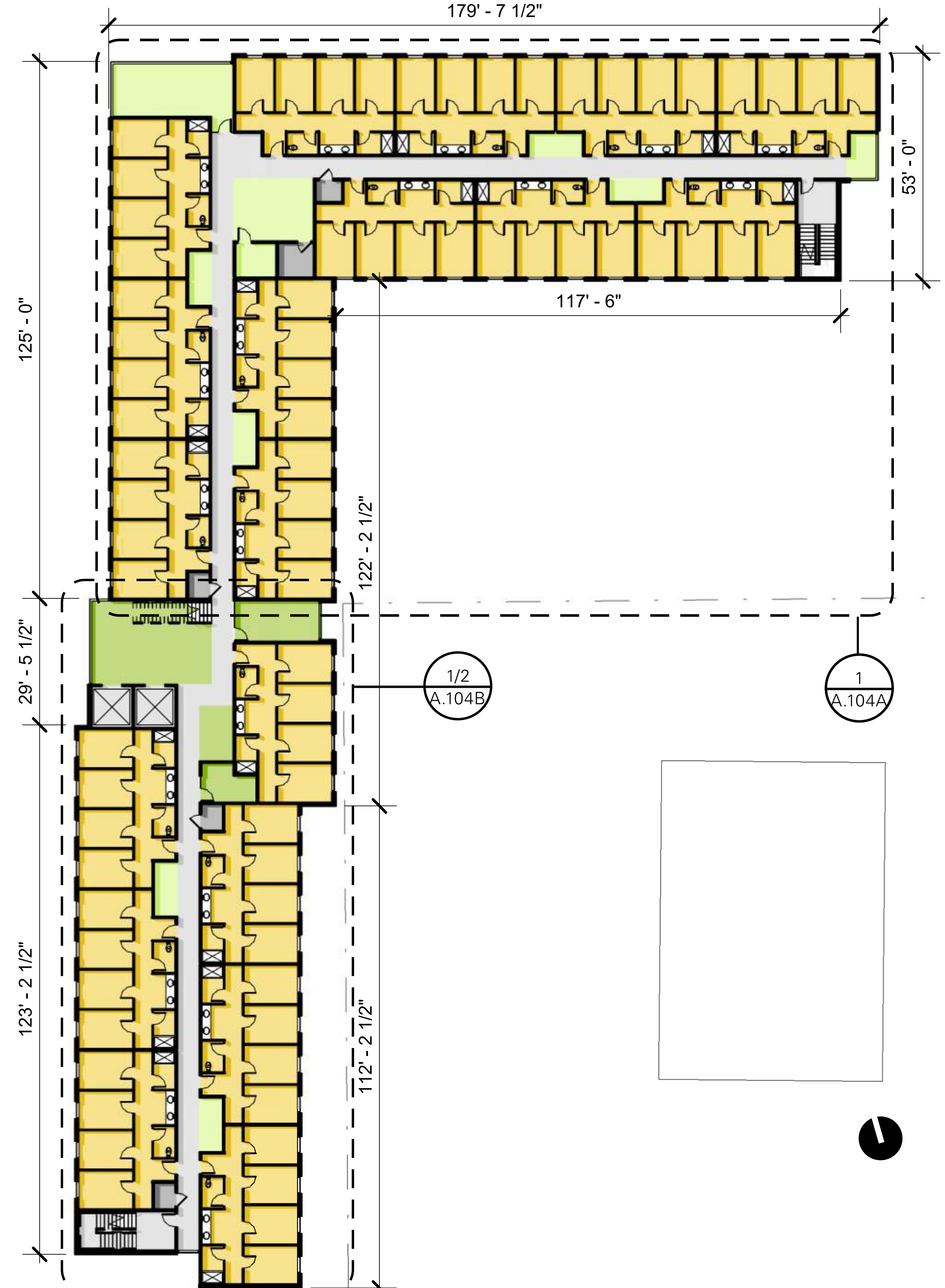
Programming: Residence Hall

Design Program | Program Plans - Level 4/6

GROSS BUILDING AREA

LEVEL	GROSS AREA
LEVEL 1	32,018 GSF
LEVEL 2	29,998 GSF
LEVEL 3	36,793 GSF
LEVEL 4	36,793 GSF
LEVEL 5	36,793 GSF
LEVEL 6	36,793 GSF
LEVEL 7	36,793 GSF
TOTAL GROSS AREA	245,981 GSF

- CIRCULATION & SUPPORT
- COMMUNITY
- NEIGHBORHOOD
- SUITE - PRIVATE
- SUPPORT



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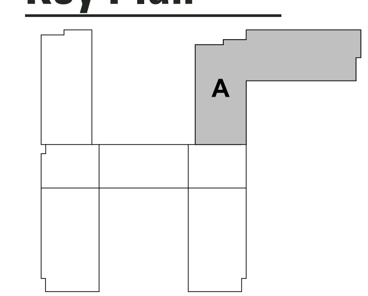
Programming: Residence Hall

Design Program | Program Plans - A-104A Level 4/6 Floor Plan Enlarged

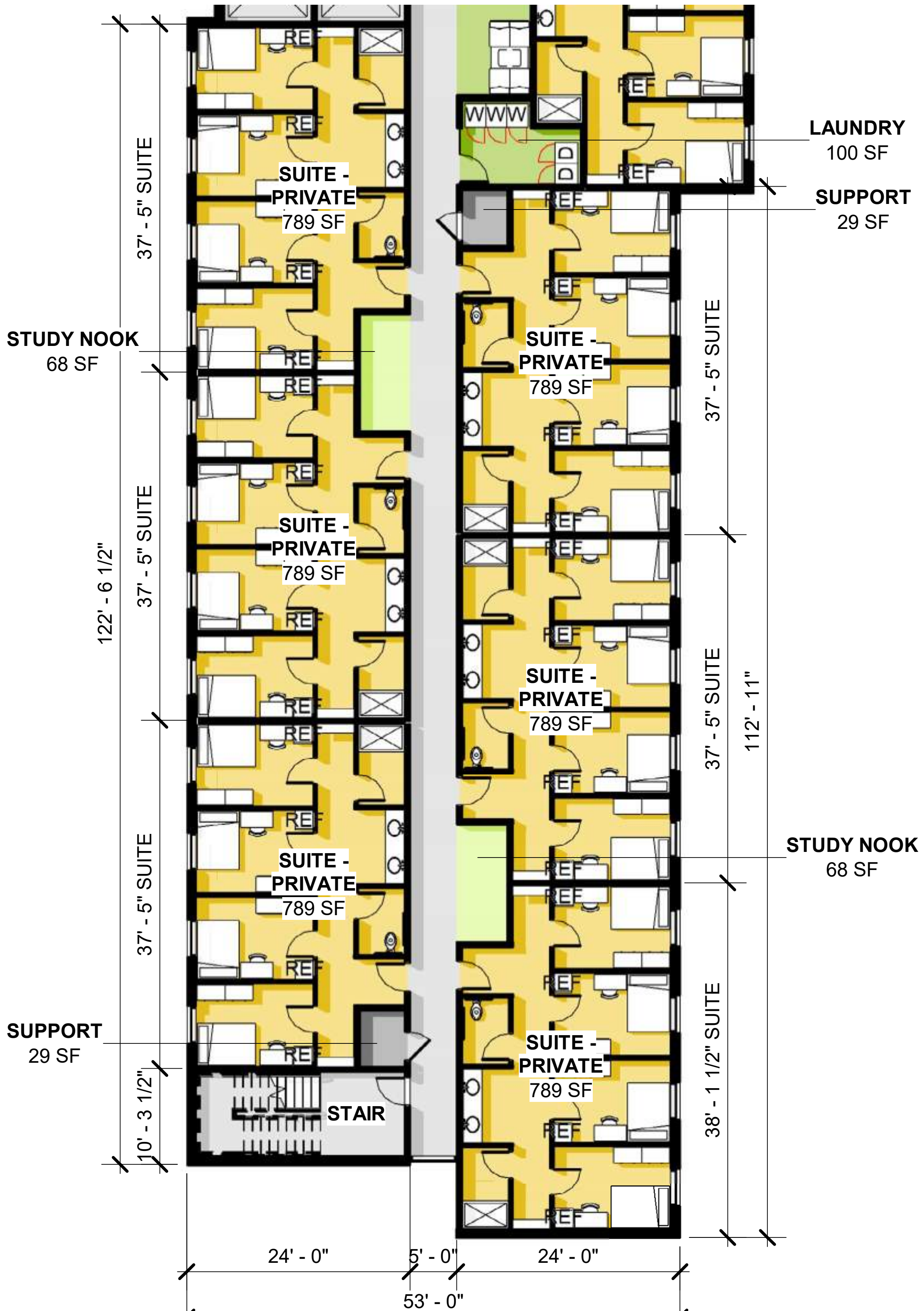
1 **Level 4/6 Floor Plan - Area A**

Key Plan

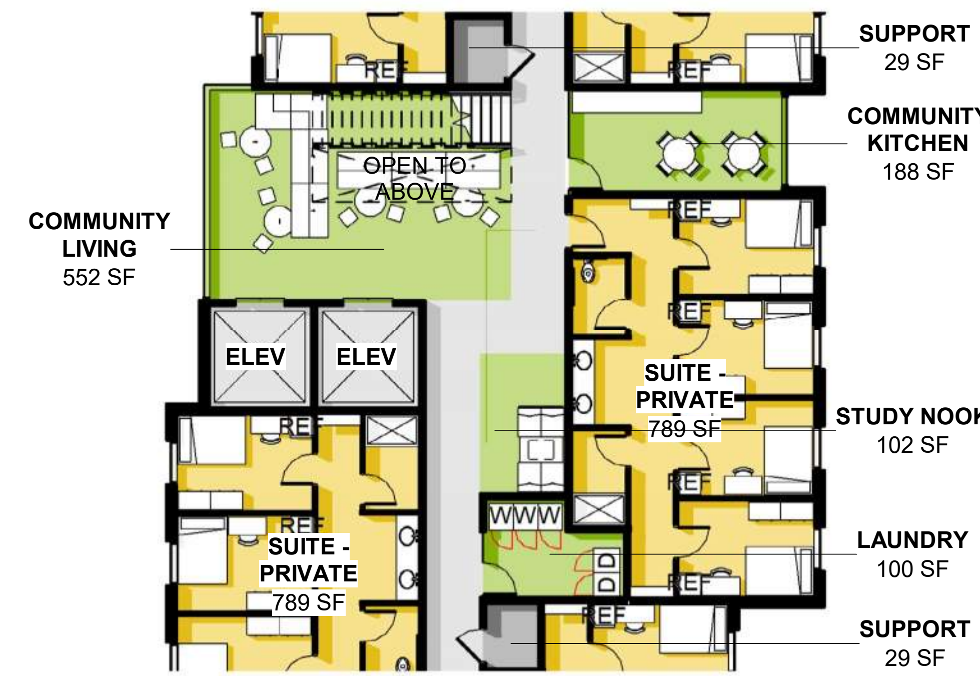


Programming: Residence Hall

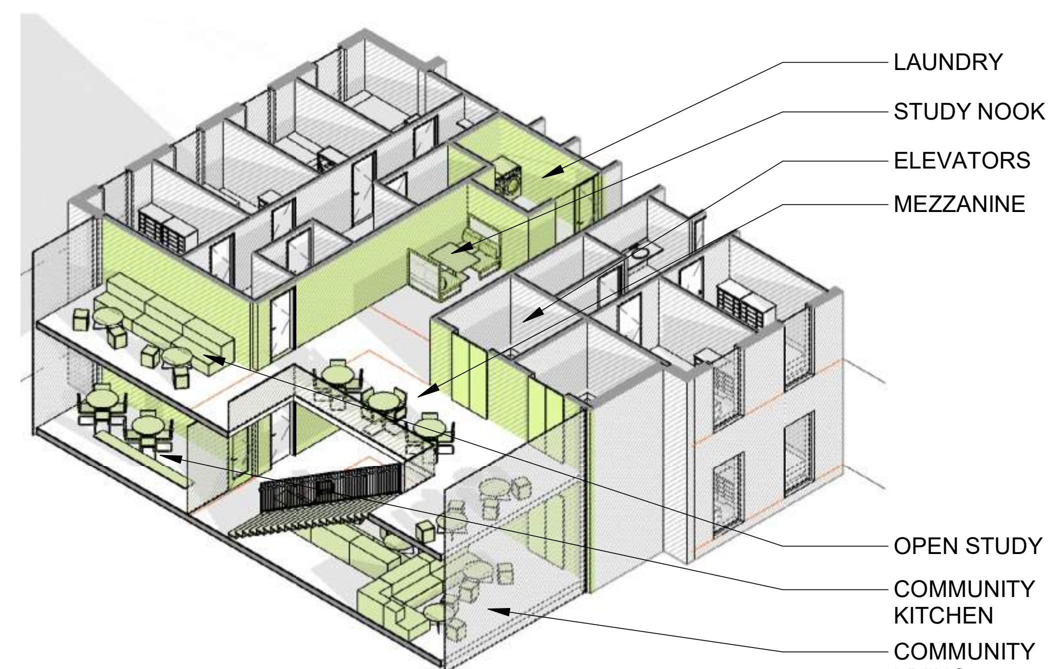
Design Program | Program Plans - A-104B Level 4/6 Floor Plan Enlarged



1 **Level 4/6 Floor Plan - Area C**

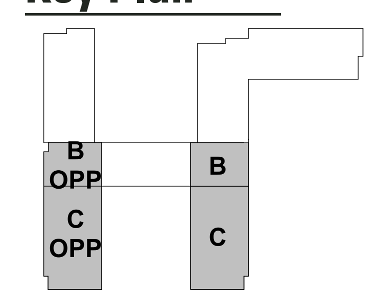


2 **Level 4/6 Floor Plan - Area B (Lower Neighborhood Level)**



3 **Neighborhood Diagram**

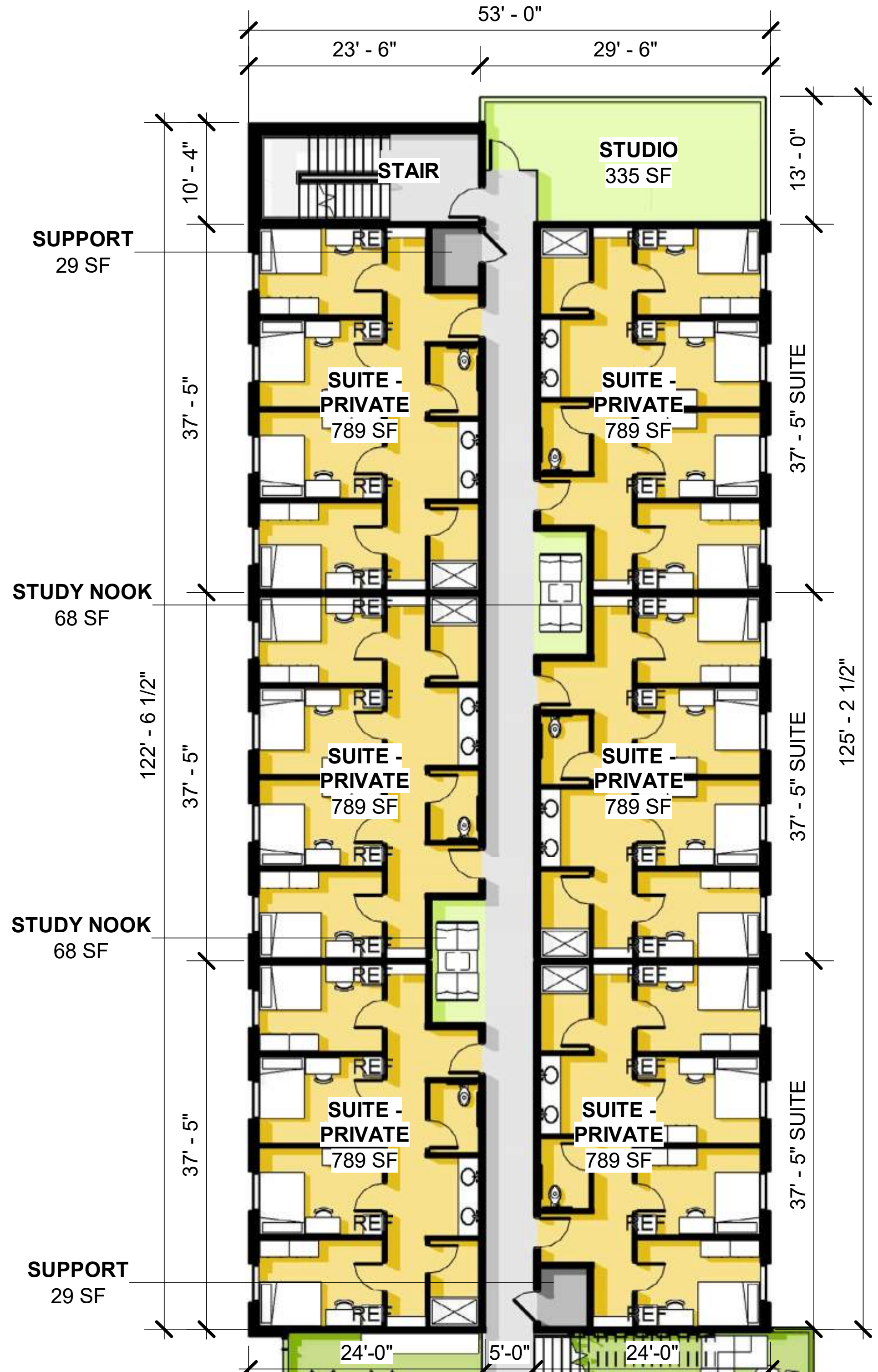
Key Plan



HED

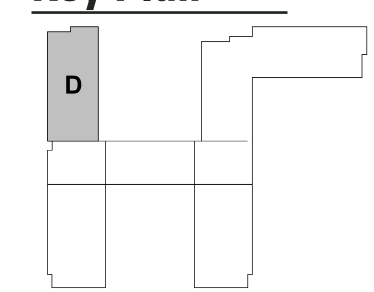
Programming: Residence Hall

Design Program | Program Plans - A-104C Level 4/6 Floor Plan Enlarged



1 **Level 4/6 Floor Plan - Area D**

Key Plan



Programming: Residence Hall

Design Program | Program Plans - Level 3/5/7

GROSS BUILDING AREA

LEVEL	GROSS AREA
LEVEL 1	32,018 GSF
LEVEL 2	29,998 GSF
LEVEL 3	36,793 GSF
LEVEL 4	36,793 GSF
LEVEL 5	36,793 GSF
LEVEL 6	36,793 GSF
LEVEL 7	36,793 GSF
TOTAL GROSS AREA	245,981 GSF

CIRCULATION & SUPPORT

COMMUNITY

NEIGHBORHOOD

SUITE - PRIVATE

SUPPORT

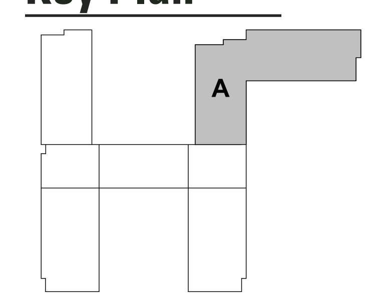
HED

Programming: Residence Hall

Design Program | Program Plans - A-105A Level 3/5/7 Floor Plan Enlarged

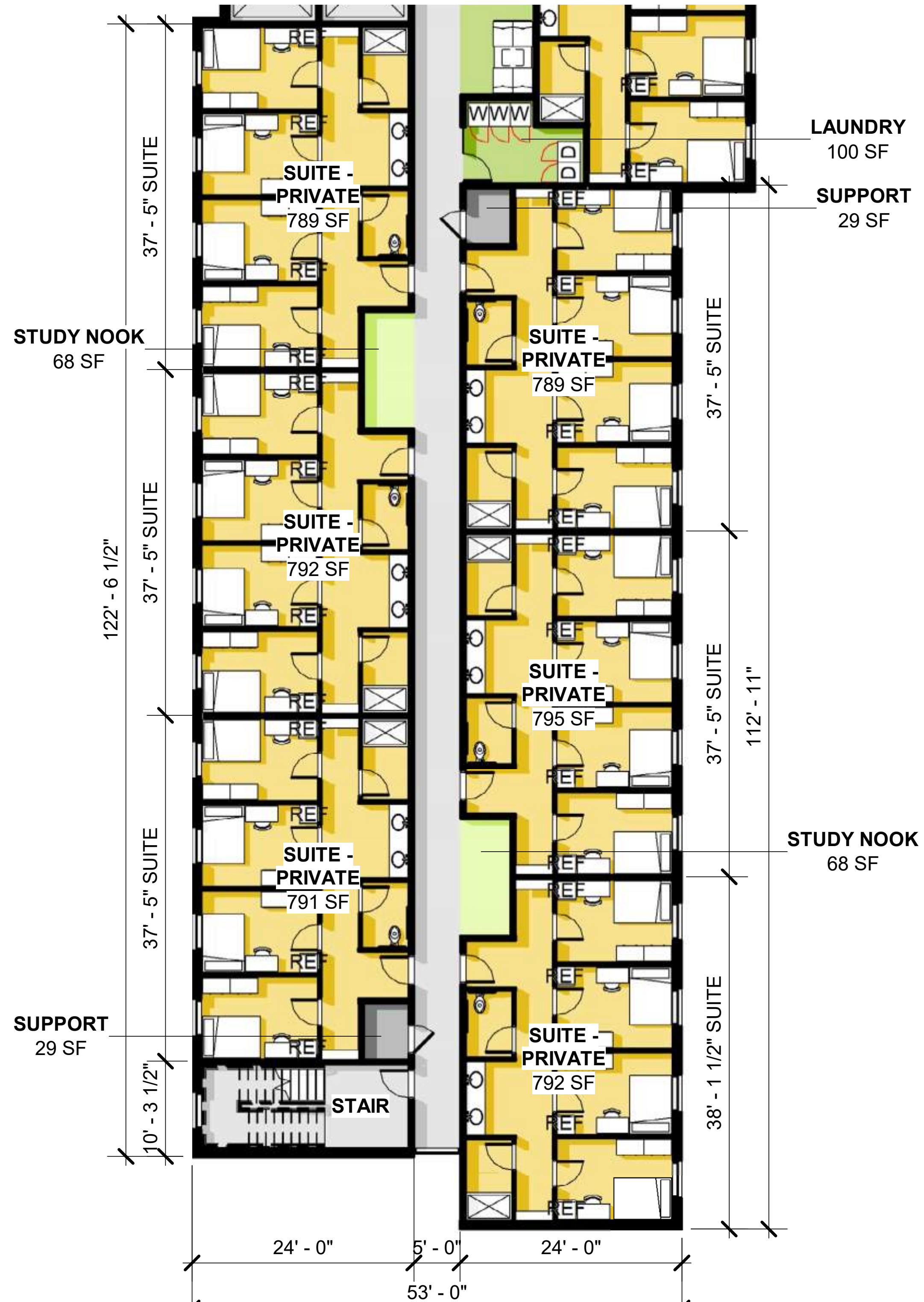
1 **Level 3/5/7 Floor Plan - Area A**

Key Plan

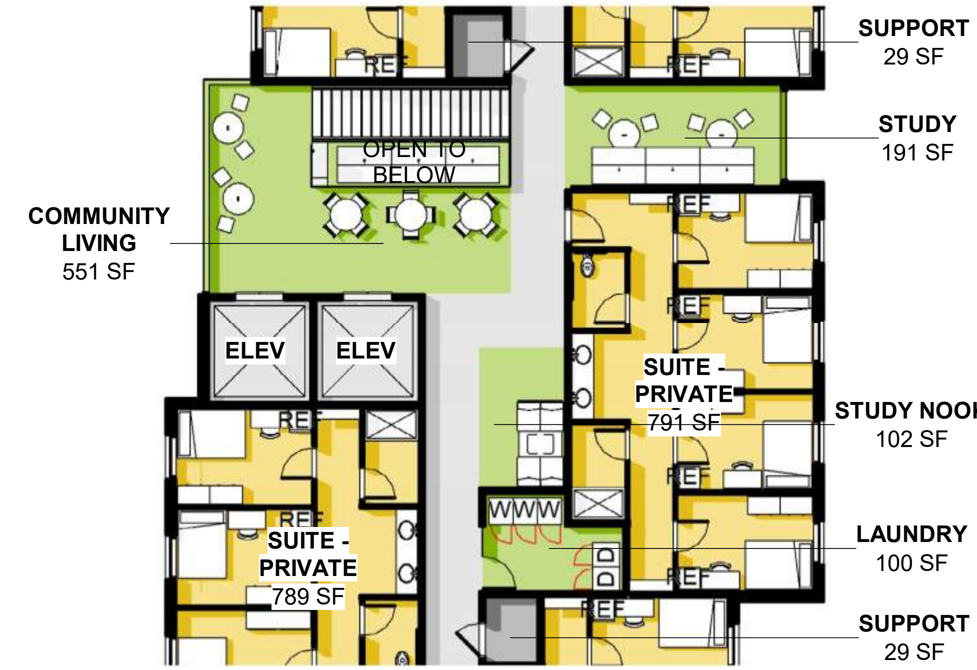


Programming: Residence Hall

Design Program | Program Plans - A-105B Level 3/5/7 Floor Plan Enlarged



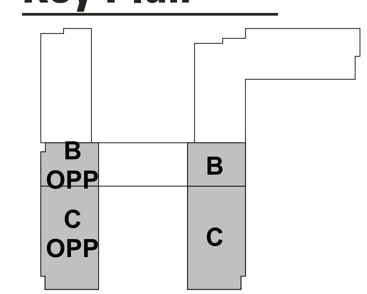
1 Level 3/5/7 Floor Plan - Area C



2 Level 3/5/7 Floor Plan - Area B (Upper Neighborhood Level)

3 Neighborhood Diagram

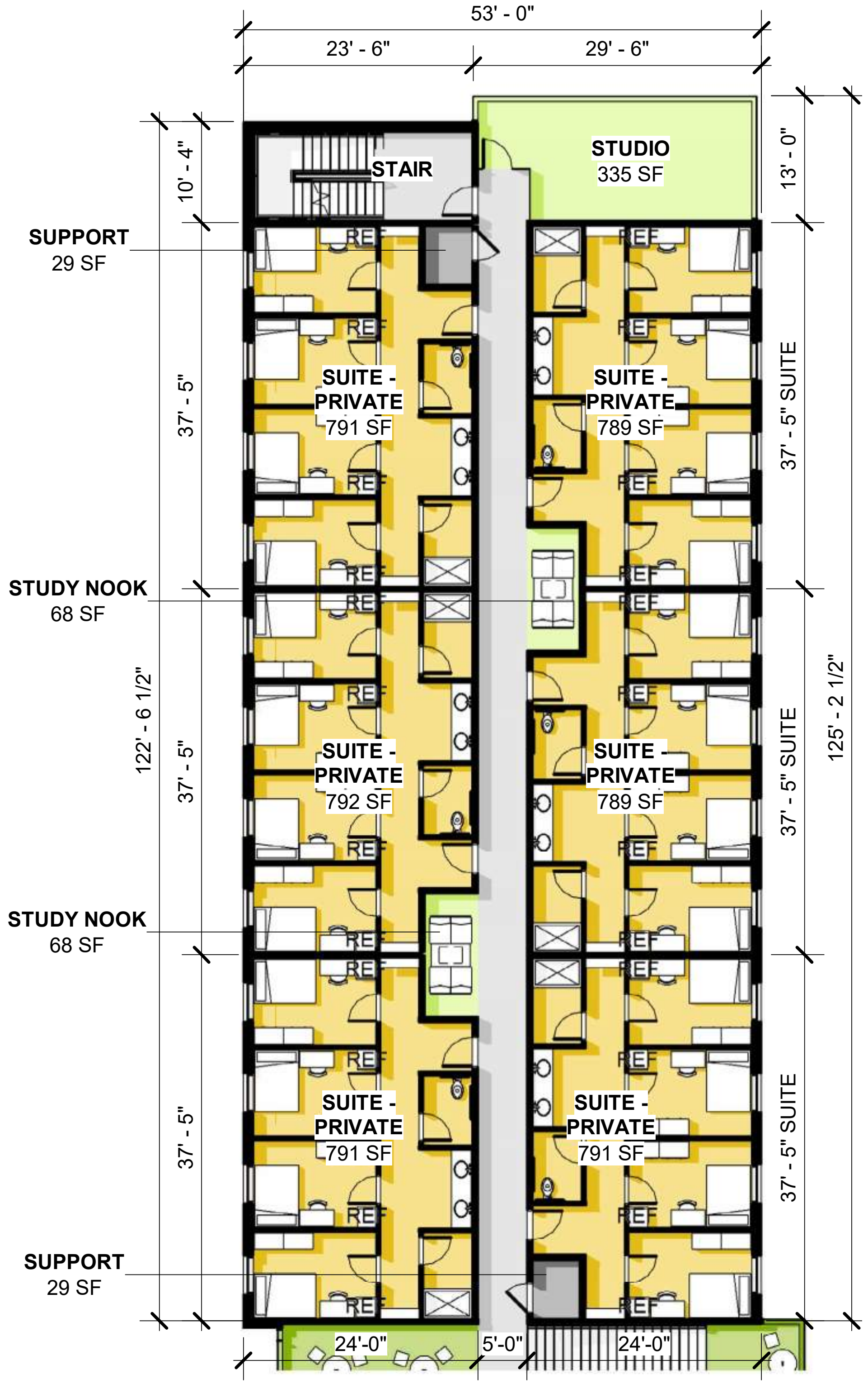
Key Plan



HED

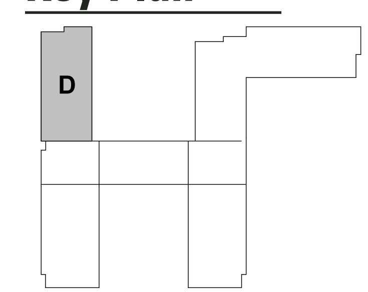
Programming: Residence Hall

Design Program | Program Plans - A-105C Level 3/5/7 Floor Plan Enlarged



1 **Level 3/5/7 Floor Plan - Area D**

Key Plan



SITE WORK

Introduction

This project will involve the construction of a new student residence hall. The residence hall will be comprised of three buildings all located in the middle of the block bounded by Oak Street, Douglas Street, McCallie Avenue, and Houston Street. The project will include site/building demolition, building construction, sidewalks, site stairs and walls, grading, drainage – including detention/retention and water quality, and utilities.

Site Demolition

Prior to any construction activities, the contractor shall obtain all necessary permits (i.e. City of Chattanooga Demolition Permit, City of Chattanooga Land Disturbing Activity Permit, TDEC CGP SWPPP/NOC). The contractor shall also contact Tennessee 811 for marking of the public utilities at least three days prior to the start of any construction activities. Demolition on the site shall consist of the removal of Frist Hall along with all structures, pavement, light poles, and trees as required for construction of the proposed buildings and site. Frist Hall will be demolished to subgrade, including all floor slabs and foundations. Pavement demolition shall remove all layers of the existing asphalt parking areas, concrete drives, sidewalks, and curbs to subgrade.

Site utilities (water, sewer, gas, storm, etc.) removal will be done on an as-required basis. There are chilled and hot water lines through the site that will be routed around the proposed buildings. The existing storm drainage through the site will be removed, abandoned in place (filled with flowable fill and capped) or relocated as required. All utility service connections to the existing building shall be removed. All above ground utilities are to be removed. Underground utilities shall either be removed or abandoned in place (filled with flowable fill and capped).

All materials except that belonging to a public or private utility company shall become the property of the contractor and shall be disposed of off–site. Rubbish and debris will be removed from the site daily to avoid accumulation at the project site. The contractor will need to coordinate with the utility owners prior to demolition of utilities.

Site Layout

The project will consist of the site preparation and construction of two new residence hall buildings positioned from McCallie Avenue to Oak Street on the east and west sides of the property with a courtyard and a connected lobby building between the two residence halls. Due to the approximately twenty-foot elevation difference between McCallie Avenue and Oak Street, the site will be separated vertically by building and site walls to create two elevations, upper and lower. The open space between the buildings will be upper and lower courtyards. The residence halls and courtyards will be accessed via sidewalks on both McCallie Avenue and Oak Street.

The site pavement will consist of new sidewalks (4” concrete with 4” base). The existing right-of-way curb and sidewalk will be replaced with detached curb (6” per City of Chattanooga standards) and sidewalk (4” concrete with 4” base).

Grading

Grading activities will commence once the site demolition is complete and all of the debris has been removed. The site shall be cleared and grubbed of all remaining surface materials. There shall not be boulders, stumps or other obstructions remaining on the site. This type of unsuitable material shall be removed to a minimum depth of 2 feet below subgrade (or in accordance with the geotechnical engineer’s recommendations). Material that is not to be used during final construction is to be disposed of off-site. Any topsoil on the site shall be stripped to full depth and stockpiled at an approved location. The grading for the site shall be necessary in order to set the buildings and courtyards at the proper elevation. All areas to receive fill shall be proof rolled prior to placement. Any proof rolled area that exhibits weak or unsatisfactory material shall be undercut and backfilled using a method approved by the geotechnical engineer (e.g. #57 or #67 stone). Fill material shall be placed in lifts not exceeding 8 inches. Areas beneath the buildings shall be compacted to 100% maximum dry density. Where required, topsoil shall be placed a minimum of 6 inches in depth. During construction the contractor will be required to maintain a free draining site; water will not be allowed to accumulate on the site.

Storm Water System

Storm drainage on the site shall consist of swales, catch basins, areas drains, piping, and underground detention/retention, and water quality. Drainage structures will be placed as required to keep the site free-draining. The pipe system within the site shall be 15-inch, 18-inch, and 24-inch HDPE or RCP pipe. The site is within the combined stormwater and sanitary sewer system in Chattanooga, therefore the pipes within the right-of-way shall be RCP, with the pipe sizes calculated as required to convey the stormwater and sanitary sewer in the area. The site has a history of flooding, and there will be coordination with the City of Chattanooga to address this issue. Roof drainage from the buildings shall be connected together with downspout boots and minimum 8-inch PVC pipe and connected to the storm structures. The building drainage will be combined with the site drainage and detained/retained in an underground system. Water quality will be incorporated between the outlet of the detention/retention system and the connection to the combined sewer in the right-of-way.

Erosion Control Measures

A Storm Water Pollution Prevention Plan (SWPPP) will be developed to provide direction and instruction for maintaining appropriate erosion controls in accordance with the Tennessee Department of Environmental Quality and the City of Chattanooga MS4. During construction, measures will be taken to prevent unnecessary erosion of the exposed soil and to prevent sediment from leaving the site. These measures will include properly built construction access drives, storm sewer inlet protection and

Programming: Residence Hall

Design Program | Civil Narrative

perimeter silt fence. Erosion and sediment measures and other protective measures will be maintained by the contractor in effective operating condition. Temporary structural practices will be removed once the corresponding disturbed drainage area has been permanently stabilized, unless they are designed to remain in place.

Utilities

The water supply for the building will come from the existing water main on Oak Street. There will be three separate domestic service connections, one for each building, with a tapping valve and sleeve for each. There will be three separate fire service connections, each with a tapping valve and sleeve to serve the sprinkler systems for each building. There will be a post indicator valve (PIV) and a fire department connection (FDC) for each building, either installed on each building or 40-feet away from the buildings. The contractor shall coordinate all taps with the City of Chattanooga. The contractor shall be responsible for testing all new lines and connections.

Each building's sanitary sewer line shall be either 6-inch or 8-inch PVC. This service line will connect to the combined sewer system located on Oak Street. Each connection to the combined sewer system will be made at a structure. All connections to a structure shall be watertight with a gasketed connection. Contractor shall coordinate the service connection with the City of Chattanooga. The contractor is responsible for testing all proposed sanitary sewer lines and connections.

Hot and chilled water connections for the mechanical systems shall be tapped off the existing lines through the site. The project MEP engineer will coordinate and produce the design. The contractor shall coordinate with the University of Tennessee at Chattanooga on the service connections.

The electric service for the buildings shall be coordinated with the City of Chattanooga. Site lighting shall be coordinated with the City and with the University of Tennessee at Chattanooga. These elements will be designed, produced, and coordinated by the project MEP engineer.

MAIN ENTRY - LEVEL 1

The main building entry is on the first floor of the New Residence Hall design and is accessed from the lower plaza level off Oak Street or from the upper plaza level off McCallie Avenue. This floor is composed of three major program categories:

- Public-facing program and access
- Private residential spaces
- Central MEP/service spaces and access

Public-Facing Program

The main entry accesses the lobby, which is double-height and can be accessed from either the upper or lower plaza level. For universal accessibility, a two-stop hydraulic elevator is suggested in the lobby space; a site ramping system is offered as an alternative solution. Within the main lobby, there is a 24-hour security desk, as well as lounge space for gathering. The lobby should also include two (2) gender-neutral single-user bathrooms and storage for carts. Adjacent to the lobby is the main office space for the building, which is comprised of:

- Open Office Administration Area
- Three (3) Private Offices
- Print and Storage space
- Staff Lounge with Kitchenette

Next to the main office is the Package and Mail room. This space should accommodate one (1) mailbox per residential suite in the building and a package locker system (Package Concierge or similar) to facilitate package management efficiently. There is also a Multi-Purpose space in this area of the building, which is intended to be used for seminars, meetings, events, etc.

Private Residential Program

Due to the site topography, only partial residential wings can be accommodated at this level. These wings are accessed via secure doors off the main lobby spaces. These points of entry give students access to the main residential circulation cores of the building. Each wing (east and west) has its own circulation core with two (2) elevators.

On the first floor, the east wing (see “Area A” enlarged floor plan, A-101A) is half of a typical residential floor; it is comprised of twelve (12) private bedroom suites. The west wing (see “Area D” enlarged floor plan. A-101C) is atypical, in that is has three (3) private bedroom suites and three (3) staff apartments. The staff apartments are positioned within the building to have private access from the exterior, as well as an exterior patio space. The staff apartments are intended to accommodate:

- Residence Director (two-bedroom apartment)
- Faculty-in-Residence (two-bedroom apartment)
- Graduate Assistant (one-bedroom or large studio apartment)

Central MEP/Service Program

The building layout takes advantage of the site’s natural grade; the building’s main MEP and service spaces are positioned behind the lobby, where residential spaces cannot be accommodated due to lack of daylighting. The centrally located MEP spaces are able to serve both residential wings. Exterior access to the main MEP and service spaces is from the west side of the site; a service drive will need to be coordinated with adjacent parking areas owned and operated by the University. This service access point provides several benefits:

- Accessible for Move-In and Move Out, providing direct access to elevators
- Potential delivery point with direct access to Mail/Package room

Each residential wing has a Main Trash room that is intended to be accessible to students for trash disposal and recycling. The Main Trash room on the west side of the building can be serviced directly from the exterior of the building.

RESIDENTIAL - LEVEL 2-9

Level 2

The second level of the building is a residential floor; however, it is not a full typical floor due to the site’s natural topography. The east wing is comprised of fourteen (14) private bedroom suites; the west wing is comprised of eight (8) private bedroom suites. At the end of each wing is a small "Studio" community space. The Studio spaces are intended to offer students the opportunity to participate in the functioning and identity of the building. From a design perspective, the space is a blank canvas, meant to be shaped by the needs and aspirations of the residential community – which will change throughout the life of the building. Examples of uses include group exercise, meditation, music, makerspace, art studio, etc. This level also has a central Neighborhood space, which is described in the following section.

Levels 3-7

Levels 3 through 7 are the typical, full floor layout. These floors are residential, accented by a central Neighborhood space that weaves every two floors together with community-focused program.

Residential

The residential portion of the typical floors is comprised of three (3) “blocks” of suites for the east wing and two (2) blocks of suites for the west wing. The north portion of the east wing has two (2) blocks of six (6) private bedroom suites and the south portion of the east wing has a block of seven (7) private bedroom suites; the north portion of the west wing has one (1) block of six (6) private bedroom suites and the south portion has one (1) block of seven (7) private bedroom suites. In each wing, the north and south portions of the floor are separated by the central Neighborhood community spaces. Each floor of the east wing has 76 student residents and each floor of the west wing has 52 student residents.

Programming: Residence Hall

Design Program | Architecture Narrative

Building Ends

A community-focused program is positioned at the north end of each residential floor, adjacent to the stairs on Oak Street. Each floor has a "Studio" space (see description of the Studio (on the previous page.)

The location of these unique program spaces at the building ends allows them to be showcased on the exterior. They will provide a sense of activity and community to those passing and approaching the New Residence Hall.

Central Neighborhood

At the heart of each residential floor is a two-story central Neighborhood, meant to be the community hub that ties every two floors together. The proposed design shows three (3) Neighborhoods per residential wing, locations being:

- Floors 2-3
- Floors 4-5
- Floors 6-7

Each Neighborhood has a group of community spaces, meant to foster gathering and socialization amongst the students of the Neighborhood. On the lower level of the central Neighborhood is the Community Living room, which is a double-height space connecting both floors. This space is intended to host gatherings of many types - from informal meetups to organized meetings amongst the entire floor. Adjacent to this social space is the Community Kitchen, which is equipped for light cooking and small group dining.

The upper level of the central Neighborhood is comprised of more social spaces. The mezzanine area contains clusters of lounge seating for informal gatherings. Adjacent to the mezzanine is an open study space, meant for either group or individual study.

On every floor, adjacent to the central Neighborhood spaces, is the Laundry. It was important to integrate the Laundry into the community spaces and give students the opportunity to socialize while waiting for their clothing to wash, rather than returning to the isolated space of their bedrooms.

GENERAL

The UTC New Residence Hall Programming includes two building towers and a connector building between the towers. Each tower contains bedrooms, circulation, community, neighborhood, and support areas. The connector building is two stories with a lobby, offices, multi-purpose area, and a circulation corridor.

The program reviewed two structural options:

- Option 1: 7- to 9-stories of cast-in-place concrete structure
- Option 2: 5-stories of cold formed metal framing supported on a cast-in-place concrete podium structure

Option 2 was selected as the preferred option, as discussed herein.

OPTION 2

Residential Tower Structure

The tower structural system could be comprised of load bearing cold formed metal framing supported on a concrete podium structure with concrete columns and two-way concrete slab. Load bearing walls could be used at the perimeter exterior walls and at the corridor walls. A 2-1/8" light-weight concrete slab (110 pcf. max.) on 6" (20ga.) Versa Floor Deep Dek composite metal deck (8-1/8" total) could be used to span between the load bearing walls and support the code required live loads. A thinner slab on metal deck could be used at the corridor to provide additional space above the ceiling for MEP.

As an alternative, load bearing walls could be located at the perimeter exterior walls and the room demising walls. A 3" light-weight concrete slab (110 pcf. max.) on 3" (18 ga.) composite metal deck (6" total) could be used to span between the demising wall and support the code required live loads. The UL assembly and the code required floor fire rating should be reviewed to confirm the acceptable floor system.

Each of the floor systems could be supported with aligning load-bearing cold formed metal studs spaced at 12" to 16" on-center. Based on a 5-story height, 6" cold formed metal studs could be used to support the floor system.

Continuous steel angle with headed studs could be attached to the perimeter exterior walls and embedded in the concrete slab. An angle and plate could be welded to the perimeter angle for support of the brick façade and provide horizontal relief required to allow for movement due to thermal and moisture variations.

Horizontal and vertical light gauge bracing could be used at the attic level to provide top of wall support, transfer lateral loads to the shear walls, and provide stability to the cold formed metal roof truss system. Another option would be to provide an attic floor framed using one of the floor systems described above with the trusses attaching directly to the attic concrete floor.

In order to maintain open areas or assembly spaces, steel columns and steel transfer beams can be used to support load bearing walls above these areas.

Sureboard walls with 14-gauge shear panels could be used as the lateral resisting system for a 5-story building. Concrete moment frames or shear walls could be used as part of the concrete podium structure.

Lobby Connector Structure

The two-story connector building could be constructed using steel framing with expansion joints on each side to provide separation from lateral movement of the tower structures. Roof joists spanning 36 feet and 28" deep spaced at 6 ft. on-center with 1-1/2" metal roof deck could be used to support the roofing material, MEP, and ceilings. Double joists could be utilized to support rooftop mechanical units. A steel moment frame could be used to support the lateral loads on the connector building.

A 16" thick concrete retaining wall could be used to support fill at the transition of the 1st and 2nd floors inside the building and the grade transition between the towers. The two site stairs could be constructed using a concrete slab-on-grade with concrete retaining walls on each side of the stairs.

Light gauge metal roof trusses spaced at 4'-0" on-center max. with 1-1/2" metal roof deck could be used for the roof system. Steel tube columns and horizontal tubes with angles could be used on gable ends with brick extending to the ridge. The steel framing will limit the brick height and provide intermediate support for a horizontal relief joint.

A 4" thick concrete slab-on-grade on compacted gravel and vapor barrier could be used in the lightly loaded areas of the buildings. Areas with storage and MEP may require an 8" thick concrete slab-on-grade over compacted gravel and a vapor barrier to support the heavy surface loading.

A geotechnical engineer will be required to perform a subsurface investigation of the proposed site and provide foundation recommendations along with site preparation requirements. However, deep foundations with tie beams and grade beams spanning between the deep foundations could be used to support the load bearing walls in the two towers and the connector building.

Programming: Residence Hall

Design Program | Mechanical Narrative

GENERAL

This narrative encompasses the Mechanical scope of work for the new Residence Hall for UTC. The Mechanical system will utilize campus chilled and high temperature hot water for building heating, cooling and domestic water heating.

Narrative is based on 784 total Beds and approximately 246,000 sf.

Building is 7 stories tall but will not be defined as a high rise.

CENTRAL HEATING AND COOLING SYSTEM

Chilled water and hot water feeding the existing Metropolitan Building will be rerouted from existing manhole on Oak Street. Lines will be rerouted around footprint of new building and re-feed existing connections to Metropolitan Building. New 8” Chilled water supply and return and 4” hot water supply and return lines shall be routed from existing manhole to feed new mechanical room in new residence hall.

Campus high temperature hot water shall be routed to a shell and tube heat exchanger to provide separation between the campus and building hot water system. The building heating hot water shall be connected to the heat exchanger. Mains from campus system shall be 4”, mains in the building shall be 6”. Hot water shall be distributed to the building through (2) 750 gpm base mounted end-suction pumps (one operating / one standby). Pumps shall have Variable Frequency Drive (VFD) to vary pump speed based on remote differential pressure sensor. Piping shall be welded steel 2.5” and above and copper 2” and below. Insulation shall be fiberglass with all service jacket, with insulation to meet energy code. Heating hot water system shall also have expansion tank and air/dirt separator, and makeup water connection.

Campus chilled water shall be routed from campus system to building booster pumps. Pumps shall be (3) 750 gpm base mounted end suction pumps (two operating / one stanby) with VFDs and remote pressure sensor. Provide Air and Dirt separator on incoming line from campus chilled water system. Pumps shall be piped with bypass with check valve to allow campus pressure to allow campus system to feed building at low load conditions. Piping shall be welded steel 2.5” and above and copper 2” and below. Insulation shall be fiberglass with all service jacket, with insulation to meet energy code. Heating hot water system shall also have expansion tank and air/dirt separator, and makeup water connection. See schematic routing and re-routing of campus utilities on page 40.

Residential Floor Cooling and Heating

Chilled and hot water shall be routed to fan coil units to feed each staff apartment and each student dorm suite. Each suite shall have ducted 4-pipe fan coil unit tied into central hot and chilled water loops. Fan coil options include:

- Floor mounted cabinet type (often located below the window of each room
- Exposed cabinet type (fan coil and piping exposed in the space)
- Above Ceiling ducted
- Fully concealed
- With metal access panel with integral return grille
- Vertical stack fan coil (often used in hotels) requires 2x2 floor space
- Vertical Closet mounted

The floor mounted or closet mounted type are typically preferable from a maintenance perspective however the limited floor space it will be difficult to locate space on the floor for a floor mounted or closet mounted unit.

The exposed cabinet type or floor mounted cabinet type in each space will provide individual space control for each space. However, it will leave the common area unconditioned and could be more cost prohibitive than providing a common unit to feed the suite due to the additional piping and controls.

Based on the proposed room layout we propose a single above ceiling ducted Fan coil unit to feed each suite. The ceiling area under each fan coil will need a large access panel the full size of the unit or an accessible ceiling (similar to an ACT ceiling).

Unit sizes will vary based on building orientation and solar exposure but we estimate the typical unit size for each space as follows:

- 4 Bedroom Private Suite – 900 cfm fan coil
- Community Living space – 800 cfm fan coil
- Community Kitchen space – 600 cfm fan coil
- Study room – 400 cfm fan coil
- Studio – 800 cfm fan coil

Route low pressure ductwork from each fan coil unit to supply grilles in each space. Route return to return filter grille with MERV-8 filter. Route outside air from main ventilation shaft to return of each fan coil unit to meet ASHRAE Standard 62.

Fan coil units shall be 4-pipe chilled water/ hot water fan coil units with variable speed EC fan motor. Units shall be piped with shutoff valves, inlet strainer, modulating control valve, and automatic flow balance valve for all chilled and hot water connections. Unit shall be manufactured by Trane, Daikin, JCI, or Carrier. Provide neoprene vibration isolators for each unit. Each unit shall have full DDC controls tied back to campus controls system.

See approximate HVAC layout for each suite type based on an above ceiling ducted unit on page 41.

Main Lobby and Public Areas

Provide fan coil units for each space and lobby space sized at approximately 300 sf/ton. Units shall meet requirements outlined for fan coil units for residential floor levels outlined above.

Dedicated Outside Air Units

Building outside air and ventilation shall be provided through a dedicated outside air system (DOAS) to provide preconditioned/

dehumidified outside air to each zone. Provide (2) 15,000 cfm units (one for each wing) located at roof or attic level. Unit shall be modular chilled water air handling unit with exhaust energy recovery and hot water reheat. DOAS units shall be located at attic or roof level and route outside air and exhaust using low pressure sheet metal duct to rated shafts to feed each suite or zone.

Ventilation air shall be sized to makeup for toilet exhaust, laundry exhaust and to meet ASHRAE 62 fresh air ventilation requirements.

Shafts shall be provided at each level or shared between each group of suites to feed ventilation air to each suite and provide exhaust to each toilet and shower.

Each exhaust and outside air penetration of the shaft will be required a combination fire smoke damper.

Miscellaneous

Provide the following additional systems or components:

- Duct all laundry exhaust to wall cap at nearest exterior wall
- Provide hot water cabinet heaters in stairs for freeze protection
- Provide ventilation fans and hot water unit heater for fire pump room and all mechanical spaces
- Provide exhaust ventilation for all trash and trash chute rooms and Janitor Closets

HVAC Controls

Connect all HVAC systems back to campus HVAC control system for monitoring and energy management. Controls shall be campus standard Trane or JCI controls. All controls (to include room thermostats) will report to BMS front end with graphical displays. Provide the following additional meters and monitoring points at the central BMS:

- Chilled water and Hot Water Flow metering and BTU monitoring
- BTU and Flow monitoring for Domestic hot water heating system
- Interface to building electric meter.

Mini Split System

Each IT closet and Electric room shall be provided with independent wall mounted mini-split unit equal to Mitsubishi PKA. Route hard ACR copper refrigerant pipe to condensing unit on roof. Insulate refrigerant suction line with 1” Armaflex insulation. Provide 1 ton unit for each IT closet and 3 ton for main electrical room.

Specifications

Contractor shall be responsible for providing a complete operational HVAC system in accordance with state and local codes as well as NFPA 90A, NFPA 101, and NFPA 45. The Contractor shall meet the requirements of UTC Campus Standards.

Ductwork

Sheet metal duct construction shall comply with SMACNA HVAC Duct Construction Standards Metal and Flexible. Low-pressure ductwork to be constructed as 2” w.g. positive or negative, seal class C. Seal all transverse joints. Low-pressure ductwork shall be selected in a range of 0.07” to 0.10” w.g. static pressure drop per 100 feet of ductwork and a maximum 1200 FPM air velocity. Maximum duct aspect ratio to be 4 to 1.

Supply, return, outside air and transfer ductwork to be galvanized sheet metal. Medium pressure duct shall be round or flat oval. Low pressure duct shall be round or rectangular.

Control dampers shall be ultra low leak, airfoil type. Fire and fire/smoke dampers shall be UL listed. Provide duct access panels at all fire dampers.

Piping

Heating water, 2-1/2” and larger to be ASTM A-53, Grade B, Schedule 40 steel pipe. Moisture condensate drains to be hard-drawn, seamless copper tubing. Chilled and heating water, 2” and smaller shall be Type L, hard drawn seamless copper tubing, ASTM B-88.

Chilled water piping 2 ½” and larger to be Aquatherm type piping.

Provide tangential air separators, bladder or diaphragm type expansion tanks, shot feeders, PRV’s and relief valve for closed water systems. Coils to have 2-way control valves, shut-off valves, and balancing valves with strainers. Provide manual air vents at all high points and drains at all low points.

Provide isolation valves at each floor branch take-off and each riser for all water piping (mechanical and plumbing). Valves shall be brass ball valves with stainless steel ball for 2” and smaller, and high performance butterfly valves for valves 2.5” and larger

Motors

Motors 1-hp and larger to be premium efficiency type. Motors equal and less than 1/2-hp shall be 115-1-60. Motors 3/4-hp and larger shall be 460-3-60. Motor starters for Division 15 equipment shall be provided by the Mechanical/Plumbing Contractors.

Vibration Isolation

Vibration isolation shall include concrete inertia bases for floor mounted centrifugal fans and pumps. Ceiling hung fans and motorized equipment shall have spring hangers. Provide flexible couplings at all equipment connections.

Insulation

Flexible tubular rubber type insulation equal to Armaflex AP:

- Moisture condensate drains – 1/2" thick
- Refrigerant suction lines for split systems – 1” thick
- Chilled water pumps and hydronic specialties and any other equipment that might sweat – 3/4” thick.

Programming: Residence Hall

Design Program | Mechanical Narrative

Fiberglass factory-formed and jacketed piping insulation equal to Johns Manville Micro-Lok 650 with Type AP-T jacketing:

- Heating water 1-1/2” and smaller – 1” thick
- Heating water 2” and larger – 1-1/2” thick
- Chilled water piping 2” and smaller – 1” thick (for piping not exposed to damage only)
- Chilled water piping 2-1/2” and larger – 1-1/2” thick (for piping not exposed to damage only)

Cellular Glass Insulation

- Chilled water piping 2” and smaller – 1” thick (for piping less than 8ft above finished floor in mechanical room)
- Chilled water piping 2-1/2” and larger – 1-1/2” thick (for piping less than 8ft above finished floor in mechanical room)
- At all piping hangers to prevent crushing of insulation

Blanket type duct insulation, 3/4 lb per cubic foot density, equal to Manville Microlite with FSKL aluminum foil vapor barrier facing and 2” tab with a thermal conductivity of 0.28 at 75 deg F mean temperature:

- Heating and cooling supply ductwork concealed from view – 2” thick
- Outside air ductwork concealed from view – 2” thick

Board type duct insulation, 3 lb per cubic foot density, equal to Manville 800 Series Spin-Glas with FSKL aluminum foil vapor barrier facing having a minimum R value of 4.3:

- Exposed heating and cooling supply ductwork - 1-1/2” thick
- Exposed outside air ductwork – 1-1/2” thick
- Exposed return air ductwork within the penthouse – 1” thick

Flexible sheet, closed-cell type insulation equal to Armstrong Armaflex II with and R factor of 3.7 with 2 coats of weather protective vapor barrier coating equal to Childers Encacel.

- Ductwork exposed to weather – (2) layers of 3/4” thick

System TAB and commissioning

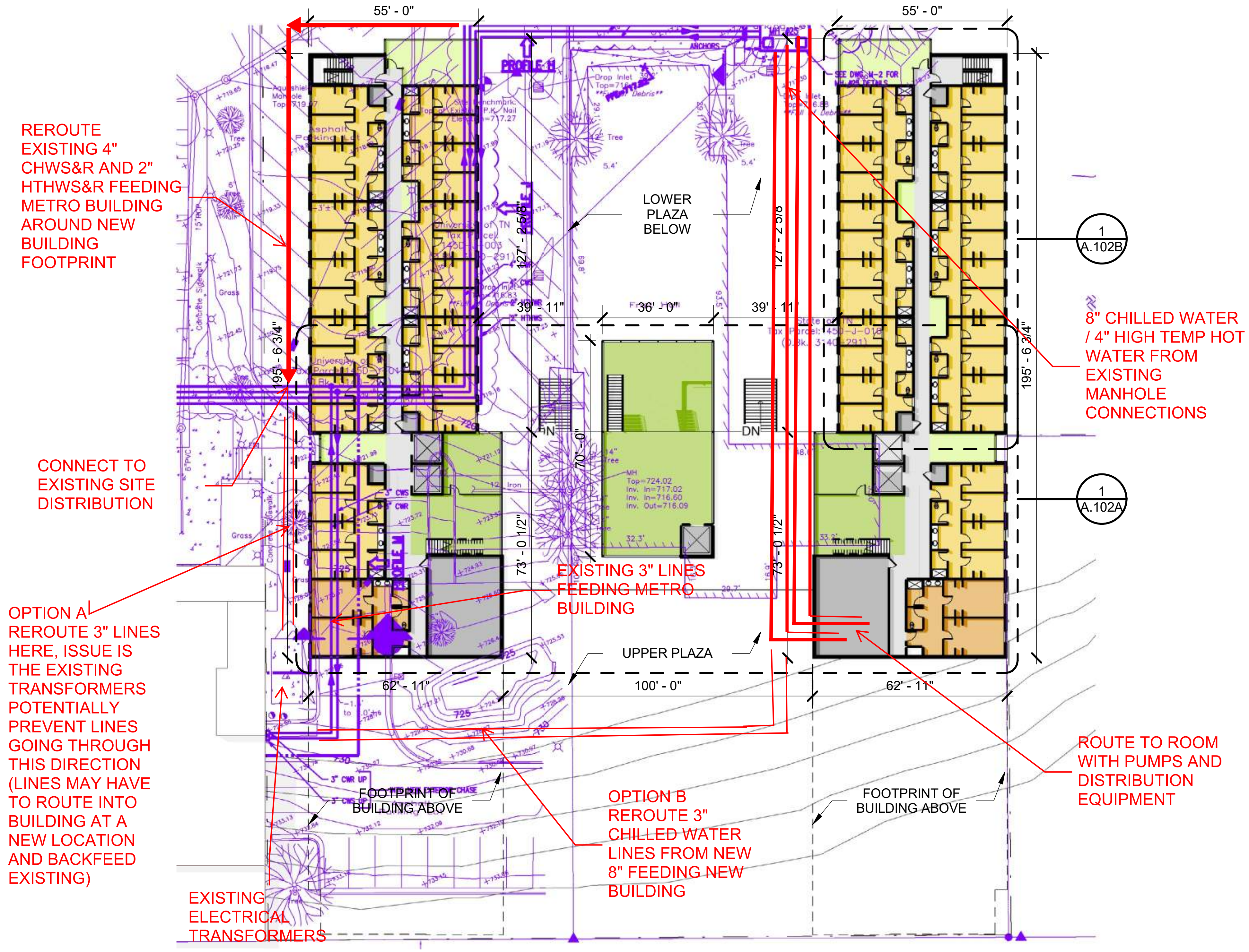
Water and air side systems shall be tested and balanced by an AABC or NEBB certified agency.

HVAC controls shall be commissioned by the contractor and tested in both the heating season and cooling season in order to maximize energy savings. Contractor shall provide a point to point demonstration of all controls in the presence of the owner’s staff

Programming: Residence Hall

Design Program | Mechanical Narrative

Note: Plan indicated is for narrative purposes only. The building footprint shown represents a previous design iteration. The 2023 programming revisions represent an updated footprint.

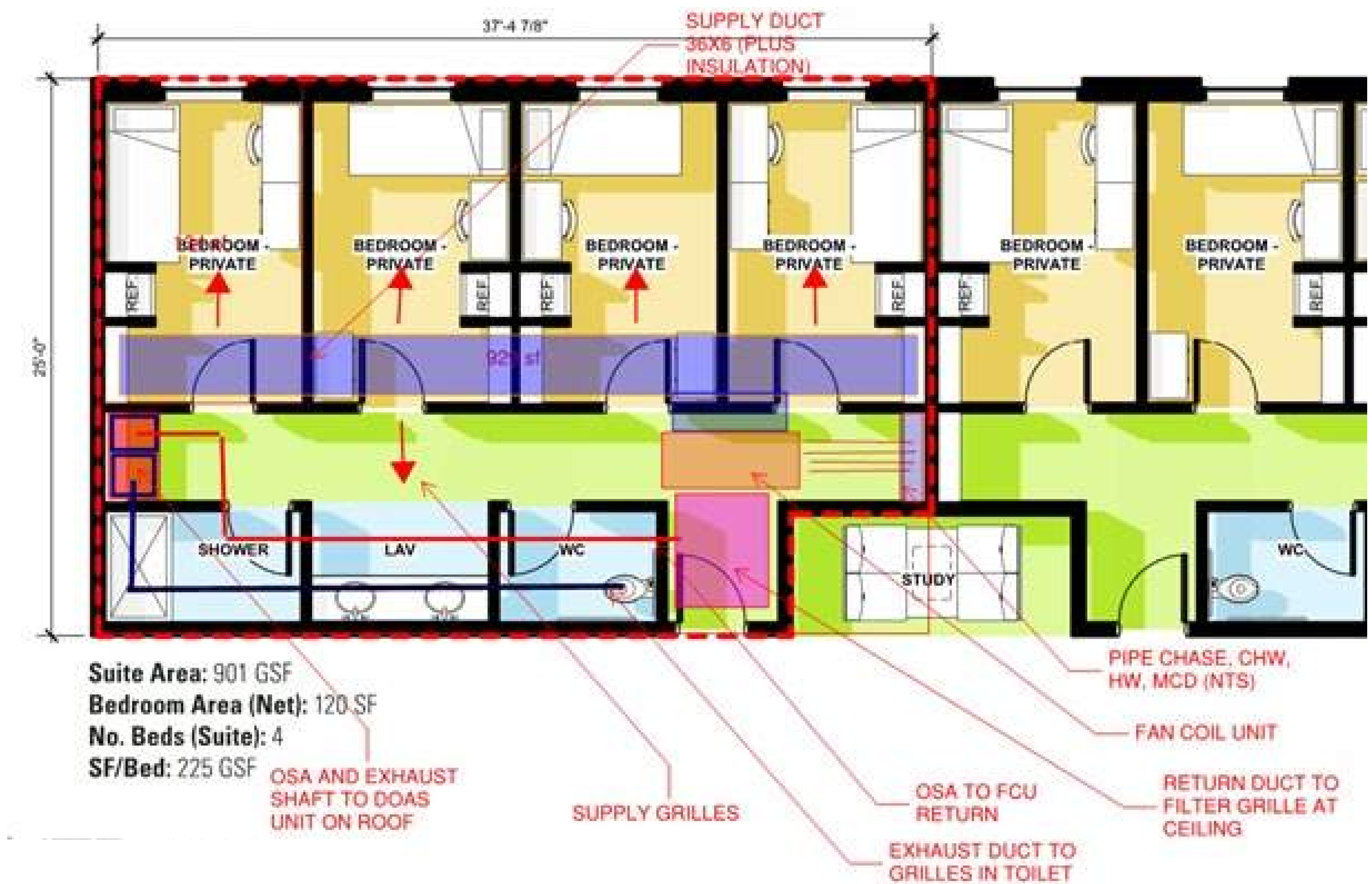


Programming: Residence Hall

Design Program | Mechanical Narrative

Note: Plan for narrative purposes. The unit layout shown represents a previous design iteration.

Suite - Private



Suite Area: 901 GSF
Bedroom Area (Net): 120 SF
No. Beds (Suite): 4
SF/Bed: 225 GSF

GENERAL

This narrative encompasses the Electrical scope of work for the New Residence Hall for UTC. Narrative is based on 784 total Beds and approximately 246,000 sf.

Building is 7 stories tall but will not be defined as a high rise.

Requirements & References

Provide all labor, materials, tools and services for a complete installation of equipment and systems specified herein. Principal features of work included are:

- Primary Electrical Distribution
- Switchboards
- Panelboards
- Power Wiring and Secondary Distribution
- Interior Lighting Fixtures and Control Equipment
- Exterior Lighting Fixtures and Control Equipment
- Convenience Outlets
- Telephone and Data Outlets and Wiring as required
- Electrical Control and Interlock Wiring as required by Mechanical Drawings, Specifications, or Manufacturer's Schematics
- Heating, Ventilating and Air-Conditioning Equipment Power
- Plumbing Equipment Power
- TV Distribution Rough-in
- Elevators
- Lightning Protection
- Surge Protection Devices
- Ground Bars
- Fire Alarm System

Comply with applicable local, state, and federal codes. Comply with applicable requirements of recognized industry associations which promulgate standards for the various trades. Employ only qualified journeymen for this work. Employ a competent qualified mechanic to supervise the work.

Perform work specified in Division 26 in accordance with standards listed in architectural narrative.

All materials and equipment used in carrying out these specifications to be American made unless approved otherwise by the Engineer and to be new and have U.L. listing, or listing by other recognized testing laboratory when such listings are available. Construction materials shall meet Factory Mutual guidelines.

Properly identify all starters, contactors, relays, safety switches, and panels with permanently attached black phenolic plates with 1/4 white engraved lettering on the face of each attached, with two sheet metal screws. Starters and relays connected by the electrical tradesman to be identified by him whether furnished by him or others.

ELECTRICAL SYSTEMS

Currently on the site for the new facility, an existing pad mounted switch 'S12P16' is located which feeds manhole 29 across Oak Street. Additionally, there is a primary ductbank from manhole 29 south back across Oak Street to a pad mounted switch adjacent to the Metro Building that feeds the transformer serving the Metro Building as well as the transformer feeding Frist Hall. Prior to the start of construction of the new building a new pad mounted switch 'S12P16' shall be located near the EPB riser pole on the southeast corner of Houston and Oak Streets. A new primary feed from the EPB riser pole to the new 'S12P16' shall be provided as well as a new manhole adjacent to 'S12P16'. New primary ductbank shall route from the new 'S12P16' into the adjacent manhole and then north to a new manhole at the northeast corner of Houston and Oak Streets then to existing manhole 29 to refeed the campus. Additionally, new primary ductbank shall route from the new 'S12P16' into the adjacent manhole and then south to a new manhole near the northwest corner of the Metro Building then east to a new manhole near the northeast corner of the Metro Building. This new manhole will then feed the existing pad mounted switch at the Metro Building with new ductbank as well as a new manhole near the southeast corner of the Metro Building near McCallie Avenue. From this manhole the primary ductbank shall route southeast and north following the property lines to new manholes at each turn. As the ductbank routes back to Oak Street the ductbank will then route west to a new manhole across the street from Manhole 28 and will route north across Oak Street to manhole 28 to complete the loop around the site. Reference proposed site plan for complete routing.

Electrical service for the facility shall originate from a pad mounted transformer located on the site fed from the existing pad mounted switch at the northeast corner of the Metro Building. From the secondary of the pad mounted transformer the contractor shall provide 11 sets each: 4#500MCM, 3-1/2" Conduit to a new 5000A, 480/277V, 3 phase, 4 wire main switchboard 'MSB' located in the main electrical room. 120/208V loads shall be fed utilizing dry type transformers.

Panelboards shall be specified for sequence phase connection to evenly balance electrical loads on each phase. Bus bars shall be copper. Loads up to 400 amperes shall utilize panelboards. Loads 400 to 1200 amperes shall utilize distribution boards. Loads above 1200 amperes shall utilize switchboards. Circuit breakers to be molded case, bolt-on type. Panelboards shall have 15 percent spare capacity and 20 percent spare breakers. A detailed short-circuit analysis shall be prepared during the design phase, and all overcurrent devices shall be coordinated so that downstream devices will trip to clear any fault. The anticipated available fault current at the transformer secondary is 65,000 amps.

Provide 3PH, 4W surge protection devices at the main service switchboard and panelboards that are connected to the secondaries of 208Y/120V transformers.

An emergency standby engine generator system shall be provided. The system shall be completely automatic for unattended operation for the duration of any loss of normal utility power. System shall be capable of reaching operating range within 10 seconds of initial start signal. Unit shall be a continuous standby 600 KW/KVA capacity. Unit to meet the requirements of NFPA 110. Unit shall be equipped for outdoor installation. Unit to be equipped with a sound attenuated housing. Starting batteries to be heavy-duty lead acid type with an automatic battery charger. A double wall diesel belly tank shall be provided with 24 hours of run capacity. The system shall be provided with a generator control panel and a remote annunciator (remote annunciator to be housed in the building command center). Transfer switches shall be provided as indicated on the drawings. Switches to be double throw actuated by a single operator. Interlocked molded case circuit breakers, contactors or transfer devices with dual solenoid operators are not acceptable. Provide an automatic exerciser to operate the unit for a period of 30 minutes every 168 hours. The emergency system shall supply power to all life safety and equipment loads in the facility including the elevators.

Lighting systems for the facility shall consist of the following:

- Classrooms: 2 x 4 direct/indirect, LED lay-in luminaires and dimmable LED can lights at the teaching board.
- Office: 2 x 4 direct/indirect, LED lay-in luminaire.
- Corridor, Lounge, and Bathroom: 2 x 4 direct/indirect, LED lay-in luminaires, LED can lights, and LED sconces.
- Storage, Mechanical, Electrical: 1 x 4 LED strip light.
- Dorm room: Surface mounted 2x4 LED panel.

Light fixtures shall be controlled via switches in combination with occupancy sensors.

Provide additional general use duplex outlets where required. Provide GFI duplex convenience outlets above counters in toilets. Provide quadraplex outlets to serve computers in the classroom and office desk locations. Receptacle circuits in sleeping and living areas shall be powered via arc fault breakers.

IT cabling shall be contractor furnished/contractor installed. All data outlets will be new and shall be located at computer stations in the classrooms and the office desk as well as in each dorm room. Wireless access points shall be provided throughout the facility as required. Service for the new facility shall originate from a telecommunication manhole located on campus routed to the new building via 3-4” conduits. All work shall be done per the latest UTC IT standards.

Provide starters as shown on mechanical drawings and scheduled on electrical drawings. Division 23 to furnish and install line- and low-voltage control wiring including conduit, conductors, and terminations for same. Starters used on 480V systems shall have individual 480/120V control transformer with two cartridge fuses in the primary and one in the secondary. Starters used inside to have NEMA-1 enclosures, starters used in damp locations or exposed to weather to have NEMA-3R enclosures.

Conductors and cables utilized for interior building installation shall be copper. Temperature rating of conductors shall be 90 degrees C. Insulation shall be THHN, THHW, or XHHW, 600 volt rated, 90 degrees C. Branch circuit wiring for all dimming systems will be required, one neutral per circuit, no common neutrals allowed.

Raceways used in building interiors shall be rigid metal. The minimum conduit size shall be 1/2”.

The entire system of raceways and equipment shall be grounded in accordance with Article 250 of the NEC. The main service switchboards shall be bonded to the street side of first flange or coupling of the incoming water line in accordance with Article 250-80 of the NEC, sized in accordance with Article 250-94 of the NEC. An additional ground wire shall be run to a tripod grounding rod system outside the building foundation. Building steel shall be connected to the building switchboard and the grounding systems shall be bonded to the lightning protection system. Separate green grounding conductors shall be installed in all feeder and branch circuits in accordance with Table 250-95 of the NEC.

Contractor to provide a functional unobtrusive system of air terminals, conductors, grounds, and other necessary components necessary for the protection of the building against damage by lightning. The lightning protection system shall be completely concealed where possible with only air terminals visible. The system shall comply with Underwriter’s Laboratories, Inc., #UL96A and NFPA-780. Upon completion of the installation, the contractor shall complete the application for the U.L. “Master Label” and forward to the manufacturer for processing. A copy of the application shall be made a part of the project closing files.

Furnish and install a complete campus standard fire alarm system as described herein and as shown on the drawings, to be wired, connected and left in first class operating condition. Include sufficient control panels, annunciators, manual stations, automatic fire detectors, smoke detectors, alarm indicating appliances, wiring, terminations, electrical boxes, conduit and all other necessary material for a complete operating system. All occupied spaces shall have a visible alarm indicating appliance. Provide duct smoke detectors in supply and return ducts of all air-handling units. The system shall be capable of on-site programming to accommodate system expansion and facilities changes in operation. The system shall be capable of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. All devices shall be addressable, shall be supervised, and the capability of being disabled or enabled individually. The system shall have one-way voice communication and tone generating capabilities with three prerecorded digitized voice messages, one for alarm, one for testing, and a standard evacuation message. The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device or sprinkler flow shall be as follows:

- All audible alarm indicating appliances shall notify occupants with the prerecorded evacuation message.
- All visual alarm indicating appliances shall flash continuously until the system is reset.
- Release all doors held open by door control devices.
- Recall all elevators.
- Activate mechanical control schemes in accordance with NFPA 90.
- Notify monitoring station.

Provide electrical connection to projection screens and all A/V equipment per manufacturer’s recommendations.

Provide electrical connection motorized door openers.

Provide electrical connection to parking equipment and car chargers as required.

Programming: Residence Hall

Design Program | Plumbing Narrative

GENERAL

This narrative encompasses the Plumbing scope of work for the New Residence Hall for UTC. Narrative is based on 784 total Beds and approximately 246,000 sf.

Building is 7 stories tall but will not be defined as a high rise.

REFERENCES

- 2012 International Building Code (IBC)
- 2012 International Plumbing Code (IPC)
- All applicable NFPA standards

PLUMBING SYSTEMS

Sanitary Waste and Vent Systems

The buildings will be provided with a complete sanitary waste and vent system utilizing Schedule 40 cast-iron pipe and fittings. Sanitary waste and vent piping shall be routed to all plumbing fixtures. Floor or wall-mounted cleanouts will be provided every 50' within the buildings. Heavy-duty couplings shall be installed at the lower three floors of construction, and at the base of all waste stacks. Two 8'' sanitary waste mains shall be routed to the site sanitary waste system. Exposed piping and p-traps subject to freezing shall be heat traced. A 4-inch sanitary waste and vent line shall serve each suite.

Storm Water Systems

The buildings will be provided with a complete storm water system utilizing Schedule 40 cast-iron pipe and fittings. The roof will be provided with cast-iron roof drains and overflow drains. The roof drains will be collected and piped to exterior storm mains on site. Overflow drains shall be routed to ground level and discharged to grade. Provide 6'' roof drains for every 6,000 square feet of drainage area. Heavy-duty couplings shall be installed at the lower three floors of construction, and at the base of all rainwater stacks.

Elevator pits shall be provided with duplex 50 GPM pumps with oil smart systems. The elevator sump pump discharge shall drain indirectly to sanitary.

Domestic Cold Water Systems

A 4" water service will be provided and will enter at the main level in the MEP Service Room. It is currently anticipated that building backflow preventers will be located in the MEP Service Room. An end suction triplex type pump will be used to boost the water pressure for the building. Booster pump shall be equal to a Grundfos Model CRE32-MLE. The domestic water booster pump shall be located in the MEP Service Room. The booster pump shall be equipped with a variable frequency drive. Domestic cold water will be distributed throughout the buildings to service the plumbing fixtures and equipment as required.

Piping shall consist of insulated Type "L" copper. Shutoff valves will be provided to isolate all fixtures and equipment. Shock absorbers will be provided at all flush valve fixtures and all other quick closing valves. All cold water lines shall be insulated with ½'' insulation. Non freeze wall hydrants spaced 150 ft. apart shall be provided around the perimeter of the buildings. Exposed piping subject to freezing shall be heat traced.

Domestic Hot Water Systems

The domestic hot water for the facility will be provided from the Campus central hot water heating system.

PLUMBING FIXTURES

All plumbing fixtures shall be low flow type. Water closets in residences shall be floor mounted tank type. Refer to architectural and campus standards for specific plumbing fixture types and manufacturers.

NATURAL GAS SYSTEM

The building will be provided with a natural gas service. The gas meter shall be located outside. Gas shutoff valves, dirtleg, and unions will be provided at all equipment.

PLUMBING SPECIFICATIONS

Steel Pipes:

Butt welded, electric resistance welded, or seamless black steel pipe, ANSI B36.10, ASTM A-120, Grade "A" or "B," Schedule 40. Welded steel pipe for gas piping.

Copper Pipes:

Type "L" hard drawn seamless, ASTM B-88: Domestic hot and cold water piping: up to 4" OD.

Type "K" hard drawn seamless for the following services:

Domestic water piping located under concrete slabs.

Type "K" rolled, soft drawn seamless for the following services: Under concrete slabs and underground where length of pipe runs between fittings exceed maximum hard drawn lengths.

Cast Iron Soil and Vent Pipe:

Standard weight, cast iron pipe with drainage fittings: Waste, vent, and drain pipe: 2" and larger.

Joints in Cast Iron Pipe:

Neoprene compression type gasketed joints in hubbed cast iron soil pipe below grade. No-hub pipe and joints may be used above slab on grade.

PIPE INSULATION

Glass Fiber

Factory-formed, fiberglass jacketed "system" type, fiberglass reinforced, white Kraft paper jacket, aluminum foil vapor barrier, and 4 pounds per cubic foot density. Temperature Limit: 650 degrees F, minimum "R" of 4.00.

Manville "Micro-Lok 650" with Type AP jacketing.

Insulate as follows:

Domestic hot water piping: 1" thick.

Domestic cold water piping: ½" thick.

PVC Fitting Covers

Provide factory premolded one-piece PVC insulated fitting covers, precut insulation inserts and installation materials for all pipe fittings, elbows, tees, butterfly valves, and couplings.

Foster Seaglass PVC fitting cover, UNI-FIT inserts and accessories.

All exposed piping shall be painted.

Programming: Residence Hall

Design Program | Fire Protection Narrative

GENERAL

This narrative encompasses the Fire Protection scope of work for the New Residence Hall for UTC. Narrative is based on 784 total Beds and approximately 246,000 sf.

Building is 7 stories tall but will not be defined as a high rise.

FIRE PROTECTION SYSTEMS

Based on building height and use, there will be automatic sprinkler & standpipe systems boosted by fire pump to comply with national and local codes. City water will be used to supply the building fire protection system.

The building will be fully covered by an automatic sprinkler system. All systems to be hydraulically designed per NFPA 13 and insurance underwriter requirements. System to be complete with Siamese connection, alarms, and all related appurtenances. Pipe shall be Schedule 40. Entire system to meet all requirements of NFPA 13 and 14.

A fire pump and jockey pump will be provided. The size of the fire pump selected will meet the full fire demand of the building sprinkler and standpipe systems per NFPA 13 and 14. Fire pump shall be equipped with service entrance rated soft start/ATS with minimum 100 KAIC rating. Fire pump will be located in a dedicated 2 hour fire rated reinforced masonry construction fire pump room and accessible from the exterior from a doorway on grade.

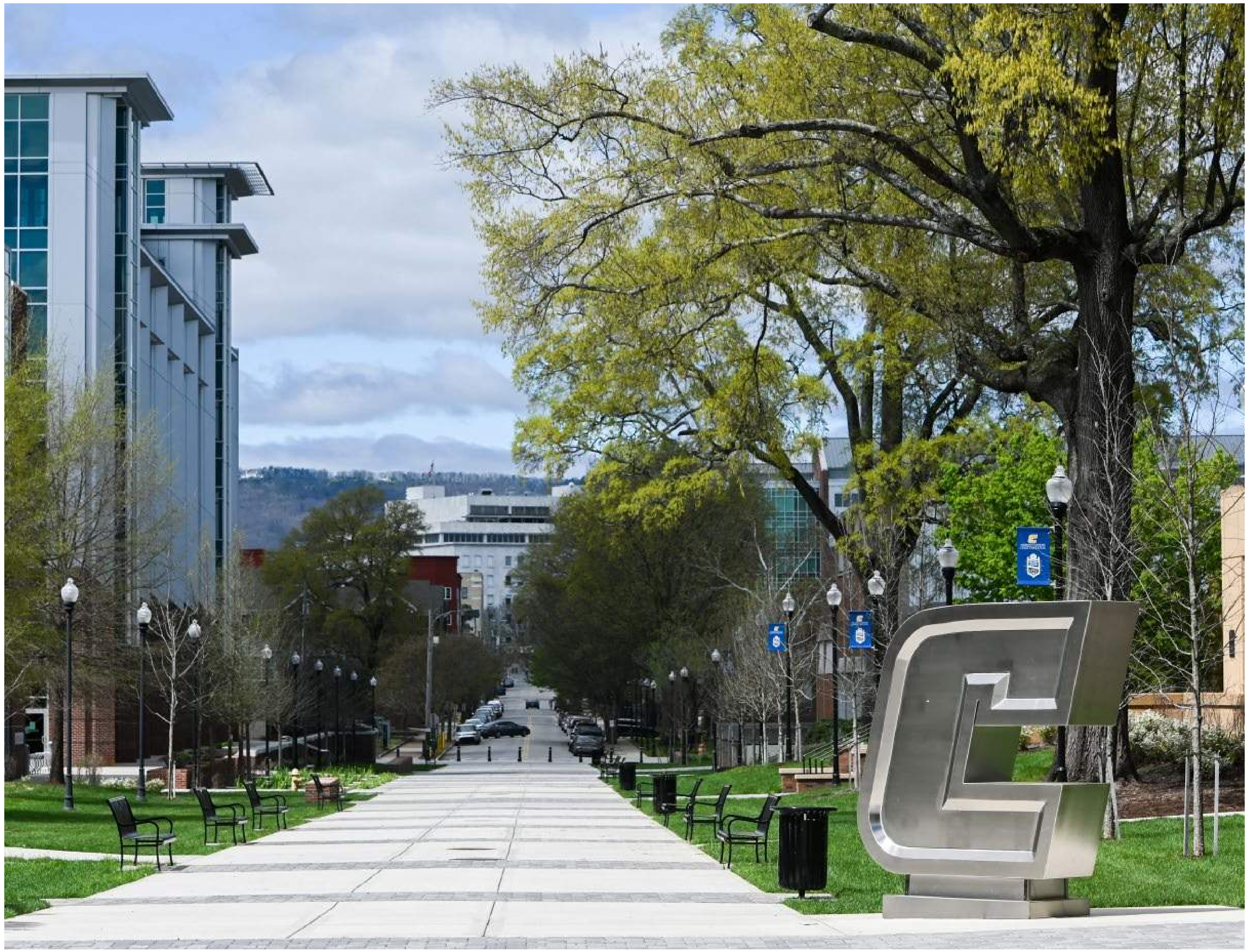
The sprinkler heads will be white, semi-recessed, quick response type for all finished areas. Sprinklers in monolithic ceilings shall be concealed with factory-painted white cover plate or white recessed sidewalls depending on architecture. Utilize brass upright heads for all areas without finished ceilings.

Class I standpipes shall be provided. Each egress stair shall have a NFPA 14 compliant fire protection standpipe, one of which shall extend to the roof with a 2 ½'' fire hose connection. All standpipes shall be interconnected. Each standpipe shall have a 2 ½'' fire hose connection and capable of providing 100 PSI at each stair landing. Additional fire department valves shall be located to provide access within 200' travel distance. Pressure reducing fire department valves and automatic sprinkler zone control valves shall be provided as required by system pressures. Each floor shall be equipped with sprinkler zone control assembly with flow switch, tamper switch, inspector test station. A 3" sprinkler drain will be provided at each stairwell equipped with pressure reducing valves. All flow and tamper switches shall be connected to the building fire alarm system.

Fire extinguishers of ABC type with UL rating 4A:80B; C in aluminum cabinets shall be located throughout the facility. Locate so that a maximum of 75 feet of travel to any space will be provided. Wall-hung fire extinguishers equal to ABC type with UL rating of 4A:80B: C shall be located in all mechanical spaces.

5

Cost Analysis
Process



PROCESS

The following cost analysis is based on the program data and conceptual floor plans for the Design Program. The purpose of this Programmatic Estimate is to establish an opinion of probable construction budget in the initial stages of project development. The project provides a New Residence Hall for the University of Tennessee Chattanooga (UTC). The project will be a 246,123 SF facility housing 784 beds. The project will be constructed with a cast-in-place concrete foundation with metal stud framing above grade.

Cost Analysis
Cost Qualifiers

OVERALL COSTS

The Estimated Cost to Construct (ECC) represents the total cost for construction performed by a prime contractor under a single contract with UTC. The ECC shown includes escalation extending the pricing to the midpoint of construction.

Refer to the following page for breakdown of estimated costs.

MARKUPS

Prime Contractor Markups

Included in the estimate is a 10% general conditions and profit markup. This percentage is a recommended value provided by UTC during the review of previous estimates and is based upon a general assumption about how the project will be contracted. The project is anticipated to be awarded to a single prime contractor who will subcontract most of the work to subcontractors specializing in their scopes of work. Actual markup percentages are the responsibility of the bidding contractor(s) and may vary from this estimated value. Market conditions, acquisition strategy, and complexity of project will affect the percentages applied by bidding contractor(s).

Other Markups

Other markups included in the estimate include the following.

Contingency

Contingency has been included at a rate of 10% to cover unknown items and conditions at such an early stage of project development.

Escalation

This estimate includes escalation with the assumption the construction will commence in June 2024. The construction duration is anticipated to be 24-months and construction completion would therefore be scheduled for June 2026. Construction Escalation is applied at a rate of 13.15% extending pricing to the construction midpoint of June 2025. The escalation rate used in this cost estimate is based on construction economic data found in the NAVFAC Building Construction Cost Index (BCI), 2023-Q2 (Released August 2023).

MAJOR ASSUMPTIONS

The estimate assumes the work will be done on a competitive bid basis and the contractor will have a reasonable amount of time to complete the work. All contractors are equal, with a reasonable project schedule, with no overtime, constructed under a single contract with UTC, and no liquidated damages. This estimate should be evaluated for market changes after 90 days of the issue date.

A. Substructure – Special foundations have been included in the cost of this project. Refer to Structural Narrative.
B. Superstructure – A podium type foundation on the ground and first floors has been assumed in the development of this estimate. Floors above the concrete podium will be metal stud framed.
C. This estimate assumes normal market conditions and five or more qualified contractors competitively bidding on the project.
D. This estimate represents an opinion of probable construction costs for this project. Professional due diligence has been exercised in the preparation of this estimate. Final material selection, bidding strategies, and market conditions will vary. No guarantee is given or implied with the submission of this estimate.
E. This estimate is based on information available at the time of the Programmatic Design package dated November 2023.

ESTIMATE CLASSIFICATION

This cost estimate, as prepared, is considered a Class 5 as defined by ASTM E 2516-06, Standard Classification for Cost Estimate Classification System. It is considered accurate to -15% to +20%. This is not an offer for construction and/or project execution. This Class 5 cost estimate is assumed to represent the actual total installed cost within the range of -15 percent to +20 percent of the cost indicated. It would appear prudent internal budget allowances account for the highest cost indicated by this range as well as other site-specific allowances. The cost estimate has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, implementation schedule, and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

ESTIMATE METHODOLOGY

This estimate is programmatic in nature. Pricing has been used based on historical data from other projects similar in construction and use. Allowances have also been used for some portions of the work pending further detail arising from further project design development.

EXCLUDED COSTS

The cost estimate excludes the following costs:

A. Sales Tax
B. Material Adjustment allowances above and beyond included at the time of the cost estimate.
C. Liquidated damages associated with schedule delays or unforeseen conditions.
D. All fees associated with building permits, impact fees and inspections.
E. No costs associated with the testing or remediation of hazardous materials has been included in this estimate.

COST RESOURCES

The following is a list of the various cost resources used in the development of the cost estimate:

- R. S. Means 2023 Facilities Construction Cost Data
- CCS International Historical Data
- Local contractor feedback through telephone discussions regarding current construction market conditions
- Estimator judgment

Cost Analysis

Design Program

PARAMETER COSTING MODEL - BAR + L REDUCED HEIGHT				
COST SUMMARY	Cast In-Place Concrete with Metal Stud Framing Construction Duration 2 years - June '24 to June '26			
	245,981 SF Gross Area			
		TOTAL COST	RATE/SF	% of Total
01 - FOUNDATIONS		$2,014,953	$8.19	2%
011 - Standard Foundations		$614,953	$2.50	
012 - Special Foundations - Rammed Aggregate Piers		$1,400,000	$5.69	
02 - SUBSTRUCTURE		$297,637	$1.21	0%
021 - Slab on Grade		$297,637	$1.21	
022 - Basement Excavation		$0	$0.00	
023 - Basement Walls		$0	$0.00	
03 - SUPERSTRUCTURE		$6,796,455	$27.63	8%
031 - Floor Construction		$4,447,336	$18.08	
032 - Roof Construction		$1,630,854	$6.63	
033 - Stair Construction		$718,265	$2.92	
04 - EXTERIOR CLOSURE		$11,418,438	$46.42	13%
041 - Exterior Walls		$5,785,473	$23.52	
042 - Exterior Doors & Windows		$5,632,965	$22.90	
05 - ROOFING		$735,707	$2.99	1%
06 - INTERIOR CONSTRUCTION		$13,698,682	$55.69	15%
061 - Partitions		$8,665,911	$35.23	
062 - Interior Finishes		$2,870,598	$11.67	
063 - Specialties		$2,162,173	$8.79	
07 - CONVEYING SYSTEMS		$1,118,095	$4.55	1%
08 - MECHANICAL		$14,407,107	$58.57	16%
081 - Plumbing		$4,011,950	$16.31	
082 - HVAC		$9,364,497	$38.07	
083 - Fire Protection		$1,030,660	$4.19	
084 - Special Systems		$0	$0.00	

Note: The Net Project Construction Cost" is exclusive of the following items: A/E Design Fees, FFE, Branding & Theming (as applicable), Network Equipment, Admin & Miscellaneous. Refer to the UTC final Total Estimated Project Cost for inclusion of the above-mentioned "Below-the-Line-Items."

PARAMETER COSTING MODEL - BAR + L REDUCED HEIGHT				
COST SUMMARY	Cast In-Place Concrete with Metal Stud Framing Construction Duration 2 years - June '24 to June '26			
	245,981 SF Gross Area			
		TOTAL COST	RATE/SF	% of Total
09 - ELECTRICAL		$12,941,060	$52.61	14%
091 - Service & Distribution		$1,293,860	$5.26	
092 - Lighting & Power		$6,471,760	$26.31	
093 - Special Systems		$5,175,440	$21.04	
10 - GENERAL CONDITIONS & PROFIT - 10%		$6,342,813	$25.79	7%
NET BUILDING CONSTRUCTION COST		**$69,770,948**	**$283.64**	
11 - EQUIPMENT		$0	$0.00	0%
111 - Fixed & Movable Equipment		$0	$0.00	
112 - Furnishings		$0	$0.00	
113 - Special Construction		$0	$0.00	
12 - SITEWORK		$5,574,206	$22.66	6%
121 - Site Preparation		$353,318	$1.44	
122 - Site Improvements		$322,011	$1.31	
123 - Site Utilities		$1,598,877	$6.50	
123 - Site Utility Relo. Allow. (Design Team Rec.)		**$3,300,000**	$12.83	
124 - Off-site Work		$0	$0.00	
13 - GENERAL CONDITIONS & PROFIT - 10%		$557,421	$2.27	1%
NET PROJECT CONSTRUCTION COST		**$75,902,574**	**$308.57**	
14 - CONTINGENCIES		$14,102,698	$57.33	16%
131 - Design - 10%		$7,590,257	$30.86	
132 - Escalation (to midpoint of construction)*	7.80%	$6,512,441	$26.48	
NET PROJECT CONSTRUCTION COST		**$90,005,273**	**$365.90**	

* Contingency, used to escalate project costs to the midpoint of construction, is added in Section 13 - Contingencies. Escalation rates are based on guidance provided by the NAVFAC Building Cost Index (BCI) 2022 Quarter 4 (Released February 2023). Actual market escalation is documented through the fourth quarter of 2022. Rates are based on Consumer Price, Department of Defense project data, and UFC-3-701-01 published data.

6

Design Guidelines
Architectural Expression

ARCHITECTURE

All elements of the project should be designed to promote student life, culture and community. From landscape to interiors, the project will strive to be an asset to the university functionally and aesthetically.

The buildings shall be contextual with the primary goal of complementing the campus. Paradoxically as a large structure, the two wings will also redefine this part of campus. They should be considered as part of one whole and work to define and shape the central plaza architecturally.

Given its use on campus, its durability and its affordability, Brick shall be designated as a primary material. Brick size and detailing should be considered carefully as both can enrich the facade and impact scale. Metal panel is acceptable as an accent material to complement the brick. Natural light and visibility to and from interior spaces are both valued, so areas of glass are also encouraged where appropriate. Residence hall rooms will have operable windows governed at 4". They will be punched by nature and should be considered thoughtfully to produce a rhythm and balance on the facade. Due to the building's size, it is desirable that there be some variety in the facade so as not to be monotonous. Building proportions are important and the facade should strive toward a harmony of elements. Scale and massing of elements can be skillfully employed to help breakdown the scale of building.

The design should be timely and timeless, but not historicist. A Contemporary expression of details and construction with a respect for historical context is a goal of design and materiality. To that end, the use of quality materials is paramount. Pay special attention to color selection and the architectural profile of key elements. Ensure that window frame color works with brick selection and metal. Glass color should be as neutral as performance will allow.

To the degree possible, the design should minimize roof elements, penetrations, etc. Where they do occur, they should be grouped or organized as to not look haphazard.

LANDSCAPE

The two wings of the new residence hall define a large bisected courtyard space that generally aligns with and frames the renovated state office building. An entry pavilion punctuates this exterior space. Both upper and lower courts will be strategically landscaped to create a great campus green space. Comprised of an upper and lower area, the stepped plaza is a great amenity for both students from the residence hall proper as well as those just moving between classes. It will be an active hub for campus events and activities. Big enough to host a rally, club event or frisbee toss it will be flexible and functional. The plantings will be primarily of trees, grasses, and flowering plants, but avoiding shrubs and bushes. Landscape selections should change with the seasons, be native to the region and require low maintenance. The central spaces should mostly be an occupiable area with any decorative plants at the edges.

The mature height of trees should be proportional to the courtyard space and be in dialogue with the existing street trees on Oak and McCallie. Consider species that don't produce nuisance seeds, leaves, sap, etc. Select trees that are native and habitat reinforcing. They should be drought tolerant if possible with high limbs or limbs that can be pruned high to allow visibility at the understory.

INTERIOR DESIGN

The interior of the building should encourage a warm, welcoming, healthy and contemporary environment. Materials should be high quality, durable, recyclable and low maintenance. Where cost is a constraint, it is particularly important that durable materials are used in public and community areas that see the highest levels of use.

Lobby and Public Spaces

The spaces at the main entry to the building will see the highest level of activity and use. Accent materials should be considered to create an impactful first impression of the residential community; these materials should also perform well in terms of durability and acoustics. Examples of accent materials include: areas of carpet tile over polished concrete or terrazzo flooring, acoustic panels at the ceiling with integrated lighting. Interior glass partition systems should also be a consideration to allow for daylighting and increase openness, connections and community. Examples of appropriate locations for interior glass partitions are the main office space and the Multi-Purpose room.

The main MEP and service spaces behind the lobby should be composed of extremely durable, low maintenance materials. Where possible, the concrete structure should be exposed for durability and cost considerations.

Residential Floors

Bedroom Suites

The interior of the suites should be simple, functional, durable and low maintenance. Material suggestions include:

- Walls: paint, vinyl base
- Floor: carpet tile in bedrooms; resilient sheet flooring and base in bathrooms, vanity areas and interior circulation areas
- Ceiling: paint
- Solid surface vanity counter

Community Spaces

The finishes in the central Neighborhood spaces and the community areas at the building ends should be similar to those described above for the Lobby and Public spaces.

Design Guidelines

Architectural Expression | Massing Materiality

Concept image of New Residence Hall development; view of lower plaza from across Oak Street.

Design Guidelines

Architectural Expression | Massing Materiality

Concept image of New Residence Hall main entrance and lobby.

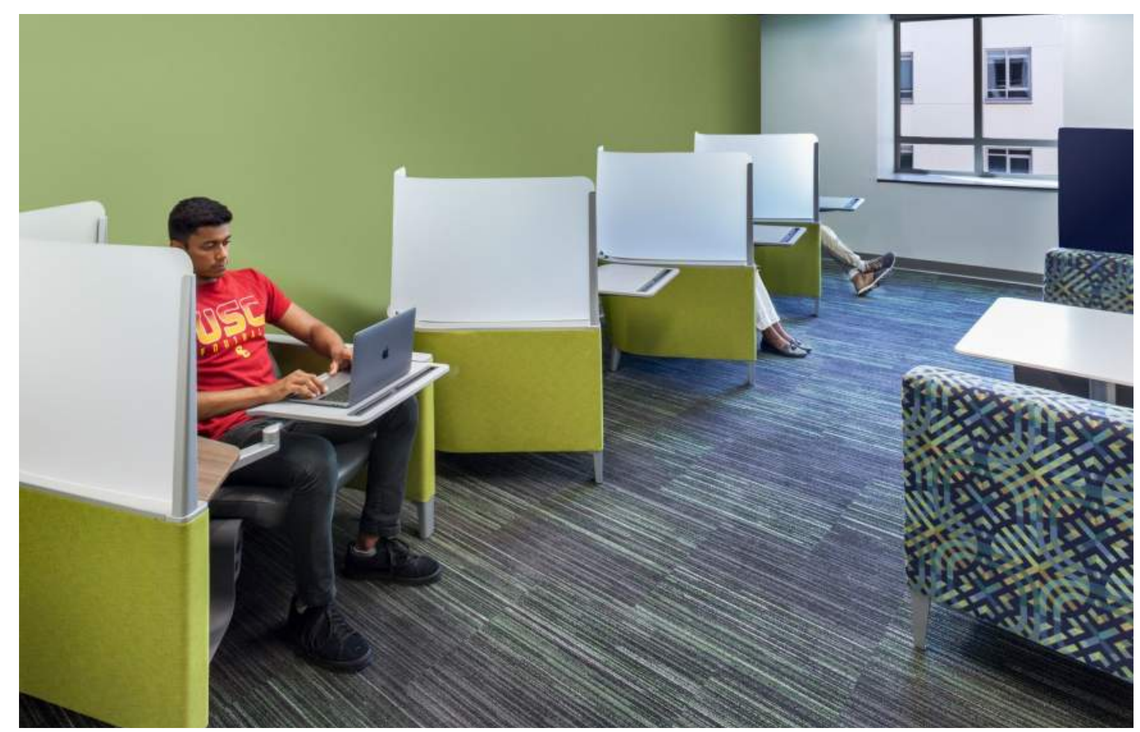
Design Guidelines

Architectural Expression | Interior Precedents

Community living or lounge space that incorporates seating for different postures (bar-height, lounge, table-height) and group sizes. Students can come to socialize or study due to the variety of seating options. This space also incorporates abundant daylighting, natural materials (wood) and inviting lighting and textures (carpet, furniture textiles in warm colors and prints.)

An informal lounge or living area that offers seating arrangements for small groups. The access to views and daylighting encourages students to leave the private space of their room to study or gather with friends.

Informal lounge or living area that encourages students to socialize in small groups or to study within a community environment.



Small "nooks" provide a great space for students to focus and study within a community environment.

Design Guidelines

Architectural Expression | Interior Precedents

Within the Central Neighborhood space of the building, recreational gaming tables can be a way to enhance community within the Community Living area.

The Community Kitchen space provides students a communal place to eat within the Central Neighborhood of their floor.

Laundry rooms that are adjacent to the Central Neighborhood living and lounge areas give students a place to spend time while waiting for their laundry. Ideally these rooms have visibility to the adjacent spaces.

Group seating within the Community Kitchen space encourages students to have meals with their neighbors, as well as an additional space to study.

Design Guidelines

Architectural Expression | Interior Precedents

An example of an Active Learning Classroom (ALC) located within a Residence Hall.

An Active Learning Classroom (ALC) within a residence hall that has direct access to daylighting and views. With movable furniture, this space is multi-function.

A smaller learning space that incorporates technology and has abundant access to daylighting and views.

A flexible studio space that can be used for various types of active learning and making.

Design Guidelines

Architectural Expression | Interior Precedents

The use of varying colors and patterns can provide a sense of identity to the distinct residential floors with the Residence Hall.

Exterior gathering spaces encourage students to socialize and study outside.

Exterior gathering spaces can give students a sense of connection to nature and to the external campus community.

7

Acknowledgments

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8

Appendix

Exhibit A | Underground Piping Relocation Study

COMPASS COMMISSIONING & DESIGN

THE UNIVERSITY OF TENNESSEE CHATTANOOGA

Underground Piping Relocation Study

University of Tennessee Chattanooga

<u>Prepared by:</u>

Compass Commissioning and Design
1605 Hamill Rd.
Hixson, TN 37343

REV-0	FEBRUARY 02, 2022	INITIAL ISSUE TO OWNER

COMPASS COMMISSIONING & DESIGN

THE UNIVERSITY OF TENNESSEE CHATTANOOGA

1. Introduction

Compass Commissioning and Design, LLC was contracted to estimate the cost and implications of relocating underground chilled water and high temperature hot water piping near Frist Hall in preparation for construction of a new dorm building. UTC supplied a sketch that showed the new dorm building footprint, which overlapped the underground piping that is planned to feed Metro Building.

The conflicting underground piping is currently being installed as part of the 2017 West Campus Utility Connections project (SBC# 540/005-06-2017) to connect the Metro building to the campus utility system. As the new dorm building is still in preliminary planning stages and it is unknown whether the project will be approved, the assumption was made that the West Campus Utility Connections project will be complete by the time the dorm project is approved and construction has begun. Therefore, the option of revising the routing as part of the West Campus Utility project was not considered.

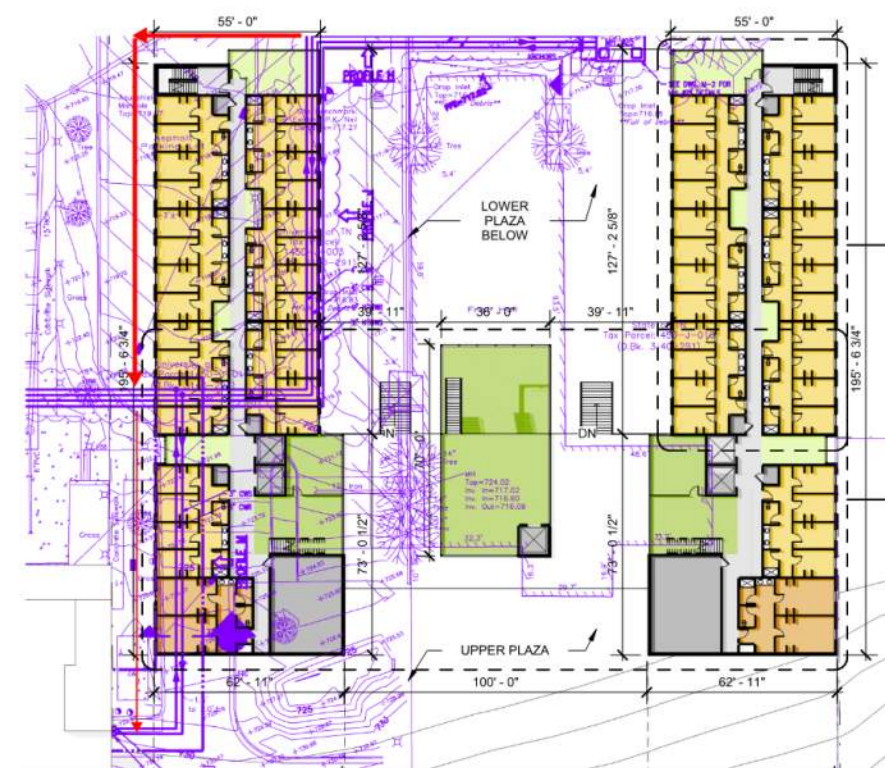


Figure 1 – Proposed Dorm Footprint Overlaid on Existing Site Utility Plan

1 | Page

Appendix

Exhibit A | Underground Piping Relocation Study

2. Scope of Work

The 4" Chilled Water (CHW) and 2" High Temperature Heating Hot Water (HTHW) piping will need to be relocated approximately 60' to the West of its current location to avoid the footprint of the new building. The 3" CHW lines that serve the East side of the Metro building will need to be relocated approximately 18' to the West.

In order to minimize the shutdown of utilities, the work will be phased such that the new piping will be laid to the extent possible before isolation, draining, and tie-in to the existing piping. The utility shutdown will only affect the Metro building, and the duration is estimated at 3 days.

Due to the utility outage, it is recommended that the work be scheduled over a long weekend or a holiday period. If that is not possible, a 500T rental chiller could be provided to serve the building during the outage period. Once tie-ins are made for the CHW and HTHW systems and Metro is served from central utilities again, the new piping will be backfilled/covered and the old piping will be excavated and removed.

See Appendix A for mechanical sketches showing the layout of the underground utilities and details of the underground pipe construction.

3. Pricing and Assumptions

Mechanical Budget Cost - $865,000.00

Includes:
- Design of new piping route & elevations
- Pipe material and fittings, by Rovanco
- Labor, materials, tools, and equipment for installation of new piping
- Security fencing, saw cutting, excavation, shoring, backfill, and removal of spoils
- Video inspection of interior of new piping prior to backfill
- Excavation and removal of existing piping shown under the footprint of the new building
- Replacement of sidewalk along Oak Street as required for new pipe routing
- Pressure testing for new piping up to tie-ins, and in service testing of all joints after tie-ins have been made

Does not include:
- Rock excavation, soil testing & bore samples
- Paving / manholes
- Removal or replacement of trees and landscaping
- Repair / replacement of any existing utilities

Rental Chiller Cost - $20,000.00

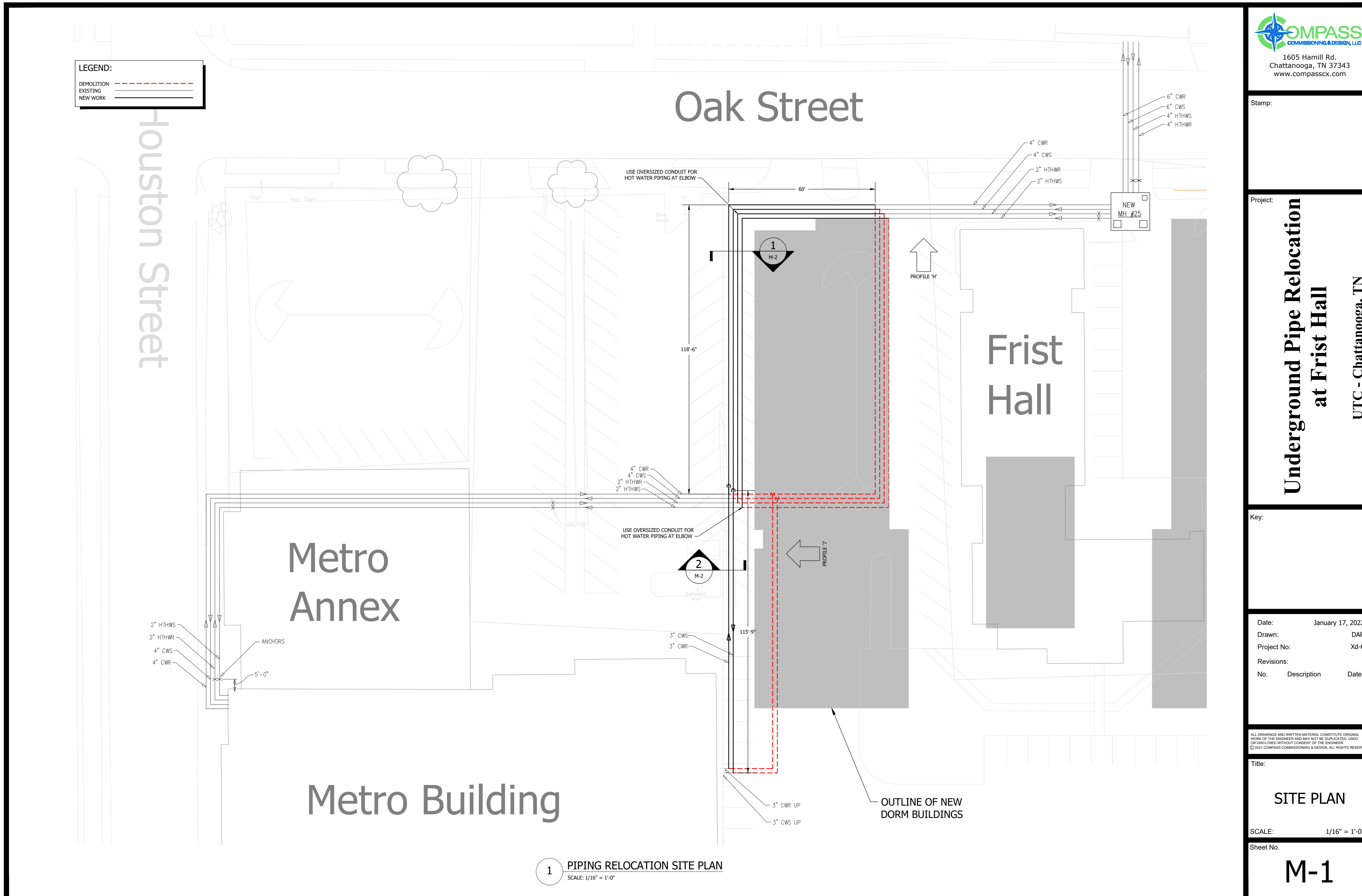
Includes:
- Rental of 500 Ton air cool chiller on trailer, with hoses and power cabling for 1 week duration
- Equipment startup is included

Total Budget Estimate - $885,000.00

Appendix A
Mechanical Sketches

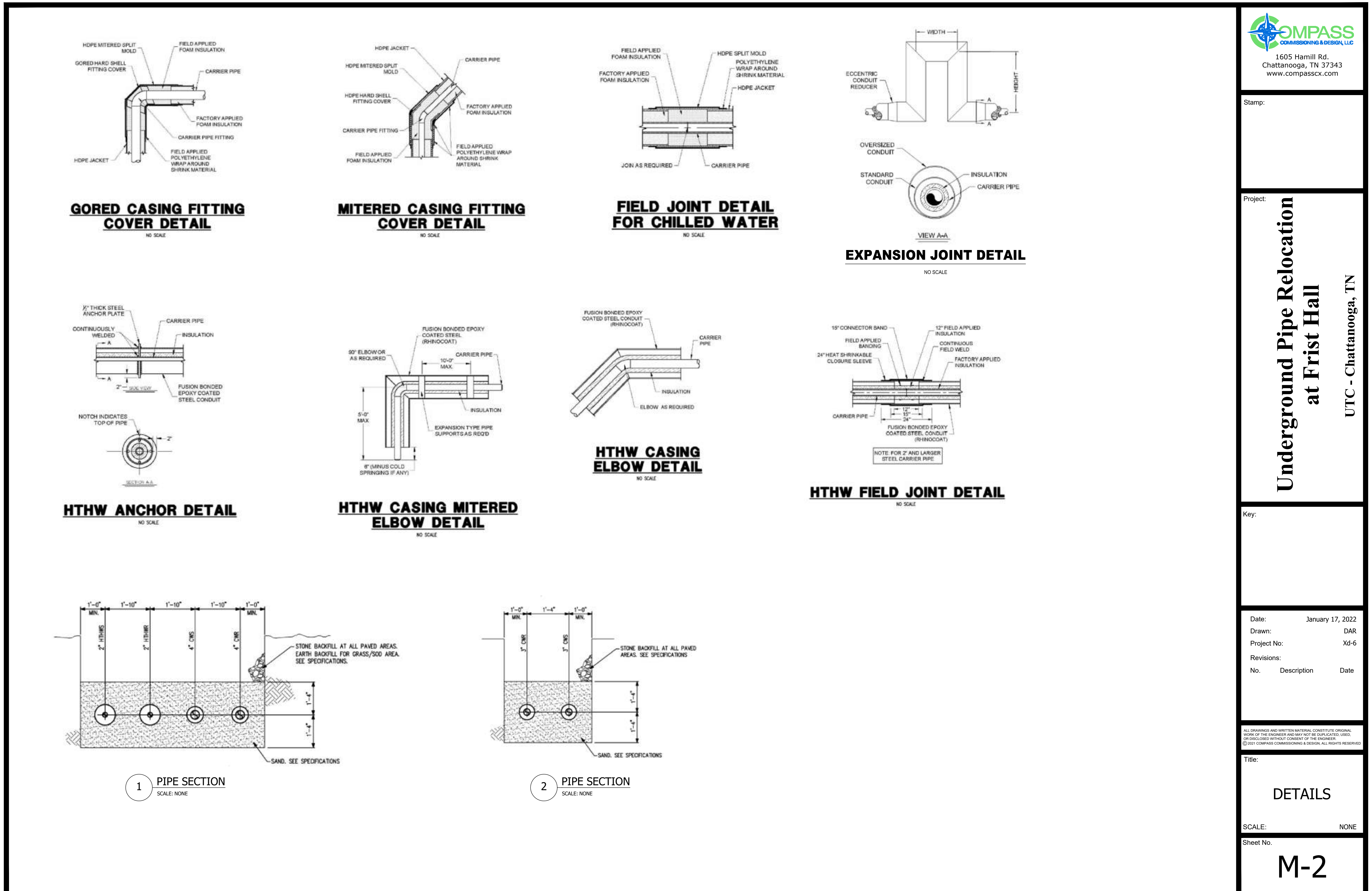
Appendix

Exhibit A | Underground Piping Relocation Study



Appendix

Exhibit A | Underground Piping Relocation Study



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March Adams & Associates Consulting Engineers

Principals
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Joe B. Hutcherson III, P.E.

Quality Engineering Since 1982

Feasibility Study
Sanitary Sewer and Stormwater Requirements
For
New Student Housing Development
University of Tennessee at Chattanooga
Chattanooga, Tennessee

Prepared For:
University of Tennessee at Chattanooga
Facilities Planning & Management

December 31, 2021

DRAFT

Prepared By:
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PO Box 3689
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March Adams Project No.: 21042

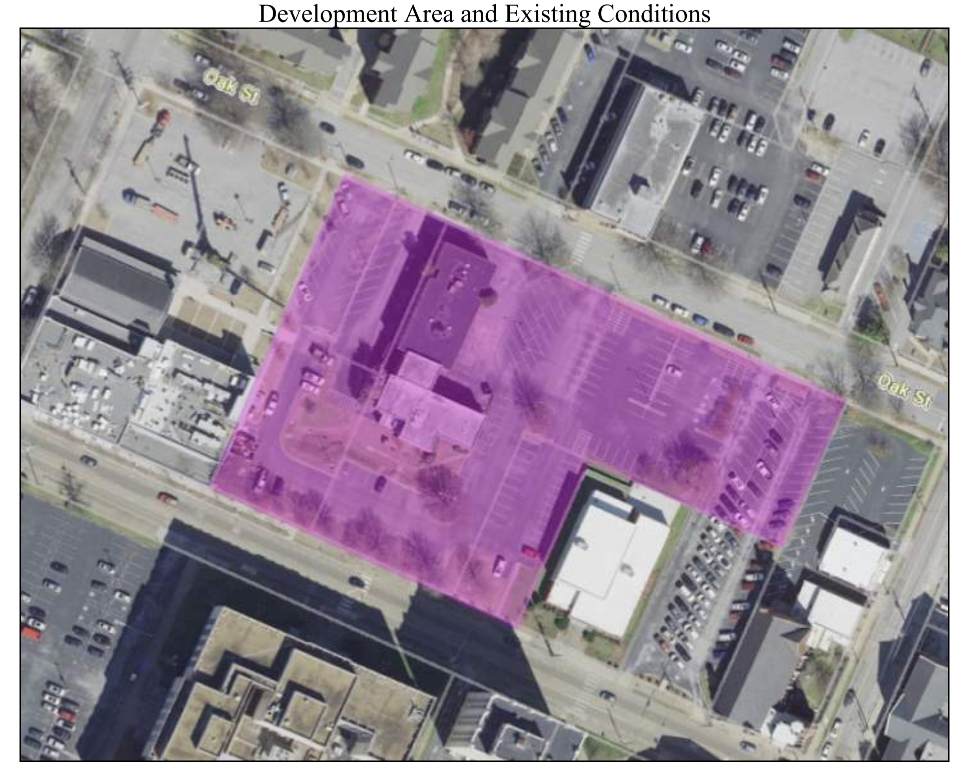
Introduction

March Adams and Associates (MAA) was contracted by the University of Tennessee at Chattanooga (UTC) to perform a feasibility study of the sanitary sewer and stormwater requirements for a proposed 900-bed housing facility on campus. This study will examine the City of Chattanooga requirements for proposed sewer calculations as well as management of post-construction stormwater runoff for the development. At the beginning of the study, UTC asked MAA to expand the scope of our services to include coordinating with Jacobs Engineering on ways to alleviate localized flooding issues in the project area due to combined sewer system surcharges. The following study will therefore cover the following:

1. Proposed sanitary sewer calculations for the development.
2. Proposed stormwater management for the development.
3. Proposed solutions for alleviating combined sewer system surcharges.

The development site is located at 510 Oak Street on UTC's campus. The housing facility would be developed on four separate lots, totaling approximately 2.02acres. The site is currently developed and is the location of an existing academics/office building and several parking areas.

Development Area and Existing Conditions

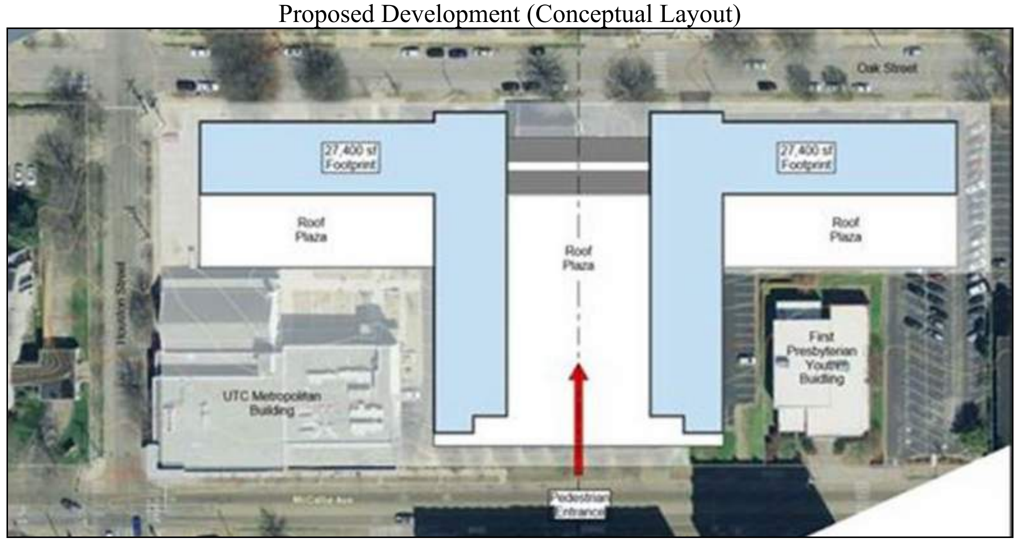


Appendix

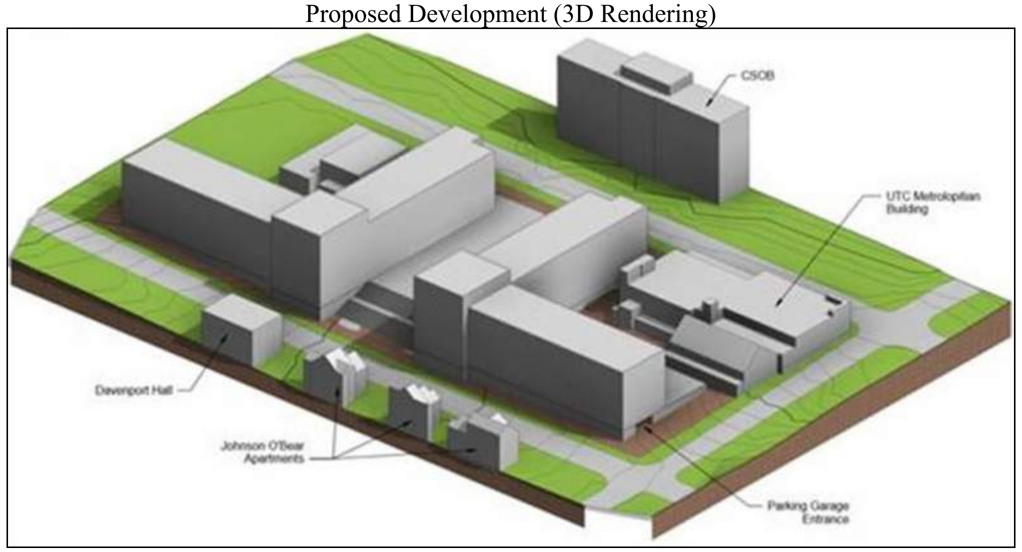
Exhibit B | Feasibility Study - Sanitary Sewer and Stormwater Requirements for New Student Housing Development

The proposed development will include two separate buildings for student housing and plazas, with a connected parking structure underneath. A restaurant, small retail shops, and office spaces are also planned for the development.

Proposed Development (Conceptual Layout)



Proposed Development (3D Rendering)



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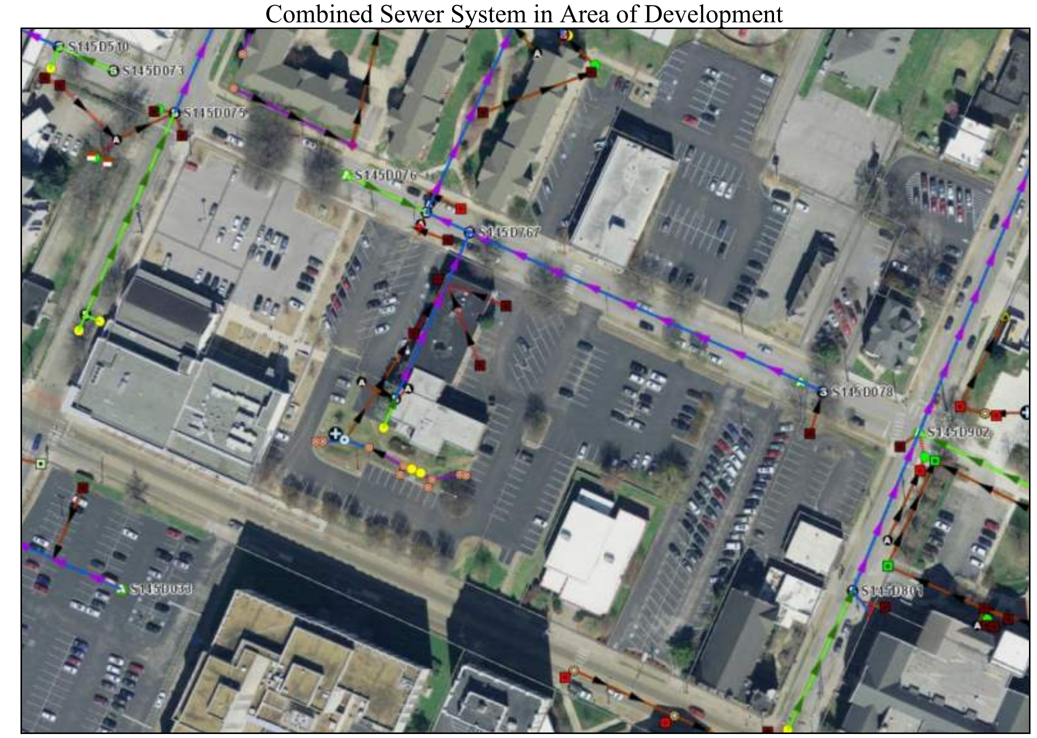
Proposed Sanitary Sewer Calculations

Sanitary sewer from the development will flow into an existing 15" diameter combined sewer pipe located in Oak Street (shown as a blue line with purple arrows in the below image). This 15" diameter pipe then turns northeast and flows through a campus housing facility towards Vine Street; this combined sewer system continues to flow down to the Citico Combined Sewer Overflow Treatment Facility.

Combined Sewer System in Area of Development



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Below are the proposed sanitary sewer calculations for the development and the resulting estimated sanitary sewer flow rate. At the time of this report, information on the existing building's use (number of classrooms, offices, etc.) was not available. However, for the purposes of this report, it was assumed that a proposed housing facility with 900 beds would generate higher sanitary sewer flow rates than the existing building.

Housing flow rates: 100 gpd/bed * 900 beds = 90,000 gpd
Restaurant flow rates: 50 gpd/seat * 250 seats = 12,500 gpd
Retail flow rates: 400 gpd/restroom * 2 restrooms = 800 gpd
Office flow rates: 25 gpd/employee * 10 employees = 250 gpd
Average Daily Flow: 103,550 gpd

Peaking Factor: 4.0 for population below 1,000

Peak Design Flow = 103,550 gpd x 4.0 peaking factor = **414,200 gpd**

$\mathbf{Q_{ss}}$ = 414,200 gpd * (1day/18hrs) * (1hr/60min) * (1min/60sec) * (1cf/7.48gal) = **0.85 cfs**

The City of Chattanooga stipulates that, when discharging into the City's combined sewer system, the sum of the sanitary sewer and stormwater runoff flow rates from a proposed development not exceed those produced from the existing conditions. When the above estimated sanitary sewer flow rate of 0.85cfs is added to the estimated stormwater runoff flow rates from the proposed development (see "Proposed Stormwater Management" section below), the total flow rates are estimated to be lower than the existing conditions flow rates. We, therefore, do not anticipate any issues with the increase in sanitary sewer flows from this proposed housing facility.

Proposed Stormwater Management

The City of Chattanooga stipulates that, for developments in a combined sewer area, stormwater runoff flow rates from the peak storm events (2-yr through 100-yr) be detained and managed onsite. Furthermore, because runoff from the site gets treated at the Citico Combined Sewer Overflow Treatment Facility, treatment of the stormwater runoff onsite is not required.

The existing site, as previously mentioned, is currently developed and is largely covered with imperious surfaces (buildings, pavements, sidewalks, etc.). The proposed development will remain largely impervious area to the point that the impervious area coverage will likely be very similar to existing conditions. Generally speaking, if the imperious area coverage is the same or slightly less than existing conditions, then stormwater runoff detention is not required. However, there are a few items that, in our opinion, will require some level of stormwater detention onsite, including a small existing detention pond, the increase in sanitary sewer flow rates previously mentioned, and the existing discharge pipe from the site being only 15" diameter in size.

Existing Detention Pond

The existing detention pond on site is small and, per our modeling, does not provide much reduction in stormwater flow rates (1.87cfs reduction in a 10-year storm event for the area draining to the pond). However, the reduction in flow rates is not negligible and reduces the flow rates to a point that not providing stormwater detention for the proposed development would result in an increase in proposed flow rates, which is not allowed.

Increase in Sanitary Sewer Flow Rates

As mentioned in the "Proposed Sanitary Sewer Calculations" section above, the proposed development will result in an estimated sanitary sewer flow rate of 0.85cfs. When combined with the proposed development's stormwater runoff flow rates, the total flow rates into the combined sewer system would exceed the existing conditions flow rates, requiring some level of stormwater runoff detention for the proposed development.

Existing Discharge Pipe

As mentioned in the "Proposed Sanitary Sewer Calculations" section above, runoff from the site discharges into an existing 15" diameter combined sewer pipe in Oak Street. Given the drainage area flowing to this pipe, 15" diameter is too small a size to adequately handle peak storm events. With the knowledge that there are combined sewer system surcharges and overflows in this area, as well as further downstream, we recommend additional stormwater detention be provided for the proposed development to help take the burden off the existing combined sewer system. By not detaining, the existing surcharging conditions will continue and potentially be worsened by the items listed above (existing detention pond, which would be removed, and sanitary sewer flow rate increases). This 15" diameter pipe, therefore, becomes the controlling factor for the proposed detention system and the runoff rates from the development should meet, or be below, the 15" diameter pipe's flow rate capacity.

Given the large footprint of the housing facility and parking structure, having available greenspace for a typical stormwater detention pond is not feasible and the most likely scenario for providing stormwater detention is an underground detention system beneath the first level of the parking structure. Other possibilities do exist for managing stormwater detention, including green roof sections or installing pervious paver systems in Vine Street. However, in our experience, green roofs tend to be premium options due to possible increased structural supports, irrigation systems, and maintenance costs and they tend to fall victim to budgeting concerns. Pervious paver systems in Vine Street are also an option, but would also add costs to the project with the large increase in pavement work and pipe systems in Vine Street. There are also concerns about existing utility lines in Vine Street, which would limit available footprints for pervious paver systems. These alternative options can be further investigated, though, if UTC would like to explore their feasibility.

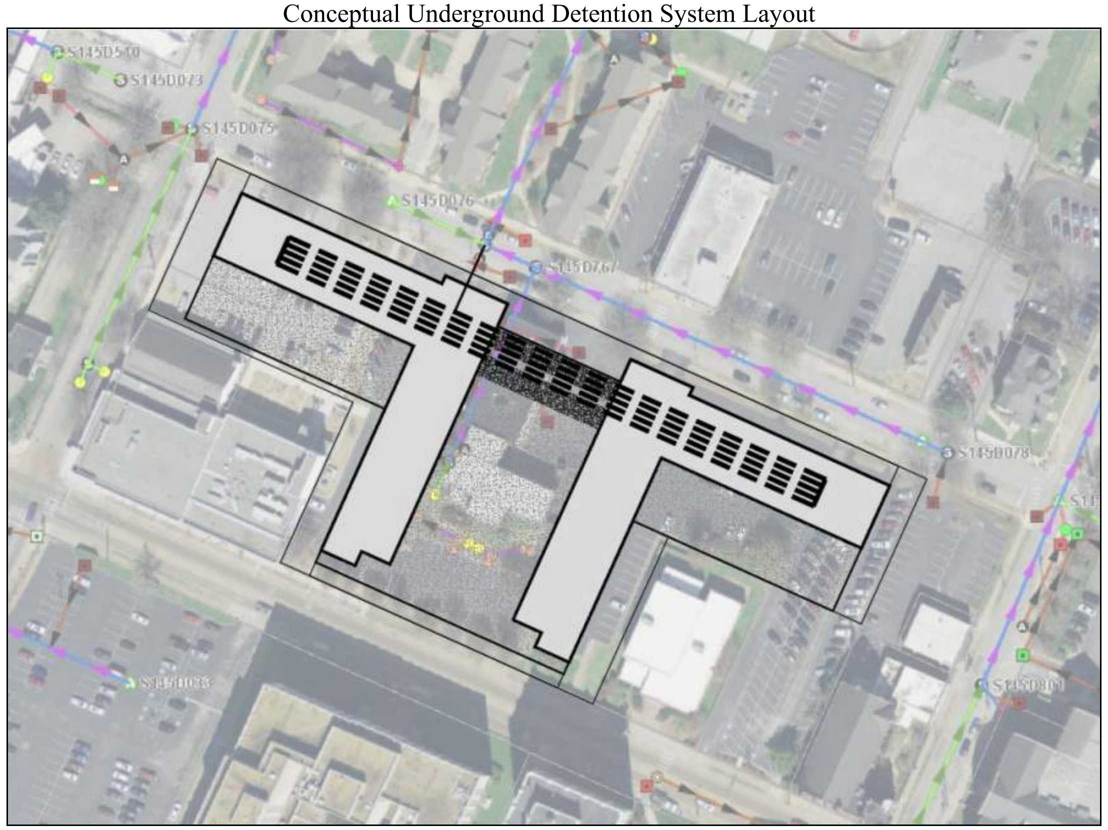
Appendix

Exhibit B | Feasibility Study - Sanitary Sewer and Stormwater Requirements for New Student Housing Development

An underground detention system would most likely consist of several runs of circular pipes or chambers, extending across the footprint of the parking structure running parallel to Vine Street (see below image for conceptual system layout). A discharge pipe from the system would connect to an existing manhole in Vine Street. This existing manhole is relatively shallow (approximately 6' deep), which limits the size of the underground pipes or chambers. To be able to drain to this manhole and still maintain adequate cover over the system below the parking level, the pipes or chambers would need to be approximately 42" diameter or smaller. This would necessitate needing more runs of pipes at longer lengths than if larger pipes were able to be utilized.

As mentioned previously, this system would be designed so the discharge flow rate would be equal to or less than the flow rate capacity of the existing 15" diameter pipe that the system is connecting to. This would reduce the existing burden on the 15" diameter pipe and help to reduce the combined sewer system surcharges and overflows. See "Exhibit A" for preliminary hydrology calculations for this conceptual underground detention system.

Conceptual Underground Detention System Layout



<u>Proposed Solutions for Alleviating Combined Sewer System Surcharges</u>

We coordinated with Jacobs Engineering on hydraulic modeling for the existing combined sewer system in the area of UTC's campus and potential solutions for alleviating or reducing surcharges and overflows. Their report is attached to this study as "Exhibit B". We recommend reading through their report in full, but below are items we want to highlight from their report.

- Section "1. Background": the report only considers the combined sewer system as the City's dedicated stormwater system is not modeled. UTC's campus is served by both the combined sewer system and the stormwater system, so deficiencies in both could be contributing to the surcharges and overflows.
- Section "2.1.1 Mabel St Regulator": in a downstream manhole, an orifice plate was discovered to be mostly covering the outgoing 42-inch pipe. Jacobs investigated and determined this orifice plate was intended to be temporary, but was never removed. After coordinating with the City of Chattanooga, this orifice plate was removed on October 26, 2021. Although the removal of the orifice plate will improve flow (see Section "3.4 Hydraulic Analysis"), surcharges and overflows are still modeled to take place during storm events, but at a reduced amount.
- Section "2.1.2 Manhole S135M904 – Concrete Slurry": in another downstream manhole, 5-inches of concrete slurry were noted in the incoming 36-inch pipe. Although this would not significantly impair flow, Jacobs coordinated with the City of Chattanooga and this slurry was removed on October 26, 2021. In this same manhole, significant inflow and infiltration was noted around the outgoing 42-inch pipe and Jacobs is coordinating with the City of Chattanooga on repairs to this pipe. Jacobs also noted that every manhole that was inspected for flow monitoring reconnaissance had some type of issue and it is recommended for UTC and the City of Chattanooga to further inspect the combined sewer system.
- Section "4. Downstream System Improvements": this section covers three potential solutions for reducing surcharges and overflows of the combined sewer system. A summary of these solutions is shown in the below table.

Table 4.1.1 Conceptual Solutions Summary

Solution	Description
Solution 1. Pipe Upsize + New Parallel Sewer Line	- Upsize 1,820-LF of the interceptor sewer line o Upsize 540 LF of 20" to 36" o Upsize 560 LF of 25" to 36" o Upsize 715 LF of 36" to 42" - New 1,450-LF, 42" parallel line from Mabel St Regulator to Citico CSOTF
Solution 2. Sewer Separation	- Separate 80 acres of combined storm and sanitary sewer
Solution 3. Pipe Upsize + Sewer Separation (Hybrid)	- Upsize 1,200-LF of the interceptor sewer line o Upsize 495 LF of 20" to 30" o Upsize 715 LF of 36" to 42" - Separate 15 acres of combined storm and sanitary sewer

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- Section "5. Conclusions and Recommendations": this section summarizes the evaluations of each potential solution listed in Section "4. Downstream System Improvements". A summary of these evaluations is shown in the below table. Jacobs ranks Solution 2 as the most preferred, as it removes the most volume of water from the combined sewer system, and Solution 1 as the least preferred, as it does not fully eliminate surcharges and overflows.

Table 5.1 Conceptual Solutions Summary

Solution	Evaluation
Solution 1. Pipe Upsize + New Parallel Sewer Line	- Does not eliminate SSO for Jun 28 - Feasibility of parallel sewer unknown
Solution 2. Sewer Separation	- Solution that removes the most volume and peak flow (8 MGD), and lowers the most the water level - Need to assess feasibility of sewer separation - May be combined with Green Infrastructure (GI) projects
Solution 3. Pipe Upsize + Sewer Separation (Hybrid)	- Hybrid solution, other variations might be identified - Need to assess feasibility of sewer separation - May be combined with Green Infrastructure (GI) projects

In order to reduce surcharges and overflows around areas of UTC's campus, major upgrades will need to be made to the combined sewer system and possibly the dedicated stormwater system. The issue is a complex one, requiring further investigation and examination, and does not necessarily have one solution for improvement. Due to the large scale of improvements to be made, one possible path forward is a phased approach over several years of comprehensive maintenance projects. While one smaller maintenance project will not solve the issue, several projects over time will help to improve the condition of the overall combined sewer system.

In the meantime, minor repairs to the combined sewer system, such as cleaning of debris and repairs of manholes and pipes, are recommended and encouraged to keep the existing system operating as efficiently as possible.

Exhibit A

Preliminary Hydrology Calculations
for
Conceptual Underground Detention System

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Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	2.190	-------	2.780	3.220	3.877	-------	4.891	Ex to Ex Pond
2	SCS Runoff	------	-------	15.53	-------	19.16	21.87	25.91	-------	32.18	Ex Bypass
3	Reservoir	1	-------	1.210	-------	1.323	1.350	3.315	-------	4.883	Ex to Ex Pond Routed
4	Combine	2, 3	-------	16.59	-------	20.38	23.17	27.25	-------	36.84	Total Ex
5	SCS Runoff	------	-------	16.34	-------	19.93	22.62	26.65	-------	32.91	Post to UG Detention
6	SCS Runoff	------	-------	1.467	-------	1.992	2.394	3.008	-------	3.974	Post Bypass
7	Reservoir	5	-------	5.640	-------	6.602	7.260	8.156	-------	9.648	Routed Post to UG Det
8	Combine	6, 7	-------	6.544	-------	7.907	8.865	10.25	-------	12.26	Total Post

Proj. file: Preliminary Hydro.gpw | Friday, 12 / 31 / 2021

Exhibit B

Report from Jacobs Engineering

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Appendix

Exhibit B | Feasibility Study - Sanitary Sewer and Stormwater Requirements for New Student Housing Development

Jacobs

D-3539100

Assistance for the UTC Housing Project

Assistance for the UTC Housing Project Report

Nov 11, 2021

Assistance for the UTC Housing Project

Project No:	D3539100
Document Title:	Assistance for the UTC Housing Project
Document No.:	
Revision:	1
Date:	November 11, 2021
Client Name:	March Adams & Associates, Inc
Project Manager:	Xavier Pedeux
Author:	Nhu Huynh and Xavier Pedeux

Jacobs Engineering Group Inc.

Appendix

Exhibit B | Feasibility Study - Sanitary Sewer and Stormwater Requirements for New Student Housing Development

Contents

Acronyms and Abbreviations

CSOTF	Combined Sewer Overflow Treatment Facility
LF	Linear feet
ft	Feet
ft^2	square feet
ft^3	cubic feet
ft/s	feet per second
gal	gallons
gpm	gallons per minute
HGL	Hydraulic grade line
SSO	Sanitary Sewer Overflow
UTC	University of Tennessee at Chattanooga

Appendix

Exhibit B | Feasibility Study - Sanitary Sewer and Stormwater Requirements for New Student Housing Development

1. Background

The University of Tennessee at Chattanooga (UTC) is a public university located in Chattanooga, Tennessee. The UTC is planning to build a new student housing on the block located between McCallie Ave, Oak St, Houston St, and Douglas St. March Adams & Associates Inc is the consultant for the UTC Housing project ("project").

The project will contribute additional flow to the existing combined sewer system in the UTC area flowing to the Citico Combined Sewer Overflow Treatment Facility (CSOTF) and to the City of Chattanooga ("City") as a whole. March Adams & Associates Inc. ("March Adams") hired Jacobs Engineering Group Inc. ("Jacobs") to perform a hydraulic analysis of the UTC area flowing to the Citico CSOTF and develop three conceptual solutions to improve the combined sewer system hydraulic conditions downstream of the project. The area is shown in Figure 1.1. The Project site is delineated in yellow while the blue outline represents the current UTC Campus area.

Figure 1.1. Overview of UTC Project and Campus area.

The UTC campus area has experienced sanitary sewer overflow ("SSOs") leading to flooding in the area during high intensity wet-weather events. Note that SSOs within the UTC campus area are not systematically reported to the City. Two (2) events in particular were reported by UTC, which occurred on June 28, 2018, and on October 30, 2019. Figures 1.2 and 1.3 illustrate the flooding issue observed during these events.

Figure 1.2 June 28, 2018 Flooding on Oak Street and Houston St near Frist Hall area.

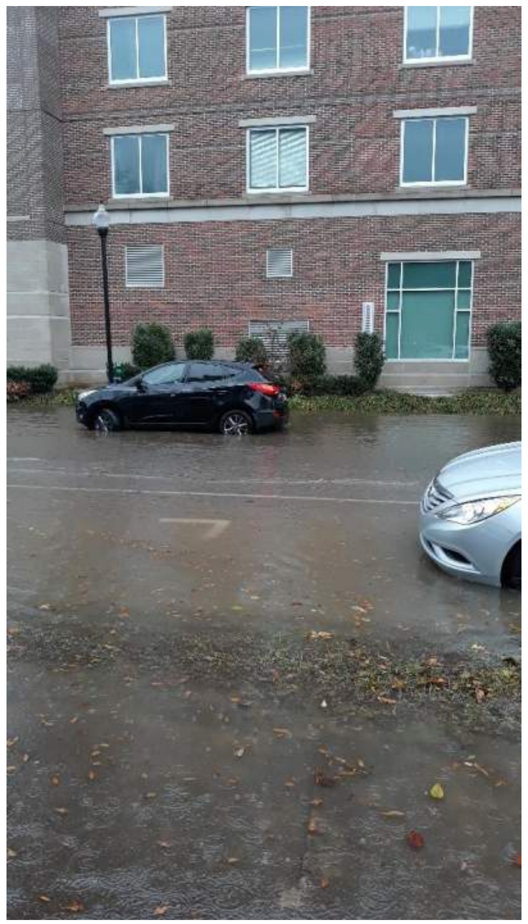


Figure 1.3 October 30, 2019 Flooding on Houston St.

This report details the study conducted by Jacobs: hydraulic analysis of the combined sewer network in the UTC area flowing to the Citico CSOTF, and the development of conceptual solutions. This analysis was performed by using the City's existing wastewater collection system hydraulic model.

Note that this study and report only considered the combined sewer system flowing to Citico CSOTF. The area is also served by a storm sewer system draining to the Tennessee River for one part, and to other drainage structures for other parts of the area. These areas where a storm sewer system exists are considered separated as they are serviced both by a storm sewer, flowing to either the river or a drain, and a sanitary sewer, flowing to the combined sewer system. The remaining areas are not separated, and both the stormwater and sanitary effluents are collected by the combined sewer system. No record of CCTV that may give indications on the storm sewers condition was found; also, the storm sewer capacity is unknown as the City's hydraulic model does not include it. It is important to note here that the combined sewer and storm sewer systems are intricately linked and that the flooding issues might be caused, best evaluated and resolved, by studying both systems concurrently.

2. Field Investigations and Flow Monitoring

At the start of the project, an existing flow meter was installed at manhole S136P041. This meter provided good flow data but unreliable water level data, therefore the hydraulic model could not be calibrated for level. As level is the key parameter for this study to evaluate sewer overflows, it was decided to relocate the flow meter in coordination with the City and ADS, the flow monitoring subcontractor to the City.

The Jacobs project team directed ADS to look for an alternate site in the upstream system.

2.1 Field Investigations

2.1.1 Mabel St Regulator

ADS was first directed to assess manhole S135M223 for meter installation. This manhole has two lids and is known as the Mabel St regulator. This manhole includes: an egg-shaped incoming pipe; a weir wall to an outgoing egg-shaped pipe; an outgoing 42-inch pipe; and an orifice plate obstructing most of this 42-inch pipe section. The Jacobs project team researched and found record drawings for the regulator. Record drawings confirm that a weir was built across the egg-shaped sewer formerly flowing to the Tennessee River, and indicate that a "temporary orifice plate" was installed on the new 42-inch sewer flowing to Citico CSOTF. These findings are illustrated in Figures 2.1.1.2 and 2.1.1.3 below. These works were performed as part of the Mabel Street-Citico C.S.O. Interceptor Sanitary Sewer Replacement Contract No. CSO 5A-98 by the City in 1998. Figure 2.1.1.4. provides a plan view of the Mabel St Regulator.

This orifice plate constitutes an obvious hydraulic bottleneck for the upstream UTC system. After verifying that the removal of this plate would not have adverse impacts to the downstream City system and based on the "temporary" nature of the plate shown in the record drawings, it was decided in coordination with the City and UTC/March Adams that the plate should be removed.

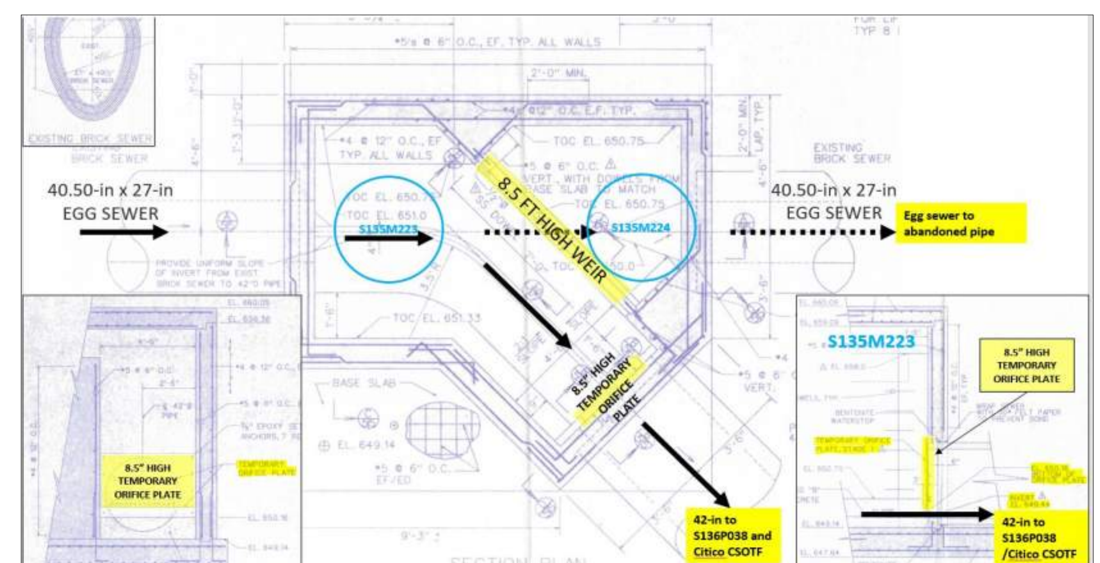


Figure 2.1.1.1. Mabel St Regulator Record Drawings (S135M223)

Figure 2.1.1.2. Incoming egg-shaped sewer and weir wall in Mabel St Regulator (S135M223)

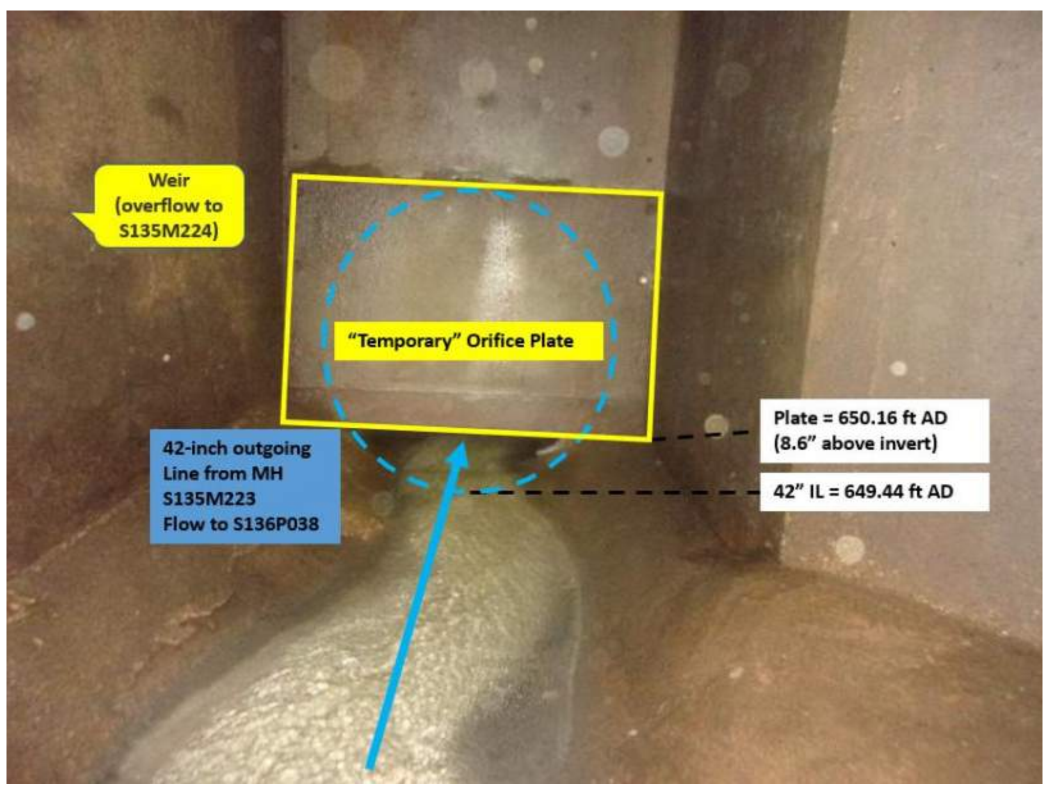


Figure 2.1.1.3. Orifice Plate in Mabel St Regulator (S135M223)

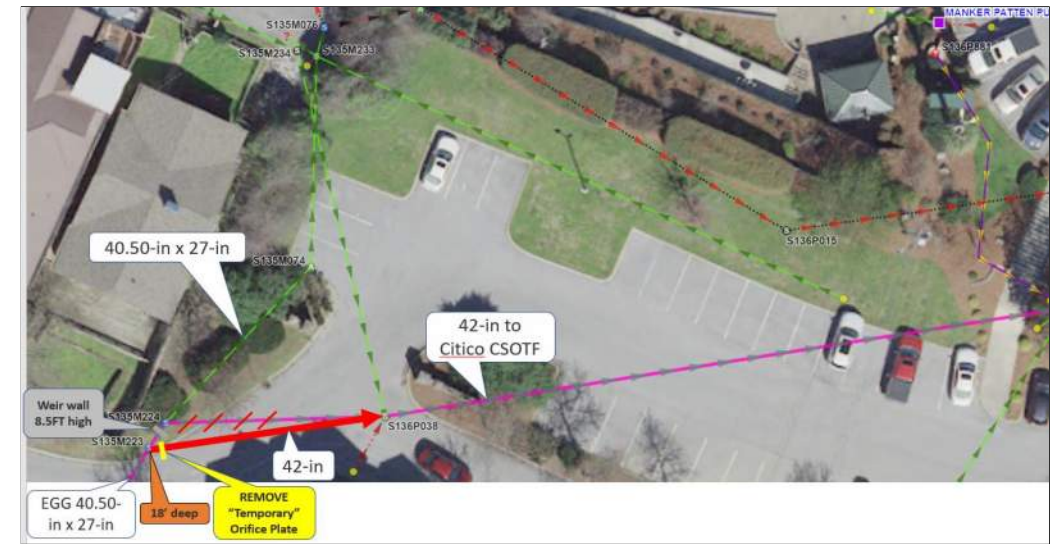


Figure 2.1.1.4. Plan view of the Mabel St Regulator (S135M223 and 224)

The City sent staff to assess the best way to remove the plate. Due to its size, the plate could not be removed out of the manhole without demolishing it. The most efficient way to eliminate the obstruction was to remove the plate from the 42-inch section and attach it to another wall in the same manhole. This was performed on October 26, 2021 as shown in Figure 2.1.1.5.

Figure 2.1.1.5 View of orifice plate relocated on the manhole wall on Oct 26, 2021.

2.1.2 Manhole S135M904 – Concrete slurry

Jacobs directed ADS to evaluate manhole S135M904 as a next candidate for a flow monitoring location. ADS reported another issue. 5-inches of concrete slurry were observed on the incoming 36-inch pipe, as shown in Figure 2.1.2.1, thereby reducing the hydraulic section of this pipe flowing from the UTC area and causing backwater.

Figure 2.1.2.1. Concrete slurry on incoming 36-inch pipe to manhole S135M904

Jacobs coordinated with the City to get the concrete slurry removed from the pipe, which was done on October 26, 2021. Note that significant Inflow and Infiltration (I/I) was observed on the 42-inch outgoing pipe from manhole S135M904 as shown in Figure 2.1.2.2. Jacobs will coordinate with the City for repairs. Jacobs will also recommend UTC/City to perform manhole inspections and CCTV of the combined sewer system (and the storm system) since issues were found at every manhole that was inspected for flow monitoring reconnaissance.

Figure 2.1.2.2. Significant I/I observed on 42-inch outgoing pipe from manhole S135M904

2.1.3 Flow Meter Installation at Manhole S135M222

The ADS flow meter was finally installed at Manhole S135M222, immediately upstream of the Mabel St Regulator, which proved to be an adequate site, on June 15, 2021. See Figure 2.1.3.1. Figure 2.1.3.2 illustrates the relative locations of the Mabel St Regulator (S135M223), concrete slurry at manhole S135M904, and flow meter site at manhole S135M222.

Figure 2.1.3.1. Flow meter installed at Manhole S135M222

Figure 2.1.3.2 Overview of field investigation and flow monitoring area.

2.2 Flow and Rainfall Monitoring Data

Data from ADS flow meter M135M222 was recorded from June 15, 2021 through August 19, 2021, along with the rainfall data from the City's rain gauge RG05 located at the nearby Orchard Knob Pump Station. Once Jacobs project team considered that sufficient and adequate wet weather flow data had been collected, the data was utilized for a smart automated model calibration. The level (depth) data shows that the pipe surcharged on 10 occasions during the monitoring period used for calibration, June 15 to August 19. Figure 2.2.1 shows the depth, velocity, flow, and rain hydrographs, as well as the depth vs. velocity scatter graph for this time period.

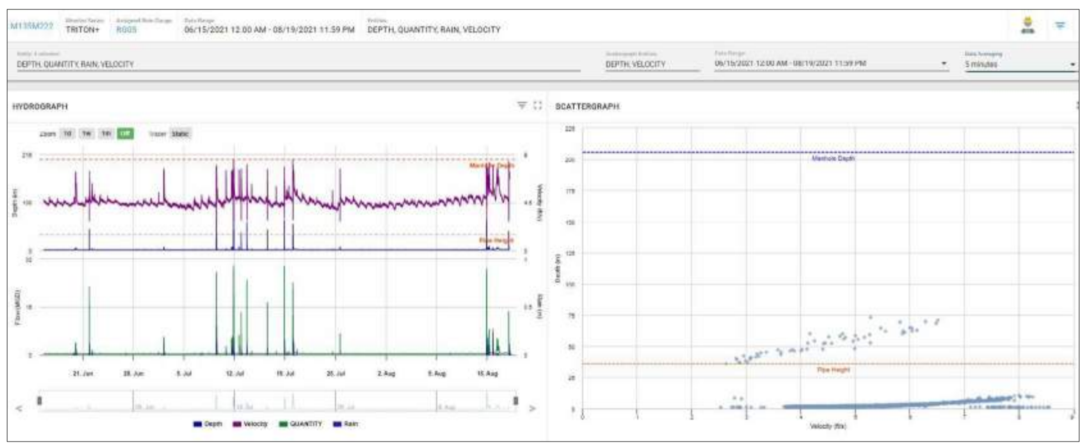


Figure 2.2.1 Flow and Rainfall Monitoring Data – June 15 to August 19, 2021

3. Hydraulic Modeling

3.1 Calibration of UTC Area Hydraulic Sub-model

A hydraulic sub-model was built in Infoworks ICM to evaluate hydraulic capacity in the UTC area. This was done by cropping the City's existing wastewater collection system hydraulic model at the former meter location, manhole S136P041. Figure 3.1.1 shows the sub-model and outlines the project location (yellow), the discharge manhole for the project (yellow arrow), and the sewer line from the project to this manhole (red line). The orifice plate discovered during field investigations was added into the model to represent the 'Existing Conditions' scenario. The model was calibrated under this scenario using the flow data monitored at manhole S135M222 by the new ADS meter, and the rainfall data recorded by the City's rain gauge RG05, for the June 15 to August 19, 2021 time period. The model sub-catchments were adjusted to reflect the dry and wet weather hydraulic and hydrologic parameters.

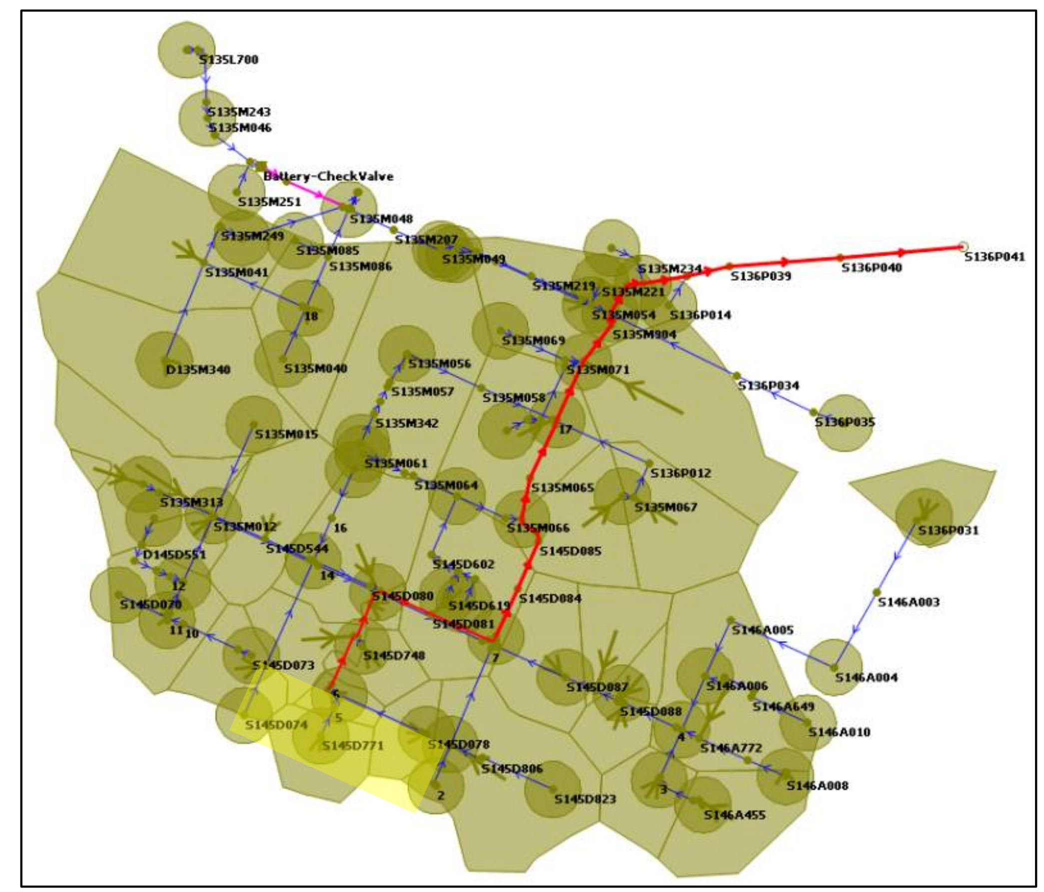


Figure 3.1.1 Overview of the Infoworks ICM Hydraulic Sub-model for the UTC area

HED

3.2 Model Validation

The model was validated using the 2 historical storm events reported by UTC as causing flooding. The characteristics of these events are shown in Table 3.2.1 and 3.2.2. The total rainfall depth is the sum of the rain recorded over the event; the peak hourly intensity is the maximum amount of rain recorded over one hour during the event; the 24-hour rainfall depth is the maximum amount of rain recorded over a 24-hour rolling interval. The maximum rainfall depth recorded over a period of 24-hour for both these events is less than the reference 2-year, 24-hour design storm (3.67 in). However, comparing to the design storm (0.4 in/hr), the rainfall intensity was 2 times higher on Oct 30, 2019, and 4.5 times higher on June 28, 2018.

The calibrated model was run under the 'Existing Conditions' scenarios for these 2 storm events. Figures 3.2.1 and 3.2.3 show the peak hydraulic grade line (HGL) along the sewer from the project to manhole S136P041 for these events. The peak HGL indicate that the model is validated for both historical events as the model predicts (or reproduces) the overflows that occurred in the Vine St area. Figures 3.2.2 and 3.2.4 present the validated results for the UTC network under the wet weather event on June 28, 2018 and October 30, 2019, respectively. In these figures, dashed red lines represent surcharged pipes caused by a pipe capacity issue. Orange lines represent surcharged pipes caused by these downstream restrictions. Pink dots represent the SSOs in the area. The model shows pipe issues and SSOs in the area, confirming that the model reproduces the observed conditions during these historical events.

Table 3.2.1. Reference 2-year, 24-hour design storm

Reference event	Duration (hours)	Total rainfall depth (in)	Peak hourly intensity (in/hr)	24-hour Rainfall Depth (in)
2-year, 24-hour design storm	24	3.67	0.4	3.67

Table 3.2.2. Historical events used for model validation

Historical event	Duration (hours)	Total rainfall depth (in)	Peak hourly intensity (in/hr)	24-hour Rainfall Depth (in)
June 28, 2018	0.7	1.76	1.76	2.22
October 30, 2019	31.9	3.03	0.8	2.58

Assistance for the UTC Housing Project Jacobs

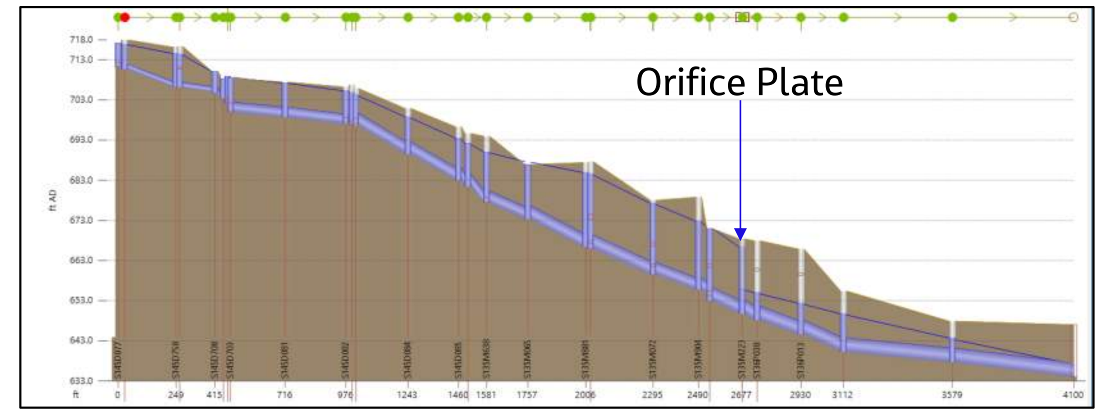


Figure 3.2.1. Predicted Peak HGL for the Jun 28, 2018 Storm Event under 'Existing Conditions' Scenario

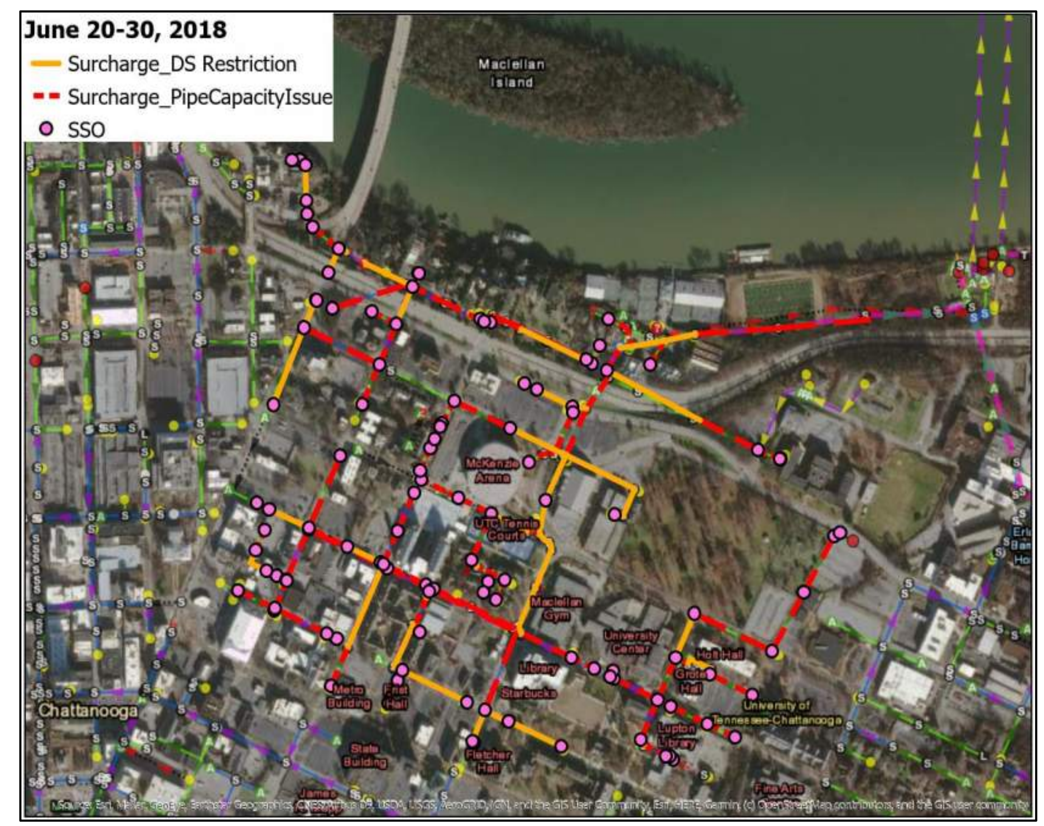


Figure 3.2.2. Predicted Pipe Surcharge and SSO for the Jun 28, 2018 Event under 'Existing Conditions' Scenario

Appendix

Exhibit B | Feasibility Study - Sanitary Sewer and Stormwater Requirements for New Student Housing Development

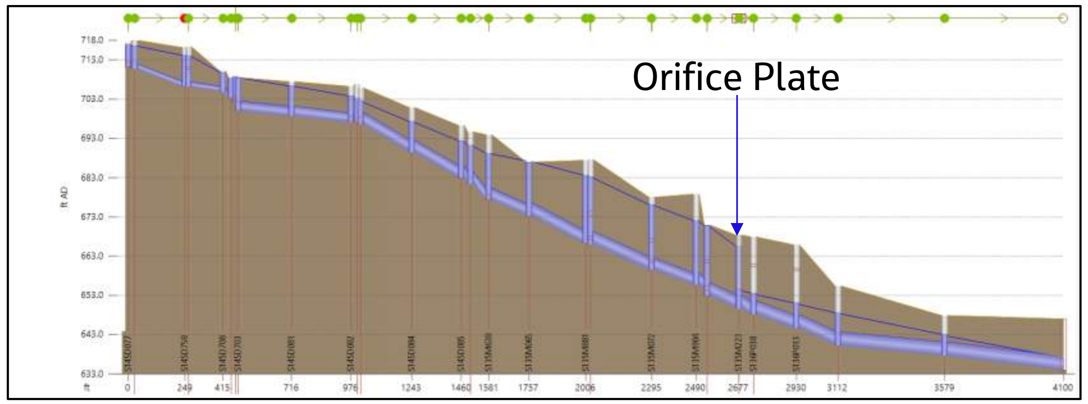


Figure 3.2.3. Predicted Peak HGL for the Oct 30, 2019 Storm Event under 'Existing Conditions' Scenario

Figure 3.2.4 Predicted Pipe Surcharge and SSO for the Oct 30, 2019 Event under 'Existing Conditions' Scenario

3.3 Flows from the UTC Housing Project

March Adams provided their stormwater and sanitary sewer flow calculations as shown in Figure 3.3.1 and Figure 3.3.2. Stormwater flow was decreased from 16.59 cfs to 6.54 cfs due to onsite detention; therefore, no storm flow was added to the model. An additional 0.1 MGD sanitary flow was added to the model catchment.

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	------	2.190	------	2.780	3.220	3.877	------	4.891	Ex. to Pond
2	SCS Runoff	------	------	15.53	------	19.16	21.87	25.91	------	32.18	Ex Bypass
3	Reservoir	1	------	1.210	------	1.323	1.350	3.315	------	4.883	Ex to Pond Routed
4	Combine	2, 3	------	16.59	------	20.38	23.17	27.25	------	36.84	Total Ex
5	SCS Runoff	------	------	16.34	------	19.93	22.62	26.65	------	32.91	Post to Pond
6	SCS Runoff	------	------	1.467	------	1.992	2.394	3.008	------	3.974	Post Bypass
7	Reservoir	5	------	5.640	------	6.602	7.260	8.156	------	9.648	Routed Post to Pond
8	Combine	6, 7	------	6.544	------	7.907	8.865	10.25	------	12.26	Total Post

Figure 3.3.1. Stormwater Calculations

Housing flow rates: 100 gpd/bed * 900 beds = 90,000 gpd
Restaurant flow rates: 50 gpd/seat * 250 seats = 12,500 gpd
Retail flow rates: 400 gpd/restroom * 2 restrooms = 800 gpd
Office flow rates: 25 gpd/employee * 10 employees = 250 gpd
Average Daily Flow: 103,550 gpd

Peaking Factor: 4.0 for population below 1,000

Peak Design Flow = 103,550 gpd x 4.0 peaking factor = **414,200 gpd**

Q_{SS} = 414,200 gpd * (1day/18hrs) * (1hr/60min) * (1min/60sec) * (1cf/7.48gal) = **0.85 cfs**

Figure 3.3.2 Sanitary Sewer Flow Calculations

3.4 Hydraulic Analysis

The updated, calibrated, and validated hydraulic model was run for the 2-year, 24-hour design storm under the 'Existing Conditions' scenario to analyze the existing hydraulic conditions in the area. Figure 3.4.1 shows the resulting peak HGL along the sewer from the project to manhole S136P041 and where the orifice plate was located. The peak HGL clearly illustrates the flow restriction caused by the orifice plate at manhole S136M223. Under the design storm, the sewer is surcharged all the way, with a predicted SSO at 1 manhole in the Vine St area (shown as a larger pink dot in Figure 3.4.2). Some of the pipe surcharge is caused by the pipe being undersized for the water flowing to it (pipe capacity issue). These pipes create a hydraulic bottleneck, causing upstream pipes to be surcharged (downstream restriction issue). These two kinds of pipe surcharge as well as SSO are illustrated in Figure 3.4.2.

Appendix

**Exhibit B | ** Feasibility Study - Sanitary Sewer and Stormwater Requirements for New Student Housing Development

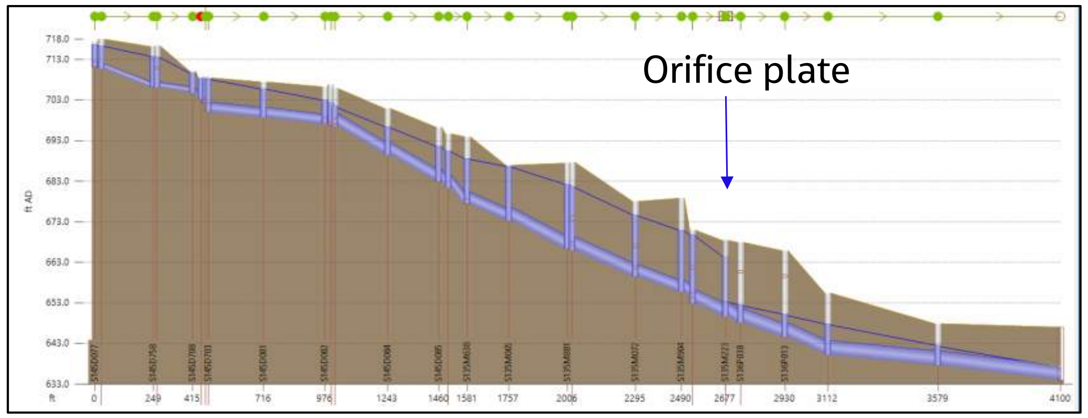


Figure 3.4.1. Predicted Peak HGL for the 2yr24hr Design Storm under 'Existing Conditions' Scenario

Figure 3.4.2. Predicted Pipe Surcharge and SSO for the 2yr24hr Design Storm

Figure 3.4.3 presents the same model results but with the orifice plate removed ('Plate Removed' scenario). The effect of the plate removal is beneficial as it will equalize the flow upstream and downstream of its former location and slightly reduce the upstream surcharge and SSOs. Model results indicate that although the plate removal will allow the combined sewer from the UTC area to flow more freely, the flooding issue still needs to be resolved. The next section presents conceptual solutions to improve the area's hydraulic conditions.

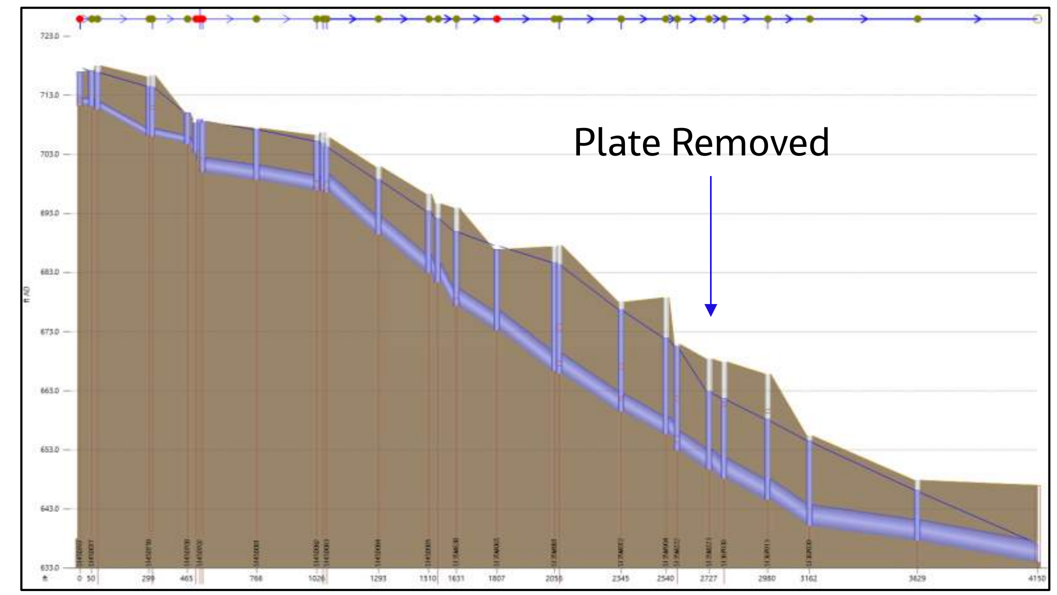


Figure 3.4.2 Predicted Peak HGL for the 2yr24hr Design Storm under 'Plate Removed' Scenario

4. Downstream System Improvements

4.1 Methodology

The primary objective of this study was to develop conceptual solutions to reduce pipe surcharge and eliminate SSO in the area. Note that in this report, an SSO is considered “eliminated” if that SSO is not predicted to activate under the modeled conditions for the referenced design storm. The calibrated model under the ‘Plate Removed’ scenario was used to develop and evaluate conceptual solutions to improve hydraulic conditions in the system.

The three following conceptual solutions were developed. Solution 1 proposes pipe upsize and a new parallel sewer line from Mabel St Regulator to Citico CSOTF; Solution 2 proposes 80 acres of sewer separation; and Solution No. 3 proposes pipe upsize and 15 acres of sewer separation.

Table 4.1.1 Conceptual Solutions Summary

Solution	Description
Solution 1. Pipe Upsize + New Parallel Sewer Line	- Upsize 1,820-LF of the interceptor sewer line o Upsize 540 LF of 20” to 36” o Upsize 560 LF of 25” to 36” o Upsize 715 LF of 36” to 42” - New 1,450-LF, 42” parallel line from Mabel St Regulator to Citico CSOTF
Solution 2. Sewer Separation	- Separate 80 acres of combined storm and sanitary sewer
Solution 3. Pipe Upsize + Sewer Separation (Hybrid)	- Upsize 1,200-LF of the interceptor sewer line o Upsize 495 LF of 20” to 30” o Upsize 715 LF of 36” to 42” - Separate 15 acres of combined storm and sanitary sewer

Three design storms (2yr, 24hr, 5yr, 24hr, and 10yr, 24hr) were used to analyze the sensitivity of each solution to larger events, along with the 2 historical storm events that were used for the model validation above.

Design Storm	Duration (hr)	Rainfall Depth (in)	Peak Hourly Intensity (in/hr)
2yr, 24hr	24	3.67	0.40
5yr, 24hr	24	4.48	0.49
10yr, 24hr	24	5.11	0.56

4.2 Solution 1 - Pipe Upsize and New Parallel Sewer Line

4.3 Solution 1 - Overview

Solution 1 proposed to upsize approximately 1,820-LF of the interceptor sewer line as outlined in Table 4.1.1. Solution 1 also proposed to install approximately 1,450-LF of 42” diameter parallel line from Mabel St Regulator to Citico CSOTF. This new sewer would be a wet weather relief sewer when a certain level is reached in manhole S135M223. This new parallel sewer capacity is required for this solution due to flow and level increase from upstream pipe upsize. Figure 4.2.1.1 shows the map of the area for Solution 1.

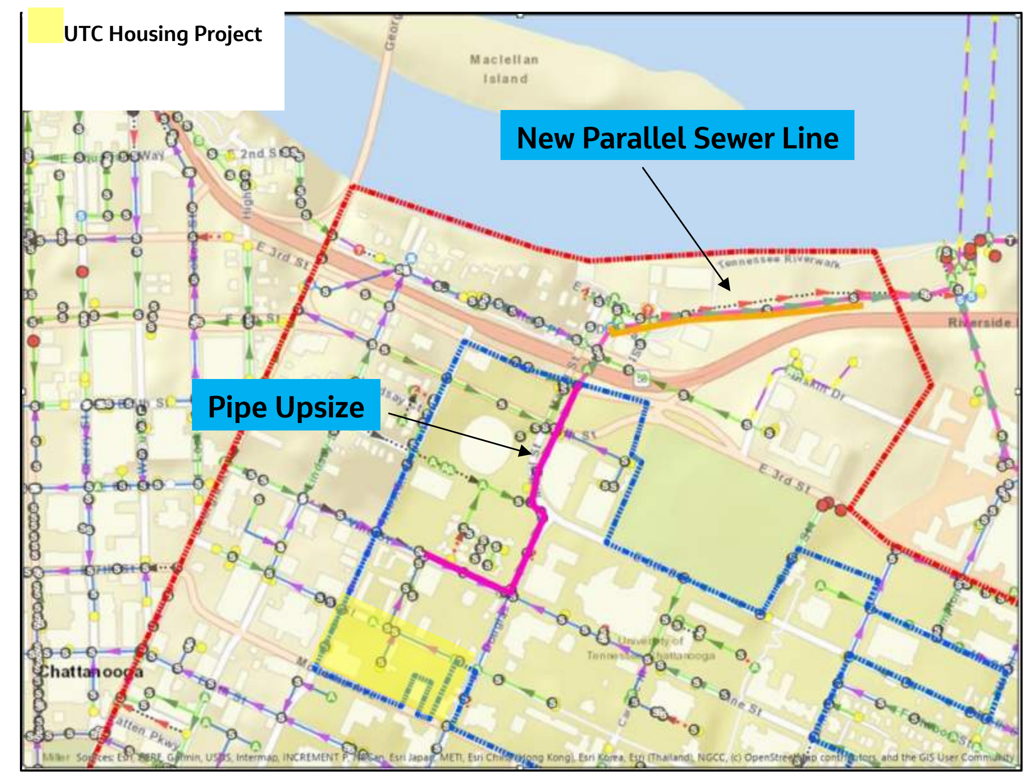


Figure 4.2.1.1 Map of the area for Solution 1

4.3.1 Solution 1 - Results

Pipe surcharge was evaluated along the main interceptor sewer line from the project to Citico CSOTF during three design storm events and two historical storm events. The results of each run are described below.

For the 2yr, 24hr design storm, the pipe surcharge was mitigated all the way on the interceptor. Figure 4.2.2.1 and Figure 4.2.2.2 compare the current system condition with the plate removal in light blue and Solution 1 in dark blue. The current system condition HGL is higher than the Solution 1 HGL, and most of the Solution 1 HGL is below the pipe crown (not surcharged). Model results indicate that Solution 1 mitigated pipe surcharge for the system, and that SSOs are eliminated under the 2yr, 24hr design storm.

Exhibit B | Feasibility Study - Sanitary Sewer and Stormwater Requirements for New Student Housing Development

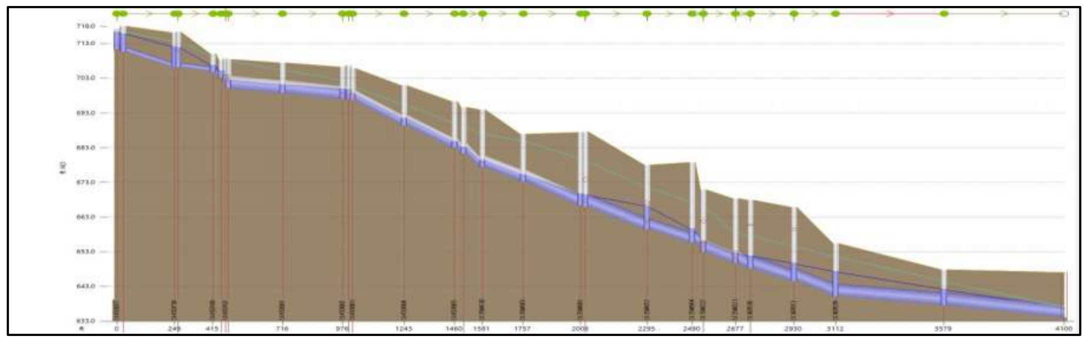


Figure 4.2.2.1. Predicted Peak HGL, 2yr24hr design storm - Solution 1 vs. 'Plate Removed' Scenario (along existing line).

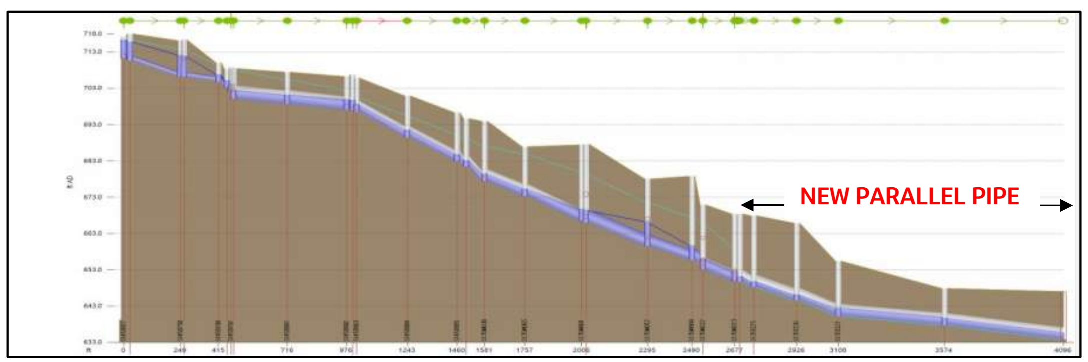


Figure 4.2.2.2. Predicted Peak HGL, 2yr24hr design storm - Solution 1 vs. 'Plate Removed' Scenario (along new line).

Figure 4.2.2.3 and Figure 4.2.2.3 show that Solution 1 will still mitigate pipe surcharge and eliminate SSO under the 5yr, 24hr and 10yr, 24hr design storms. Figure 4.2.2.3 and Figure 4.2.2.4 compare the 2yr, 24hr design storm in dark blue to the 5yr, 24hr and 10yr, 24hr design storm, respectively, in light blue. Even though the light blue is a higher HGL than the dark blue, it remains below ground and mostly within the pipe.

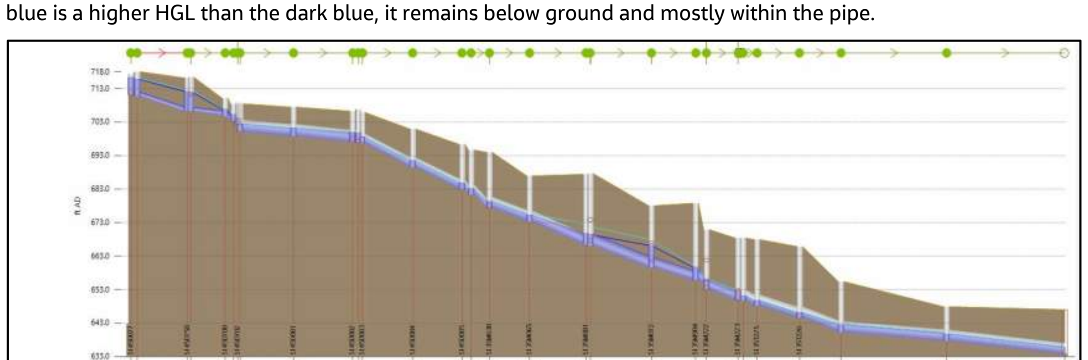


Figure 4.2.2.3. Predicted Peak HGL for Solution 1 - 5yr, 24hr vs. 2yr, 24hr design storm

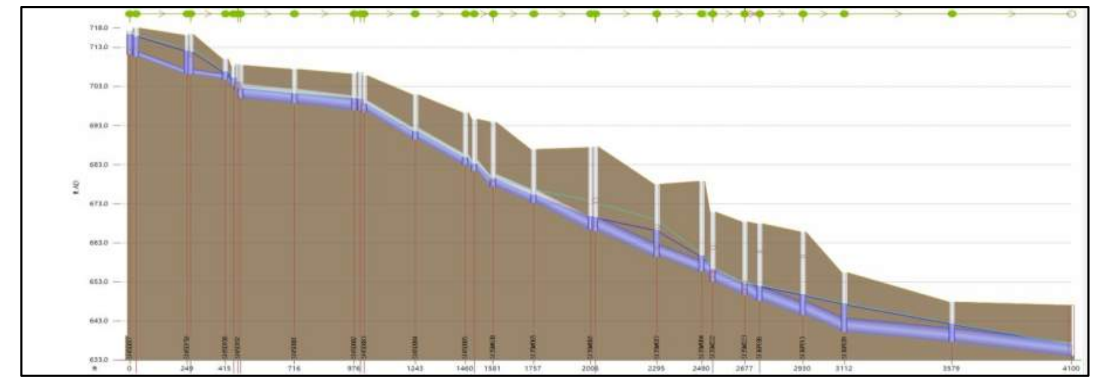


Figure 4.2.2.4 Predicted Peak HGL for Solution 1 - 10yr, 24hr vs. 2yr, 24hr design storm

Solution 1 eliminates SSOs under the 3 design storms; however, this solution would not eliminate SSO during a high intensity rainfall event like the one observed at the end of June 2018. Figure 4.2.2.5 and 4.2.2.6 compare the peak HGL under the 'Existing Condition' scenario, shown in light blue, and the peak HGL under Solution 1, shown in dark blue, respectively for the observed rain events June 28, 2018 and October 30, 2019.

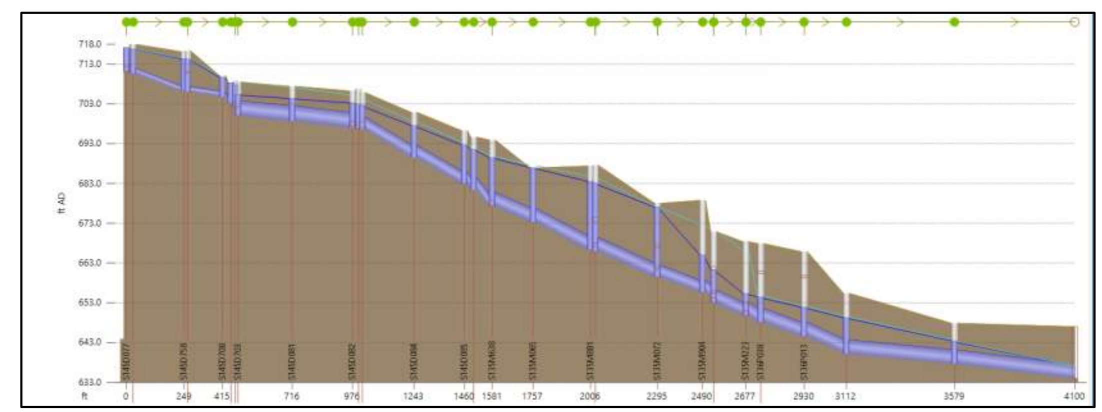


Figure 4.2.2.5. Solution 1 vs. 'Existing Condition' scenario under June 28, 2018 storm event.

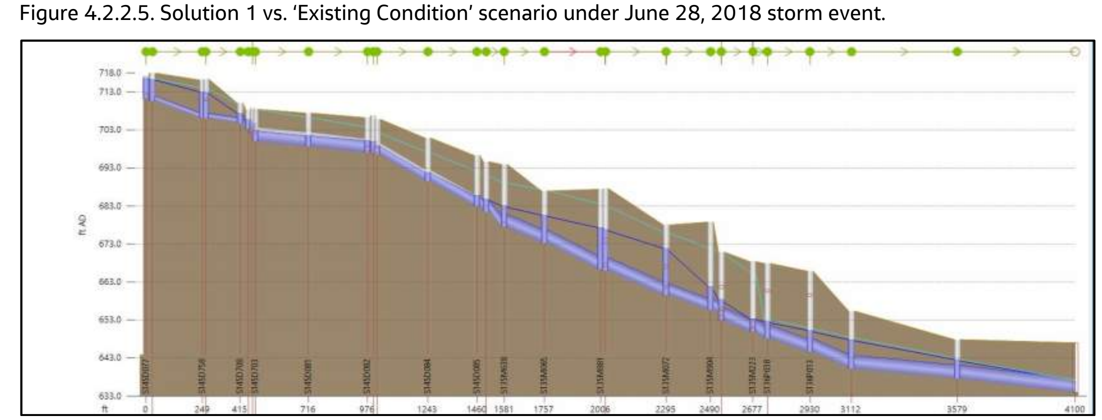


Figure 4.2.2.6. Solution 1 vs. 'Existing Condition' scenario under Oct 30, 2019 storm event.

4.4 Solution 2 - Sewer Separation

4.4.1 Solution 2 - Overview

Solution 2 proposes to separate stormwater from the combined sewer system over an 80-acre area of currently non-separated sewers (see Figure 4.3.1.1). This involves re-directing the storm drainage to the nearest and adequate existing storm sewer and keeping the existing combined sewer in use for sanitary effluents. This solution assumes that it is feasible to do so and that the storm sewer system has the capacity to accommodate these additional stormwater flows.

It has been estimated that approximately 3,600-LF of new storm sewers would be required for separation of these areas. The size of these new storm sewers (not estimated as part of this study) might be reduced if Green Infrastructure (GI) projects are put in place.

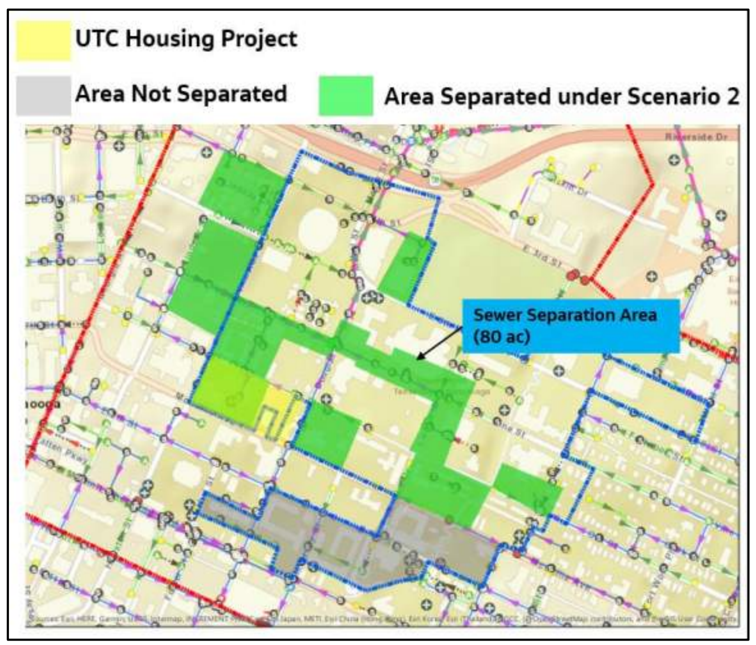


Figure 4.3.1.1 Solution 2 – Overview

Figure 4.3.1.2 presents the proposed separated areas under Solution 2 in green, and the required new storm sewer lines in dashed red arrows. The drainage lines within the green areas and currently combined with the combined sewers would be re-routed to the nearest existing storm sewer.

Figure 4.3.1.2. Solution 2 - Conceptual view of new storm sewer lines for separation

4.4.2 Solution 2 - Results

Pipe surcharge was evaluated for the main interceptor sewer line from the project to Citico CSOTF during 3 design storm events and 2 historical storm events. The results of each run are described below.

For the 2yr, 24hr design storm, pipe surcharge is mitigated all the way along the interceptor. Figure 4.3.2.1 and Figure 4.3.2.2 compare the current system conditions with the plate removed, in light blue, with Solution 2, in dark blue. The current condition HGL is higher than the Solution 2 HGL, and most of the Solution 2 HGL is below the pipe crown. Model results indicate that Solution 2 mitigated pipe surcharge all the way, and that SSOs are eliminated under the 2yr, 24hr design storm. This solution also reduces peak flow in the interceptor sewer by 8 MGD.

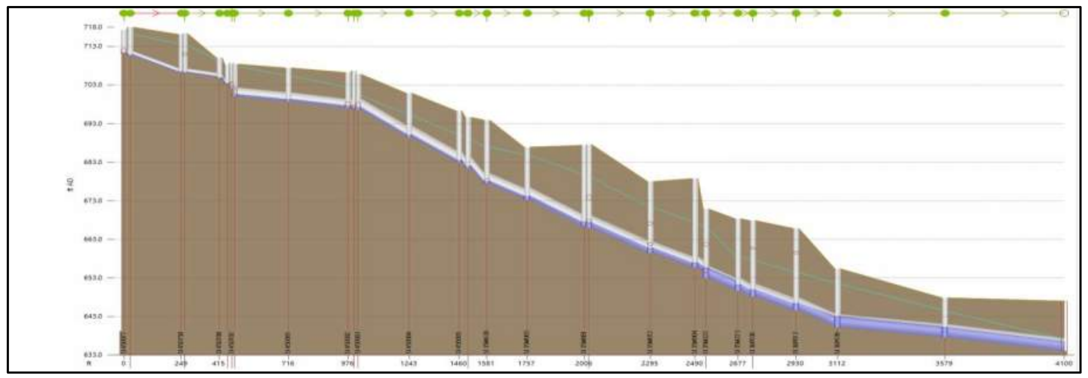


Figure 4.3.2.1 Predicted Peak HGL for the 2yr, 24hr design storm - Solution 2 vs. 'Plate Removed' Scenario.

Figure 4.3.2.2 and Figure 4.3.2.3 show that Solution 2 will mitigate pipe surcharge and eliminate SSO under the 5yr, 24hr and 10yr, 24hr design storms. Figure 4.3.2.2 and Figure 4.3.2.3 compare the 2yr, 24hr design storm in dark blue to the 5yr, 24hr and 10yr, 24hr design storm, respectively, in light blue. Even though the light blue is a higher HGL than the dark blue, it remains below ground and mostly within the pipe.

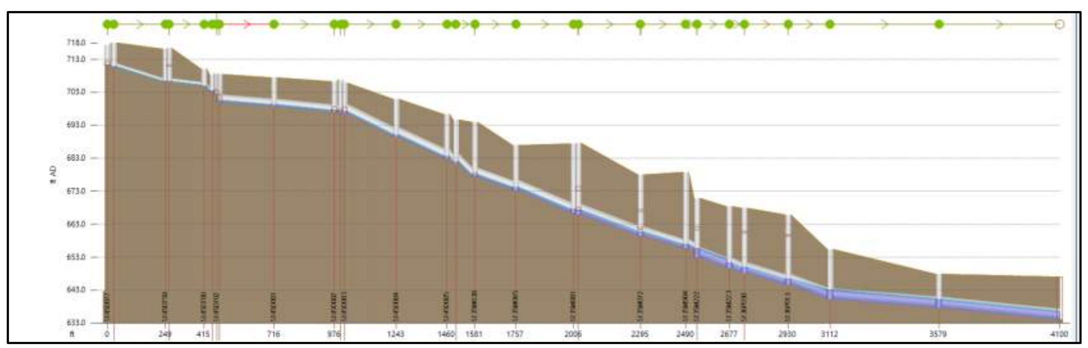


Figure 4.3.2.2. Predicted Peak HGL for Solution 2 - 5yr, 24hr vs. 2yr, 24hr design storm

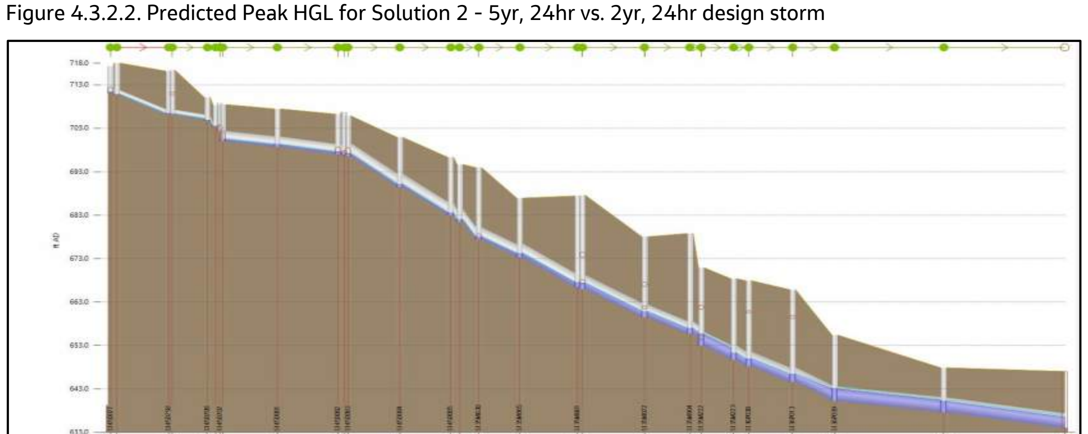


Figure 4.3.2.3. Predicted Peak HGL for Solution 2 - 10yr, 24hr vs. 2yr, 24hr design storm

Solution 2 also eliminates SSOs during an event like the one observed at the end of June 2018 and October 2019. Figure 4.3.2.4 and Figure 4.3.2.5 present Solution 2 in dark blue, and 'Existing Condition' in light blue under the June 28, 2018 and October 30, 2019 events, respectively. The Solution 2 HGL is much lower than the existing conditions HGL, and most of the Solution 2 HGL is below the pipe crown.

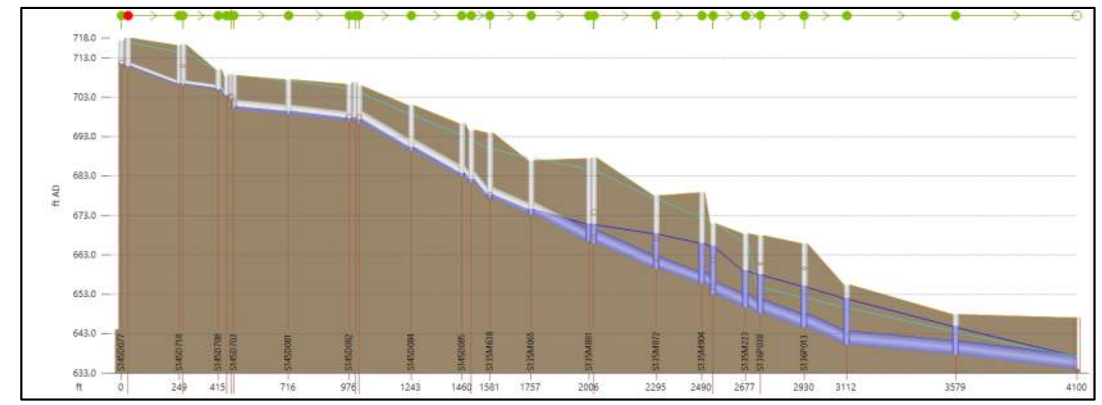


Figure 4.3.2.4. Solution 2 vs. the 'Existing Condition' scenario under June 28, 2018 storm event.

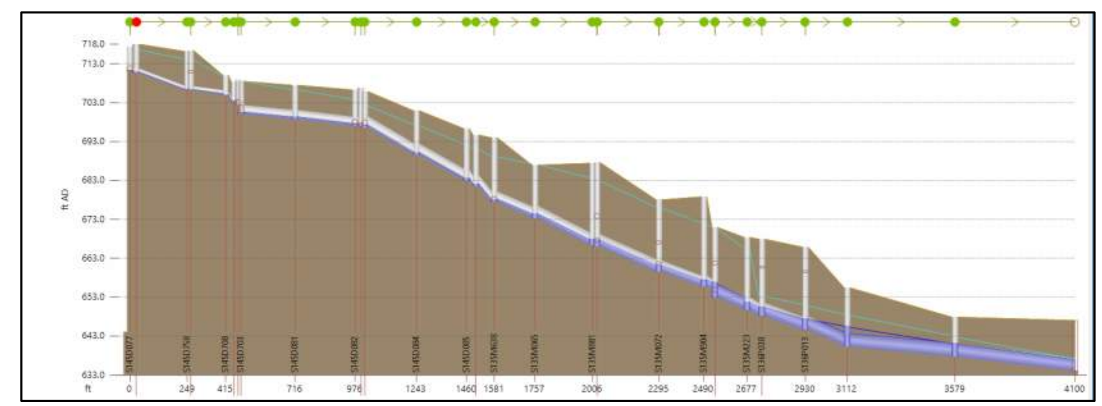


Figure 4.3.2.5. Solution 2 vs. the 'Existing Condition' scenario under Oct 30, 2019 storm event.

4.5 Solution 3 - Pipe Upsize and Sewer Separation

4.5.1 Solution 3 - Overview

Solution 3 proposed a hybrid solution with the upsize of approximately 1,200-LF of sewer interceptor (495 LF of 20" upsized to 30", and 715-LF of 36" upsized to 42") and the separation of 15 acre of currently non-separated sewers. This solution assumes that it is feasible to separate the sewers and that the storm sewer system has the capacity to accommodate these additional stormwater flows. Figure 4.4.1.1 presents the proposed pipe upsize in pink, areas separated under Solution 3 in green, area not separated in gray.

It has been estimated that approximately 1,850-LF of new storm sewers would be required for separation of these areas. The size of these new storm sewers (not estimated as part of this study) might be reduced if Green

Infrastructure (GI) projects are put in place. Figure 4.4.1.2 shows a conceptual view of the new storm sewer lines required for sewer separation in Solution 3.

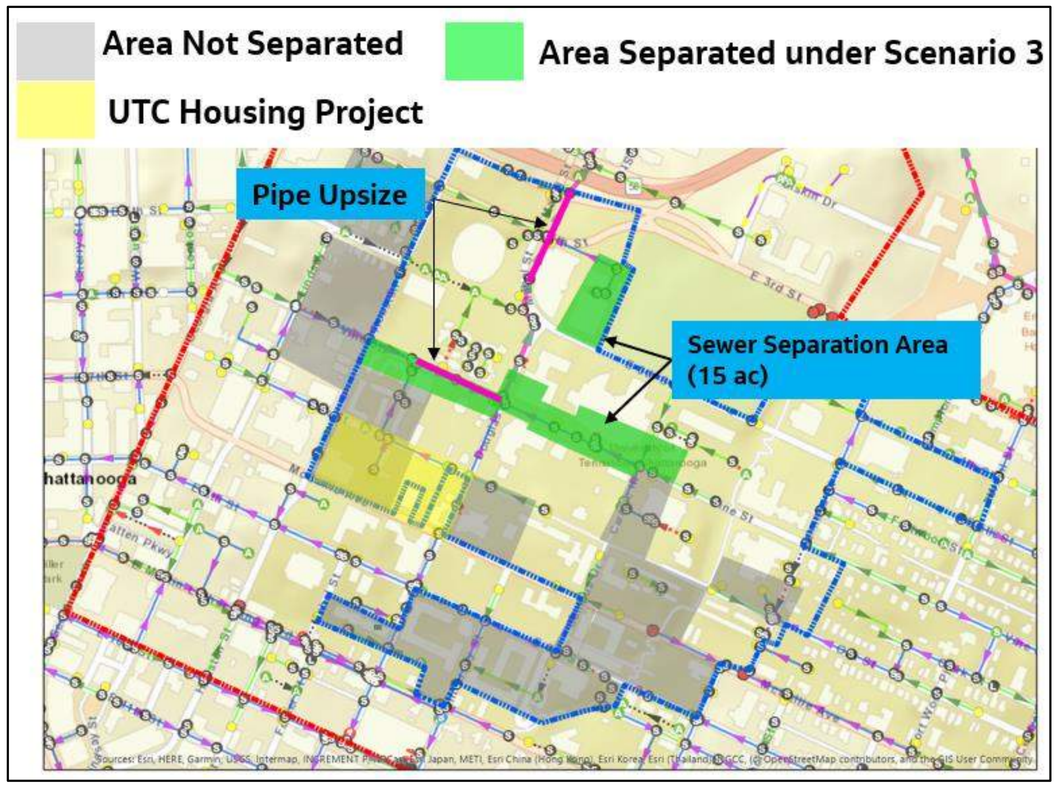


Figure 4.4.1.1 Solution 3 - Overview

Assistance for the UTC Housing Project

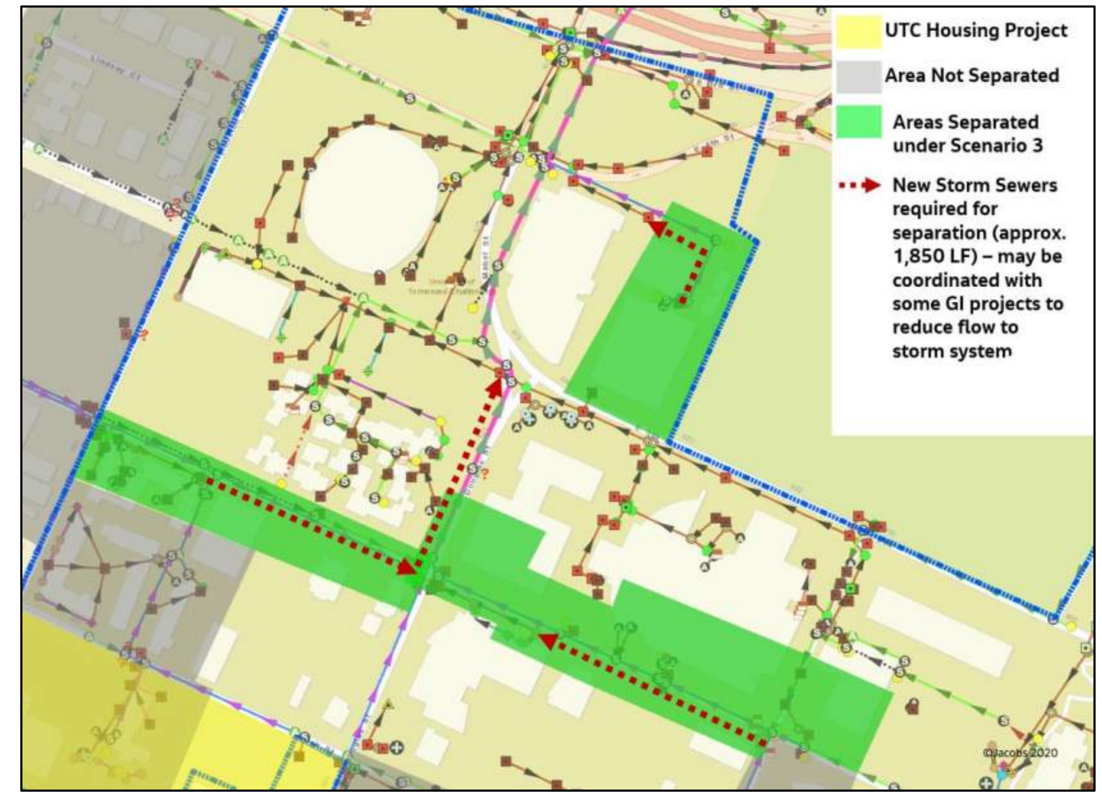


Figure 4.4.1.2 Solution 3 - Conceptual view of new storm sewer lines for separation

4.5.2 Solution 3 - Results

Pipe surcharge was evaluated for the main interceptor sewer line from the new UTC housing to the Citico CSOTF during (3) design storm events and (2) historical storm events. The results of each run are described below.

For the 2yr, 24hr design storm, the pipe surcharge is mitigated all the way on the interceptor. Figure 4.4.2.1 presents the comparison of the current system condition with the plate removal in light blue and Solution 3 results in dark blue. The current condition HGL is higher than the Solution 3 HGL, and most of the Solution 3 HGL is below the pipe crown. This indicates that Solution 3 mitigated pipe surcharge all the way, and that SSOs are also eliminated under the 2yr, 24hr design storm.

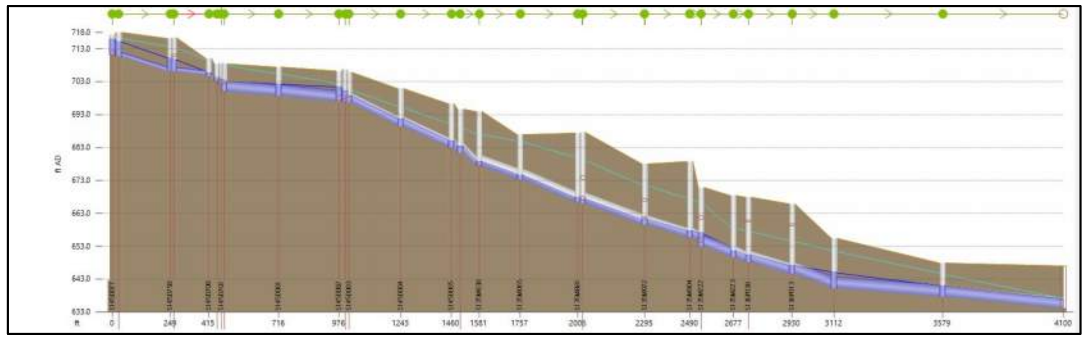


Figure 4.4.2.1 Predicted Peak HGL for the 2yr, 24hr design storm - Solution 3 vs. 'Plate Removed' Scenario.

Figure 4.4.2.2 and Figure 4.4.2.3 show that solution no. 3 will mitigate pipe surcharge and eliminate SSO under the 5yr, 24hr and 10yr, 24hr design storms. Figure 4.4.2.2 and Figure 4.4.2.3 compare the 2yr, 24hr design storm in dark blue to the 5yr, 24hr and 10yr, 24hr design storm, respectively, in light blue. Even though the light blue is a higher HGL than the dark blue, it remains below ground and mostly within the pipe.

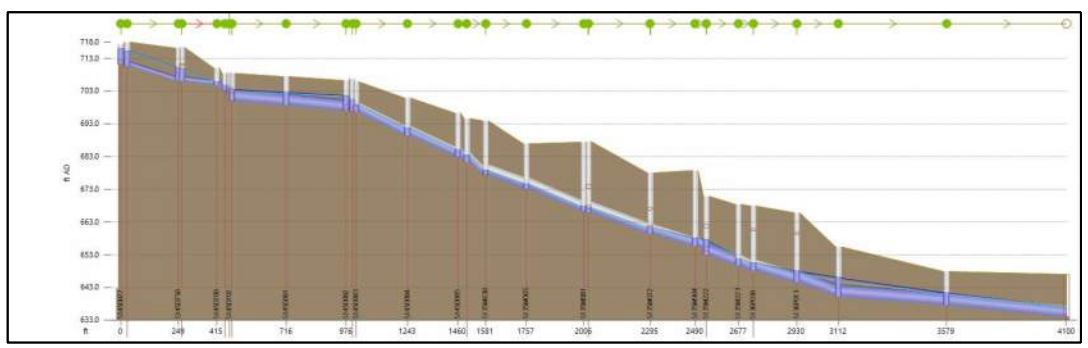


Figure 4.4.2.2 Predicted Peak HGL for Solution 3 - 5yr, 24hr vs. 2yr, 24hr design storm

Figure 4.4.2.3 Predicted Peak HGL for Solution 3 - 10yr, 24hr vs. 2yr, 24hr design storm

Solution 3 also eliminates SSOs during an event like the one observed at the end of June 2018 and October 2019. Figure 4.4.2.4 and Figure 4.4.2.5 present the Solution 3 HGL in dark blue, and the 'Existing Condition' HGL in light blue under June 28, 2018 and October 30, 2019 events, respectively. The Solution 3 HGL is much lower than the existing conditions HGL, and most of the Solution 3 HGL is below the pipe crown.

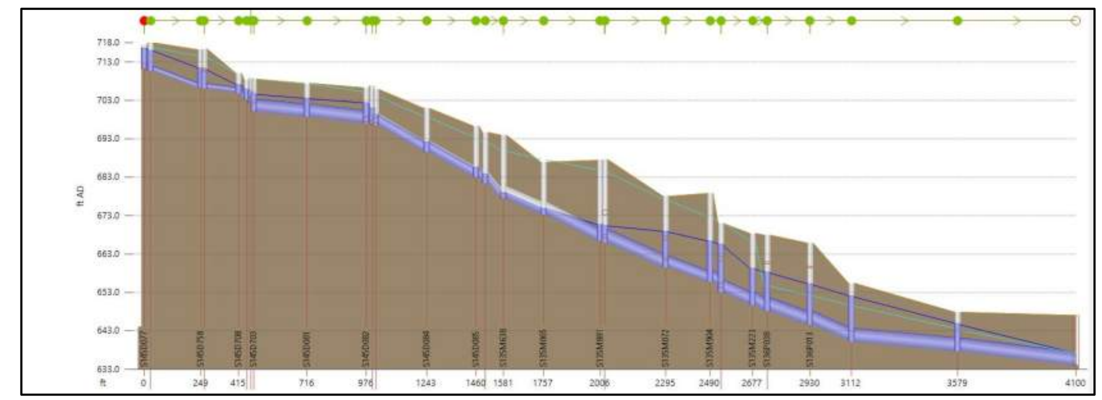


Figure 4.4.2.4. Solution 3 vs. the 'Existing Condition' scenario under June 28, 2018 storm event.

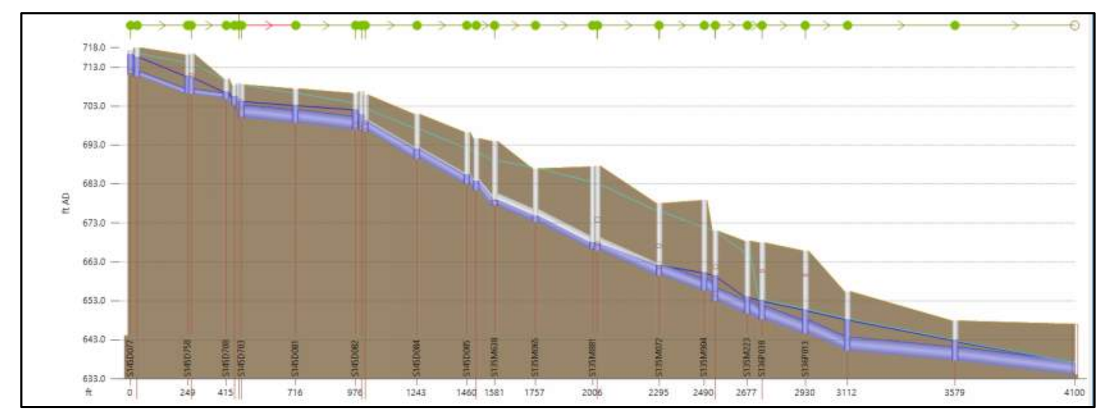


Figure 4.4.2.5. Solution 3 vs. the 'Existing Condition' scenario under Oct 30, 2019 storm event.

5. Conclusions and Recommendations

This study presented an opportunity to find and resolve field issues. The removal of the orifice plate at the Mabel St regulator on October 26, 2021 will improve hydraulic conditions in the UTC area. The calibrated model validated the historical overflow events reported by UTC and was used to assess the current hydraulic conditions and bottlenecks in the area.

With this model, three conceptual solutions were developed and evaluated to further mitigate pipe surcharge and eliminate SSOs in the area under the design storm condition. All three solutions demonstrate successful SSO elimination and pipe surcharge mitigation during the 2yr, 24hr, 5yr, 24hr, and 10yr, 24hr design storms. Solution 1, however, does not fully eliminate SSOs. Also, the feasibility of a new parallel sewer between Mabel St regulator and Citico CSOTF is unknown. This solution is the least preferred solution. Solution 2 is the most preferred solution as it removes the most volume of water from the combined sewer system and may be combined with GI projects. However, the feasibility of 80 acres of sewer separation needs to be evaluated. Solution No. 3 presents an example of a hybrid solution combining upsize and separation that may be implemented if sewer separation is not feasible everywhere.

Table 5.1 Conceptual Solutions Summary

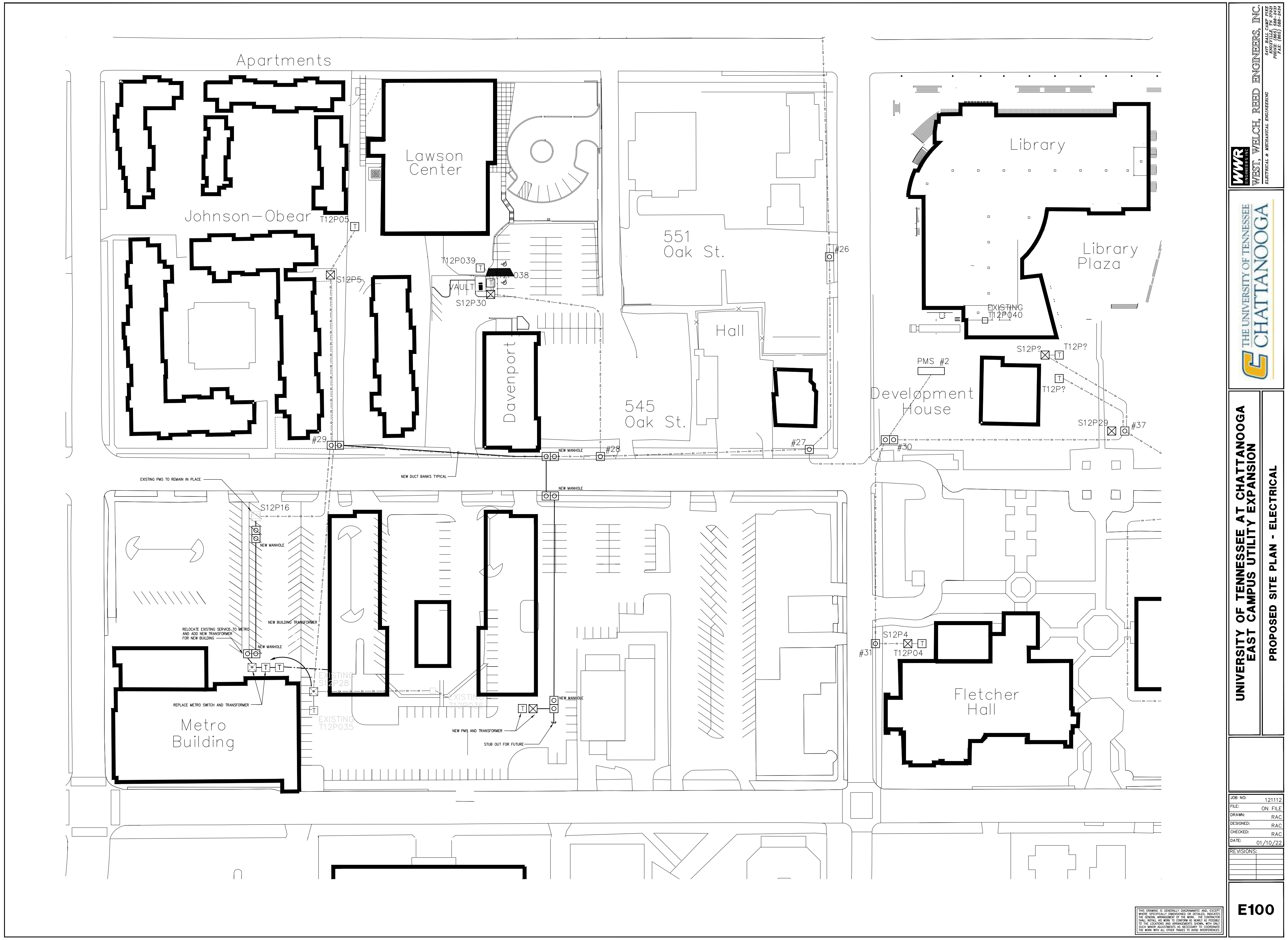
Solution	Evaluation
Solution 1. Pipe Upsize + New Parallel Sewer Line	- Does not eliminate SSO for Jun 28 - Feasibility of parallel sewer unknown
Solution 2. Sewer Separation	- Solution that removes the most volume and peak flow (8 MGD), and lowers the most the water level - Need to assess feasibility of sewer separation - May be combined with Green Infrastructure (GI) projects
Solution 3. Pipe Upsize + Sewer Separation (Hybrid)	- Hybrid solution, other variations might be identified - Need to assess feasibility of sewer separation - May be combined with Green Infrastructure (GI) projects

As a follow-up to this study, Jacobs would recommend taking the next steps below:

- Perform (UTC or City) manhole inspections and CCTV of combined sewer system and storm sewer system to assess condition, identify potential blockages, hydraulic bottlenecks, and other issues
- Perform flow monitoring at several locations of the storm sewer system to collect flow data for a sufficient number of wet weather events (at least 5)
- Develop Storm Sewer Hydraulic Model, potentially supported by some field investigations to confirm drainage catchments, pipe locations, sizes, and inverts
- Combine the storm model with the existing combined sewer system model
- Calibrate the model using the flow monitoring data and the City's rain gauge RG05 rainfall data
- Perform hydraulic analysis to assess storm system capacity, hydraulic bottlenecks, and overall hydraulic conditions of the area; assess whether the storm sewer system contributed to the flooding observed during the historical events; assess whether the storm sewer has the capacity to accommodate additional flows from sewer separation; develop overall solutions considering both storm system and combined system condition and capacity.
- Select one optimal solution, perform design, bid and construction.

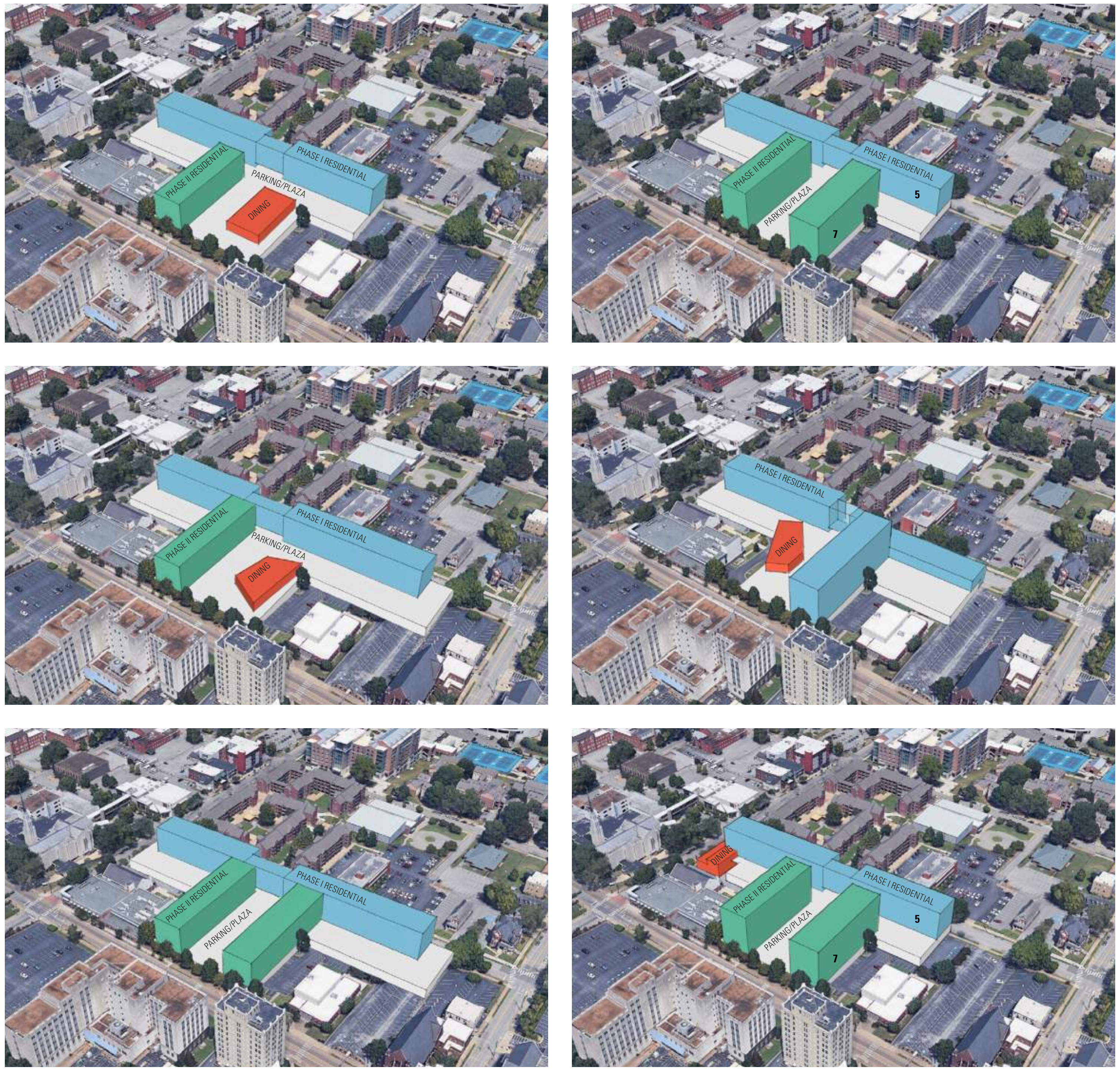
Appendix

Exhibit C | Feasibility Study - High Voltage



Appendix

Exhibit D | Programming Process Meeting Summaries



Site Design Massing Studies

PROGRAMMING KICK-OFF MEETING | 05.06-13.2021

Summary

Introduction of UT Chattanooga's project vision and goals for the New Residence Hall and Parking Garage Programming Study to the broader team. The team reviewed the scope of the programming study and the process through which the design would be developed. The purpose of this meeting was to facilitate conversation about massing options and preferred unit types. The initial programming assumptions were as follows:

- New Residence Hall to be Freshman-focused
- University interest in exploring a Residential College model
- UTC students consider housing to be one of the top factors in choosing to attend UTC; the majority of the existing housing has a single-bed (private) room style
- Initial feasibility study shows the project site supporting:
- (2) 450-bed residence hall wings; total 900 beds
- Parking podium that accommodates 600 parking spaces
- The projected project budget will not support the full 900 beds; project construction cost will determine the feasible number of beds to be built in Phase I
- Dining or a small commercial space should be studied as a programmatic component to the residential and parking program

Existing Site Considerations

The long edge of the site runs parallel to Oak Street, which is envisioned as a major pedestrian way for the University in the future. While the University is currently undergoing a new master planning process, it is understood that the proposed design for the New Residence Hall and Parking Garage needs to address and contribute to the pedestrian quality of Oak Street. Other key site considerations include:

- The proposed site is in the UTC Special Permit area
- The cross-slope of the site has a topographic elevation increase of roughly twenty (20) feet from Oak Street to McCallie Avenue

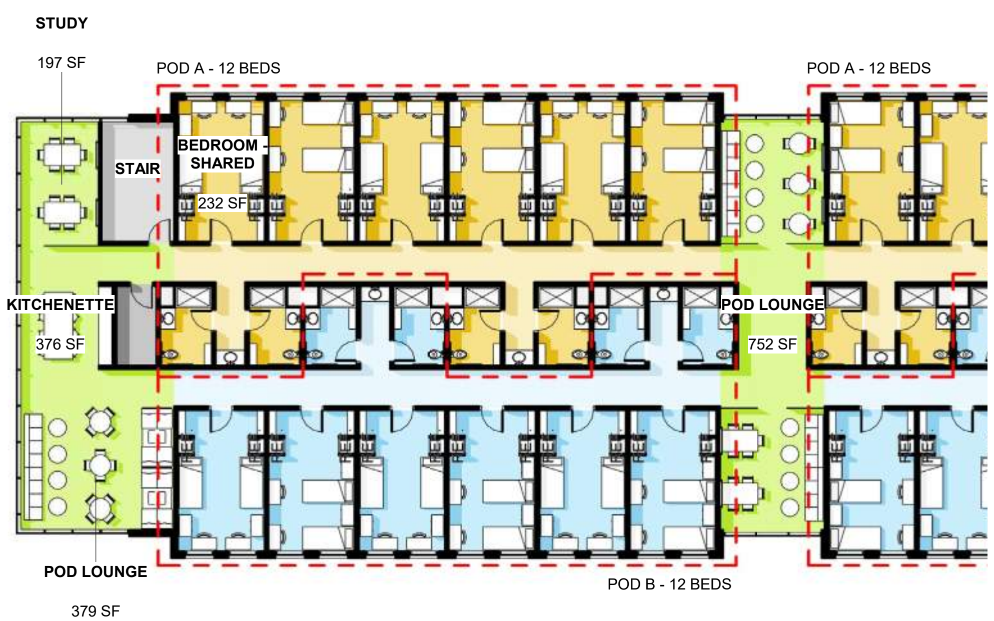
Site Design Massing Studies

A series of massing strategies were presented for discussion that study the scale and distribution of program on the site. The key takeaways from these massing studies were as follows:

- Maximizing the building density on the North (Oak Street) edge of the site is the most efficient programmatically
- The entry to the existing Metro Building must be considered in all programming options
- The building scale should be varied along Oak Street to avoid creating a "wall" effect
- The separation of the dining program from the residential will allow for project phasing, if necessary
- Phase II residential could be constructed as perpendicular building wings that connect into a Phase I residential "bar" along Oak Street
- A single, consolidated residential entry point is a priority from both a security and operations perspective

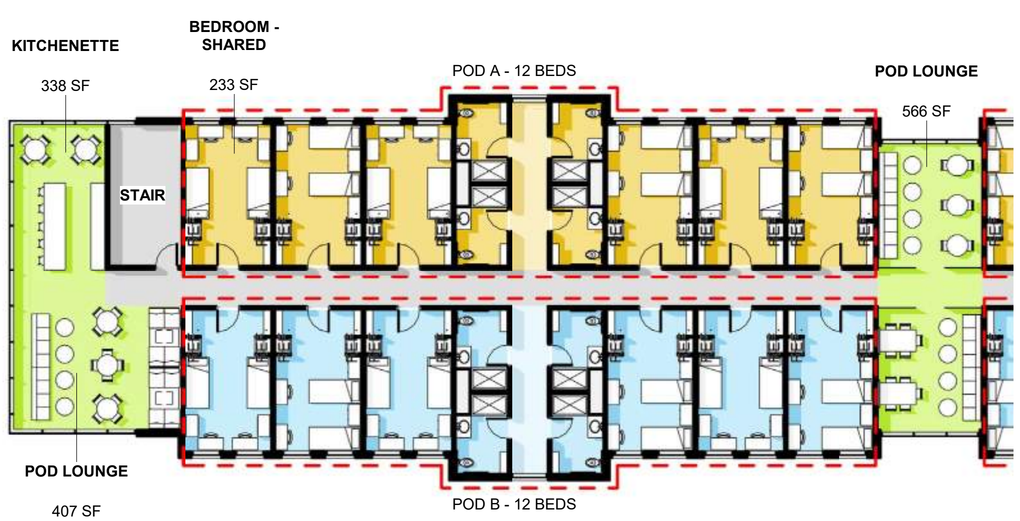
Appendix

Exhibit D | Programming Process Meeting Summaries

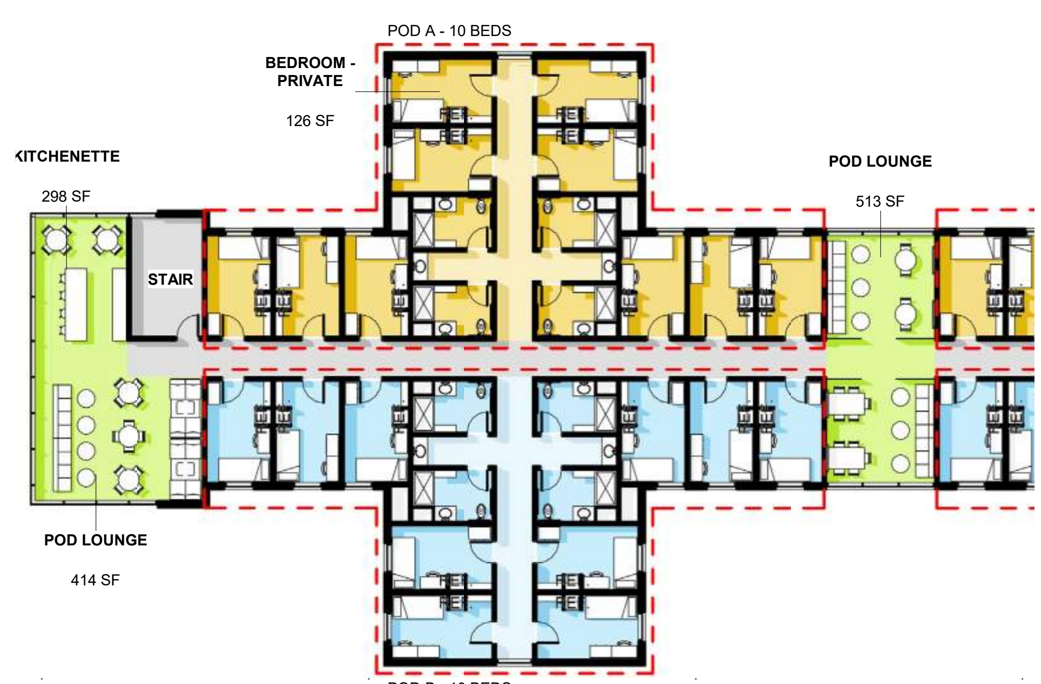


OPTION 01 | Shared Bedrooms; Twelve (12) Student Pod; 246 GSF/bed

OPTION 01A | Private Bedrooms; Eight (8) Student Pod; 311 GSF/bed



OPTION 02 | Shared Bedrooms; Twelve (12) Student Pod; 229 GSF/bed



OPTION 02A | Private Bedrooms; Ten (10) Student Pod; 281 GSF/bed

PROGRAMMING MEETING | 05.20.2021

Summary

The purpose of this meeting was to seek alignment on bedroom types and pod configuration options. The pod configurations presented were designed with minimal "private" student space to encourage community and social interaction amongst the Freshman students within the communal spaces of the building. Each option set is characterized by a differing location of the bathroom pods amongst the other program elements.

Option 01 Set

In the Option 01 pod configurations, the bathroom pods are studied at the center of the floor, serving as division elements. The physical separation that is created allows for more privacy amongst the individual residential pods.

Option 02 Set

In the Option 02 set, the bathroom pods are studied along the exterior wall of the floor, removing the physical separation between the different residential pods. By placing the bathroom pods on the exterior, there is potential for increased daylighting into not just the bedrooms, but the corridors and bathroom pods as well. Daylighting is shown to have a positive impact on the mental health of building occupants.

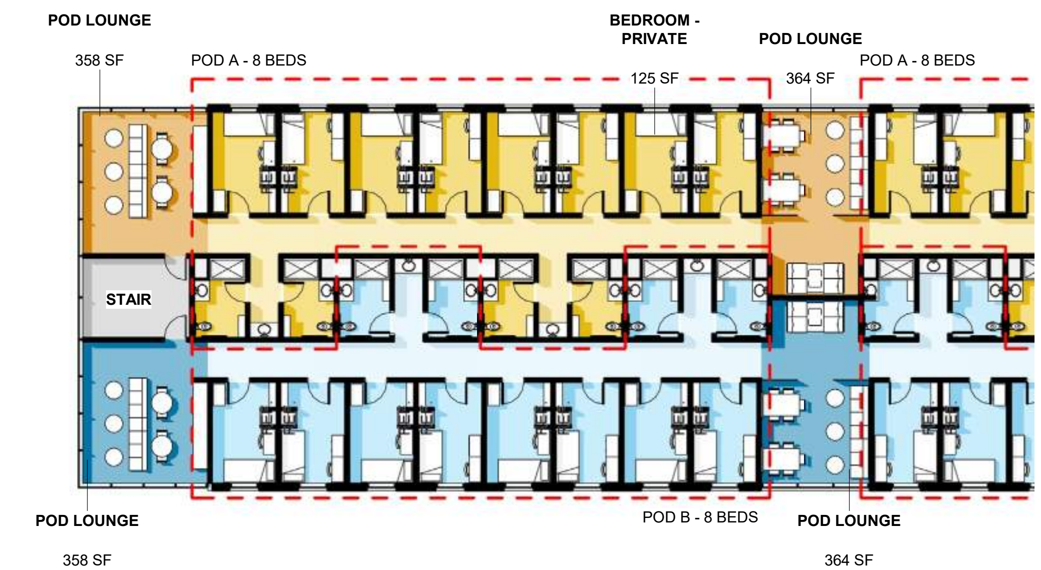
Key Takeaways:

- The combination of shared bedrooms and shared bathroom pods is not marketable to the current UTC student
- There is a need to create gender separation within the bounds of a single floor when creating room assignments
- There is a target ratio of three to four (3-4) beds per bathroom

Appendix

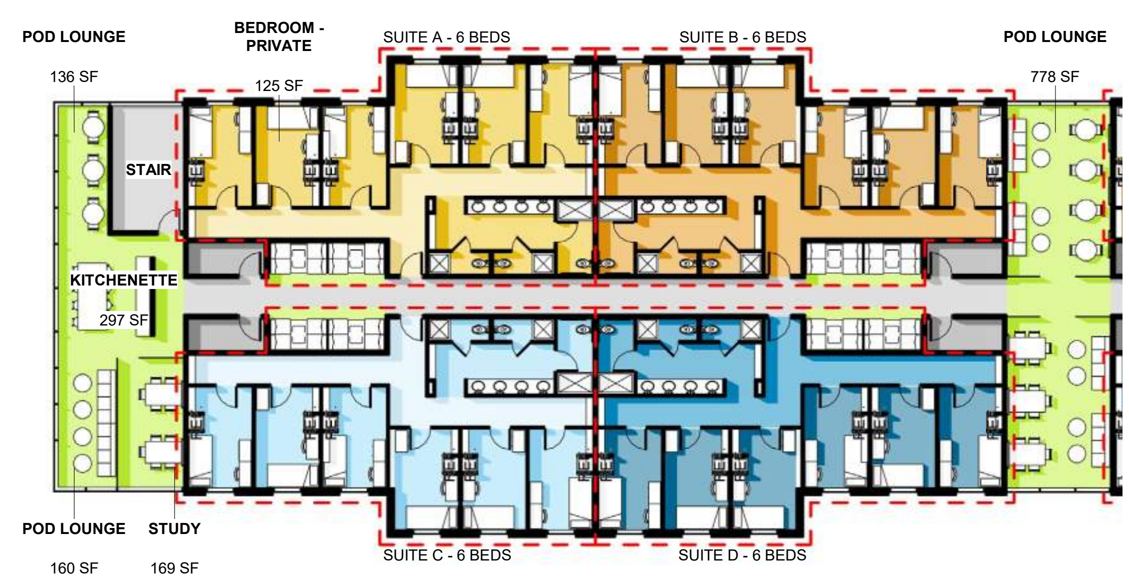
Exhibit D | Programming Process Meeting Summaries

OPTION 01 | Private Bedrooms; Eight (8) Student Pod; 311 GSF/bed



OPTION 01 - Divided Floor | Private Bedrooms; Eight (8) Student Pod; 311 GSF/bed

OPTION 02 | Private Bedrooms; Four (4) Student Suites; 299 GSF/bed



OPTION 03 | Private Bedrooms; Six (6) Student Pod; 313 GSF/bed

PROGRAMMING MEETING | 05.27.2021

Summary

The purpose of this meeting was to seek alignment on the residential style. Based on feedback that the UTC student prioritizes private bedroom space, each program layout studied the organization of private bedrooms and shared bathrooms. Both pod configurations and suites were considered.

Option 01 Set

The Option 01 pod configuration was preferred from the previous programming meeting. An alternative "divided" approach was presented that studied dividing the floor longitudinally for increased privacy and separation amongst the residential pods.

Option 02

An efficient, four (4) bedroom suite with bathroom fixtures separated into individual compartments for increased access. Small "nooks" are carved out of the suite's footprint to accommodate communal study space or building service closets off the main corridor. The efficiency of the suite's private space is meant to encourage students to gather and socialize in the building's communal spaces.

Option 03

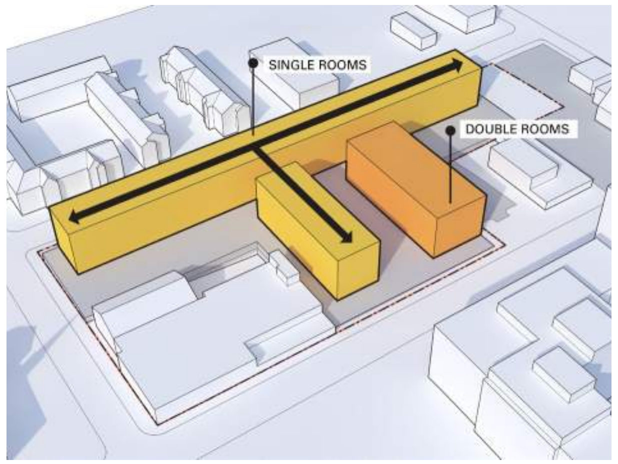
A hybrid approach between a pod configuration and traditional suite. The suite has internal circulation to access the private bedrooms, however it also incorporates a micro version of a bathroom pod. The larger bed count creates increased opportunity for social interaction amongst students; the bathroom pod is more communal in quality than a traditional suite.

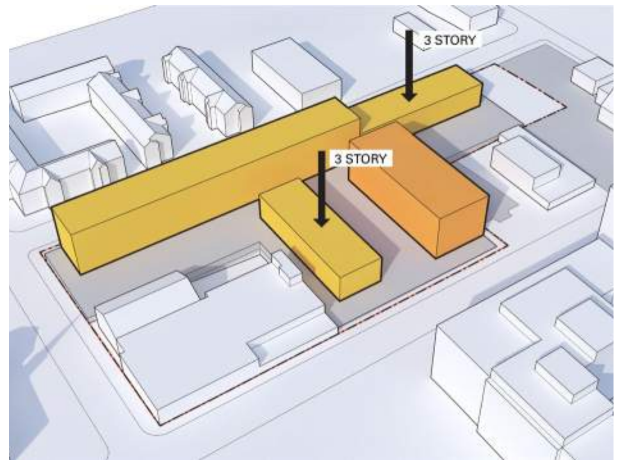
Key Takeaways:

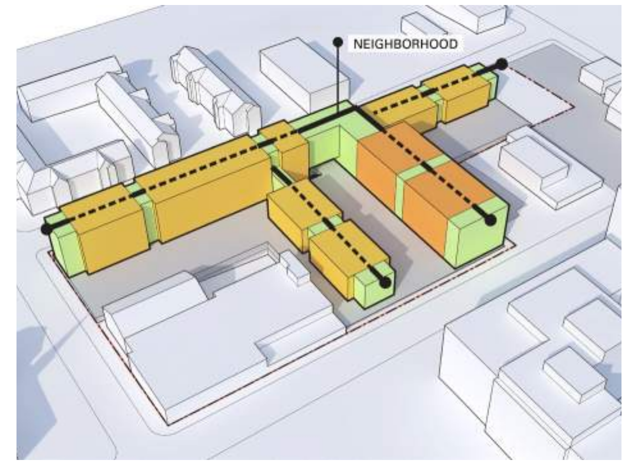
- The consensus was that Option 02 is the most appropriate residential style for UTC
- A six (6) person suite is too large for UTC. There is concern for maintaining cleanliness and for students to be able to find enough roommates to fill the suite.

Appendix

Exhibit D | Programming Process Meeting Summaries





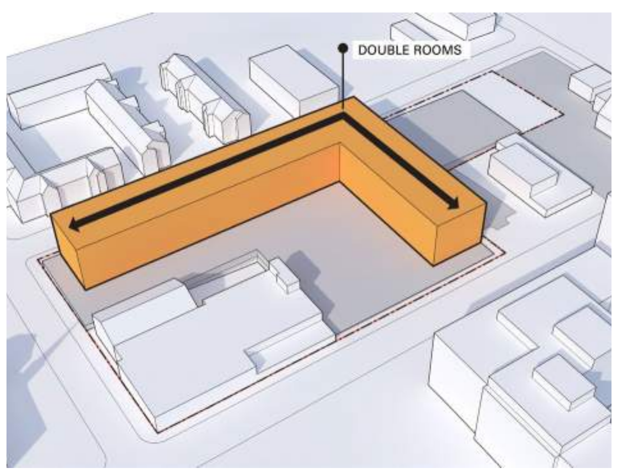


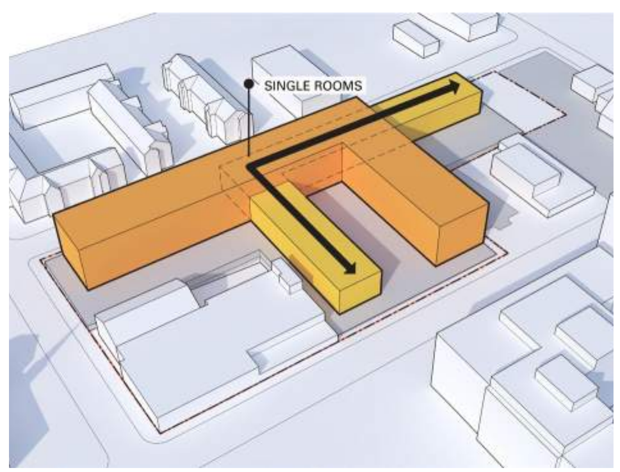
OPTION 01 | 728 Beds; 67% Private; 33% Shared | Massing Diagram

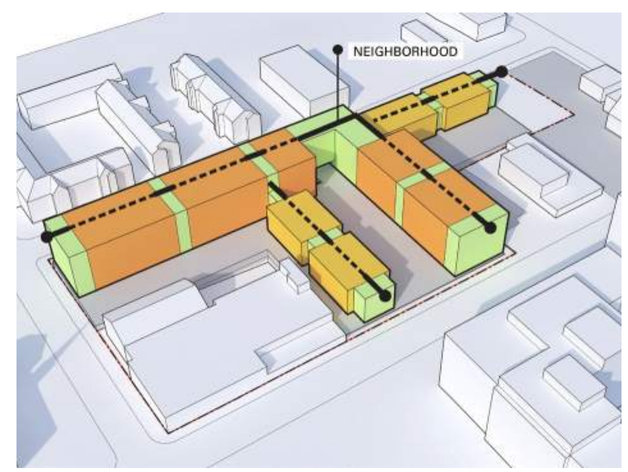
1. A bar of private bedroom suites lines the length of the site along Oak Street. Two (2) perpendicular wings sit in the plaza off McCallie Avenue: a wing of private bedroom suites and a wing of shared bedroom suites.

2. A portion of the bar along Oak Street and the private bedroom wing in the plaza are lower in building stories to provide a variety of scale within the residential development.

3. Shared living, study and social spaces are woven throughout the residential pods. A Neighborhood is at the center of the residential development, where larger shared programs are clustered around the circulation core.







OPTION 02 | 848 Beds; 25% Private; 75% Shared | Massing Diagram

1. A 5-story, L-shaped bar wraps along Oak Street and onto the plaza off McCallie Avenue. The bar is comprised of shared bedroom suites.

2. A 3-story, L-Shaped bar weaves through the higher-density bar on Oak Street onto the plaza off McCallie Avenue. The lower-scale bar is comprised of private bedroom suites.

3. Shared living, study and social spaces are woven throughout the residential pods. A Neighborhood is at the center of the residential development, where larger shared programs are clustered around the circulation core.

PROGRAMMING MEETING | 6.10.2021

Summary

The purpose of this meeting was to seek alignment on the preferred suite ratio (private to shared) and massing on site. The "building blocks" of the program massing options discussed were a four (4) bedroom private suite and a four (4) bedroom shared suite.

Massing Option 01

The massing strategy is primarily comprised of private bedroom suites with a single, higher-density wing of shared bedroom suites. Social and community spaces are woven between the residential suites. Above the main entry and lobby, the central Neighborhood spaces are clustered around the circulation core and serve as the heart of the residential community.

Massing Option 02

The massing strategy is primarily comprised of shared bedroom suites. A lower-density bar of private bedroom suites intersects the higher-density shared suites bar. By prioritizing the shared suites, a much higher bed count can be achieved in this massing option. Similar to Massing Option 01, social and community spaces are woven between the residential suites and the central Neighborhood (adjacent to the circulation core) serves as the heart of the residential community.

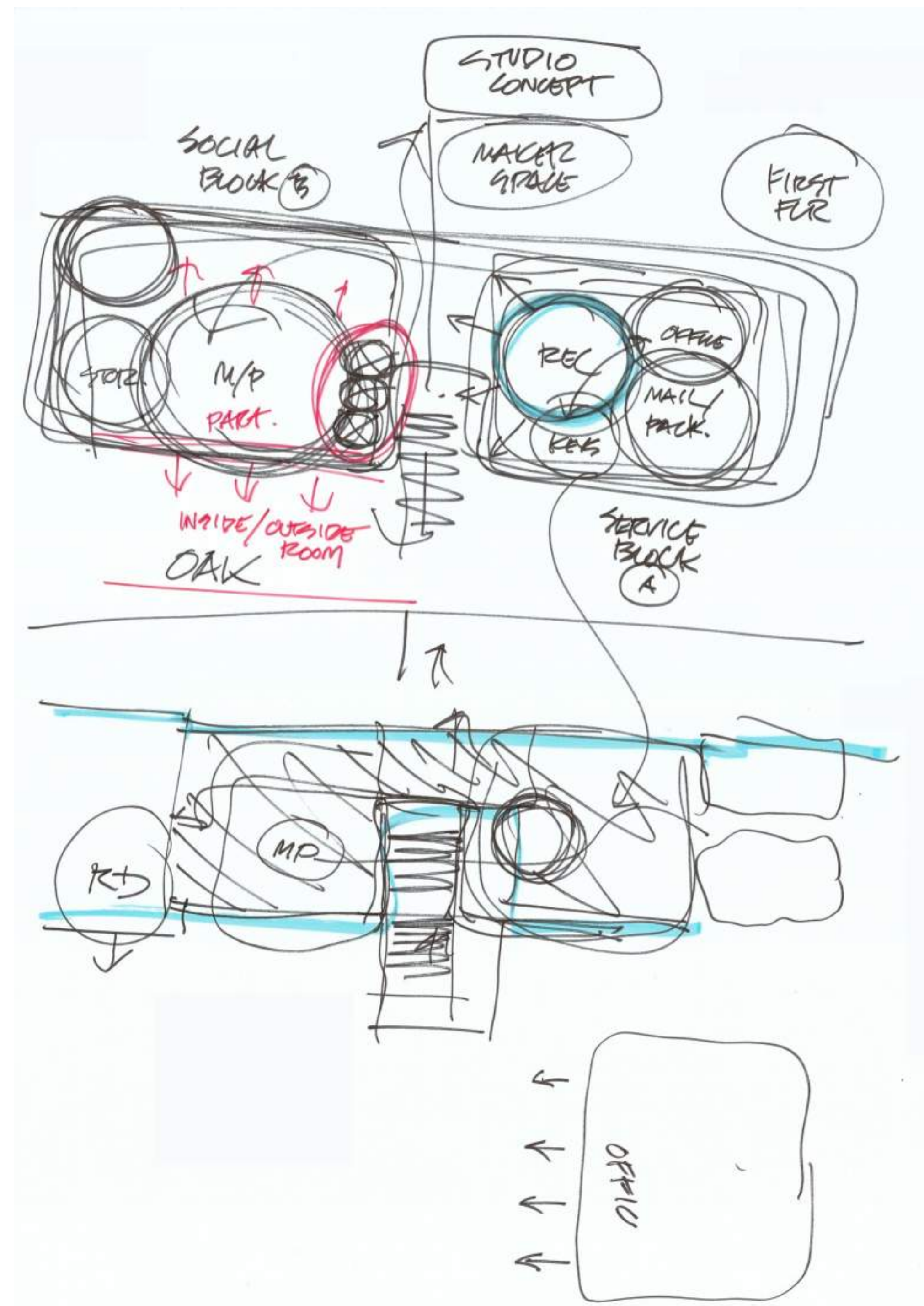
Key Takeaways:

- 33% shared bed ratio is the upper limit for what is marketable to the UTC student
- Current massing options are more efficient than the most recent campus benchmark - West Campus Housing (375 sf/ bed)
- The preference is for shared suites to be mixed throughout the building, instead of existing in a unique wing

Appendix

Exhibit D | Programming Process Meeting Summaries

Programming diagrams of central Neighborhood spaces.



Collaborative sketches of central Neighborhood spaces from the Programming Charrette.

PROGRAMMING CHARRETTE | 06.17.2021

Summary

The UTC team and the design team gathered for an in-person design charrette. The purpose of this meeting was to gain consensus and input regarding the programming of the preferred massing option for the New Residence Hall and Parking Garage prior to the final documentation of the programming effort.

A series of program diagrams were used as a base for sketching ideas to enhance the community programs within the building. In addition, the team completed a visioning exercise for the architectural and site language of the project. The compiled imagery referenced existing architecture on UTC's campus, exterior social spaces and residential architecture styles.

The design team was also able to gather input from UTC's Parking Services. Feedback was received regarding the functioning of the parking layout, to be incorporated into the finalized layout of the parking podium.

Photo of the team collaborating during the Programming Charrette.

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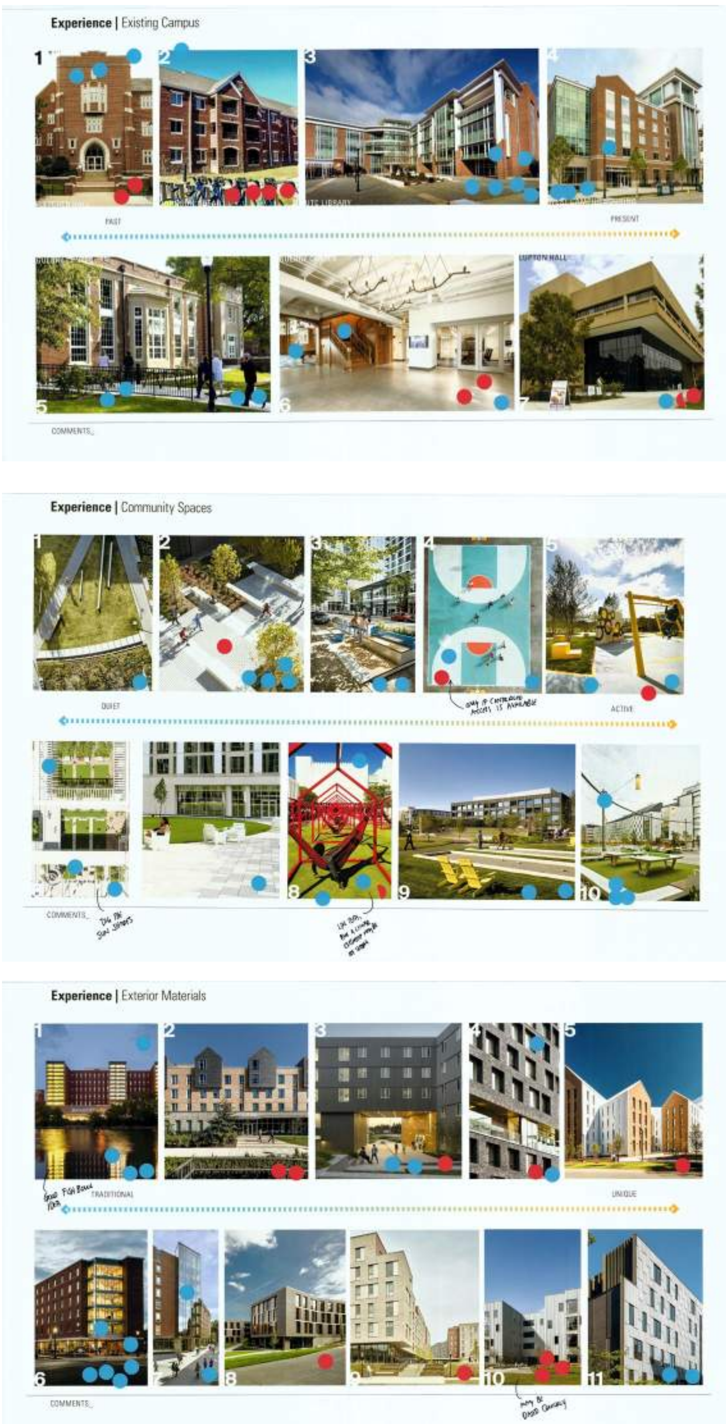
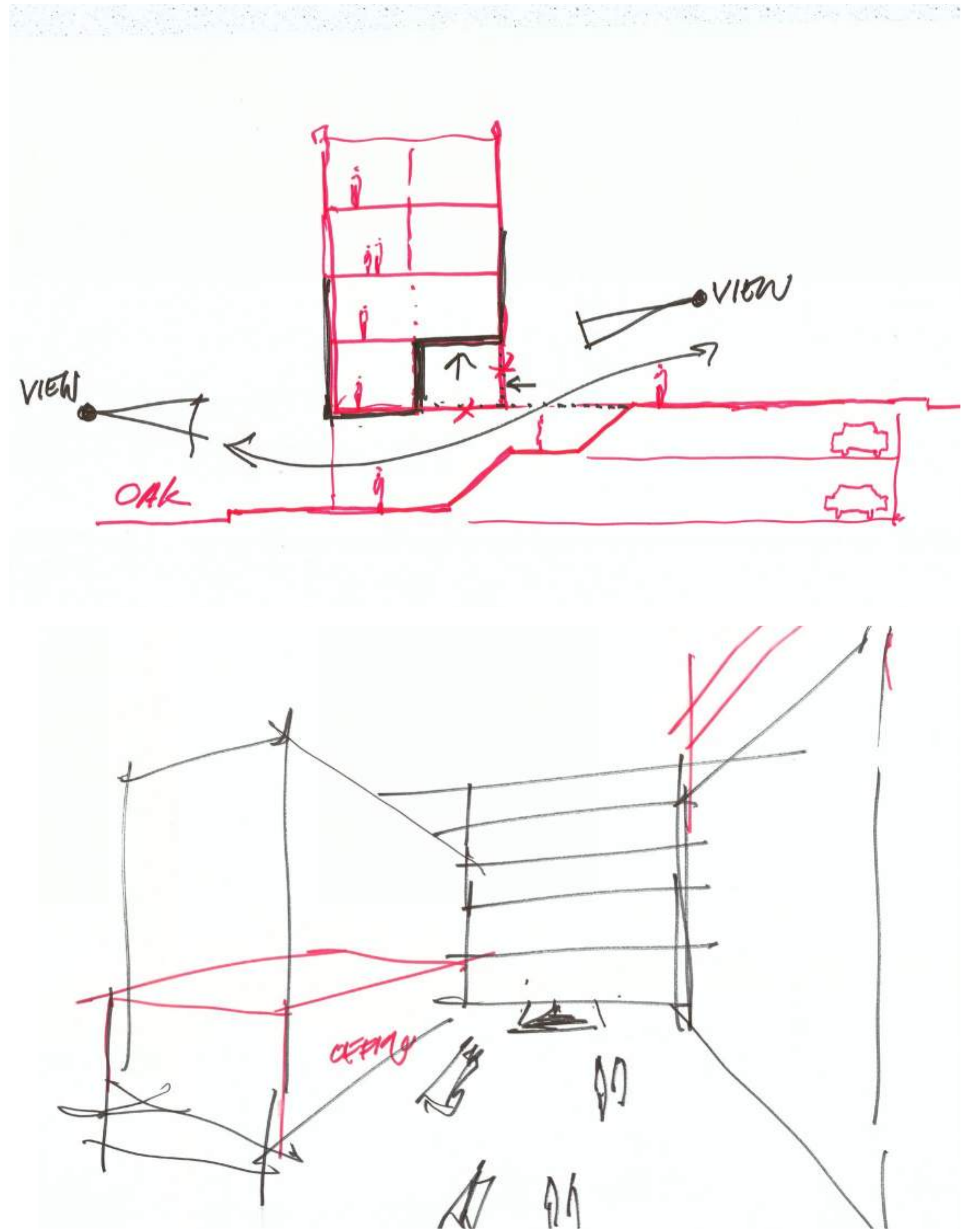
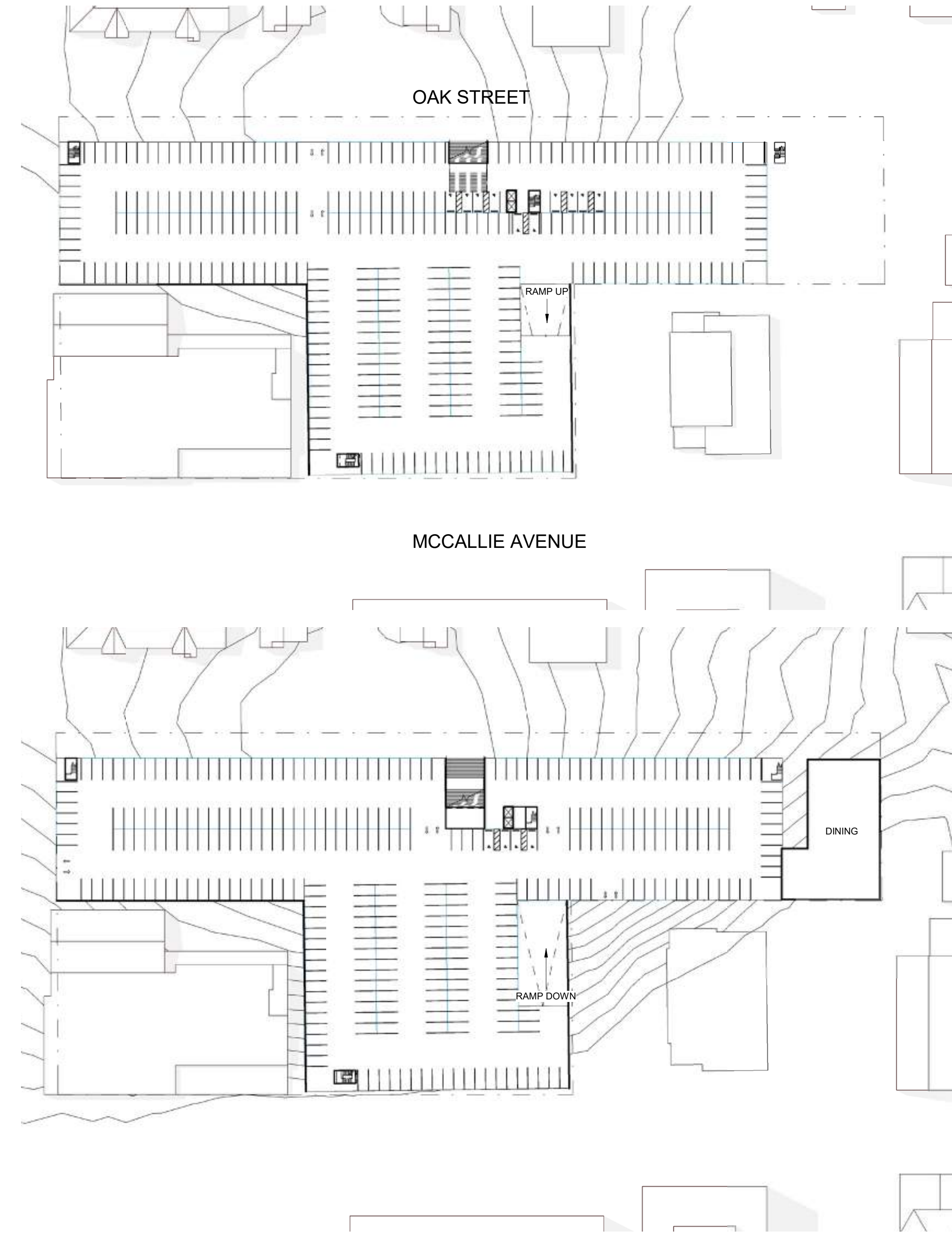
Exhibit D | Programming Process Meeting Summaries



Visioning boards from the Programming Charrette with commentary from team members. Blue dots represented favorable imagery and red dots not favorable.
(top) Existing Campus Architecture; (middle) Exterior Social Spaces; (bottom) Residential Architectural Styles.



Collaborative sketches of central Neighborhood "bridge" and breezeway connection from the Programming Charrette. (top) A section through the breezeway; (bottom) Looking towards the Neighborhood "bridge" from McCallie Avenue.



Parking Podium plans reviewed during the Programming Charrette. (top) Level 1 Parking Layout; (bottom) Level 2 Parking Layout.

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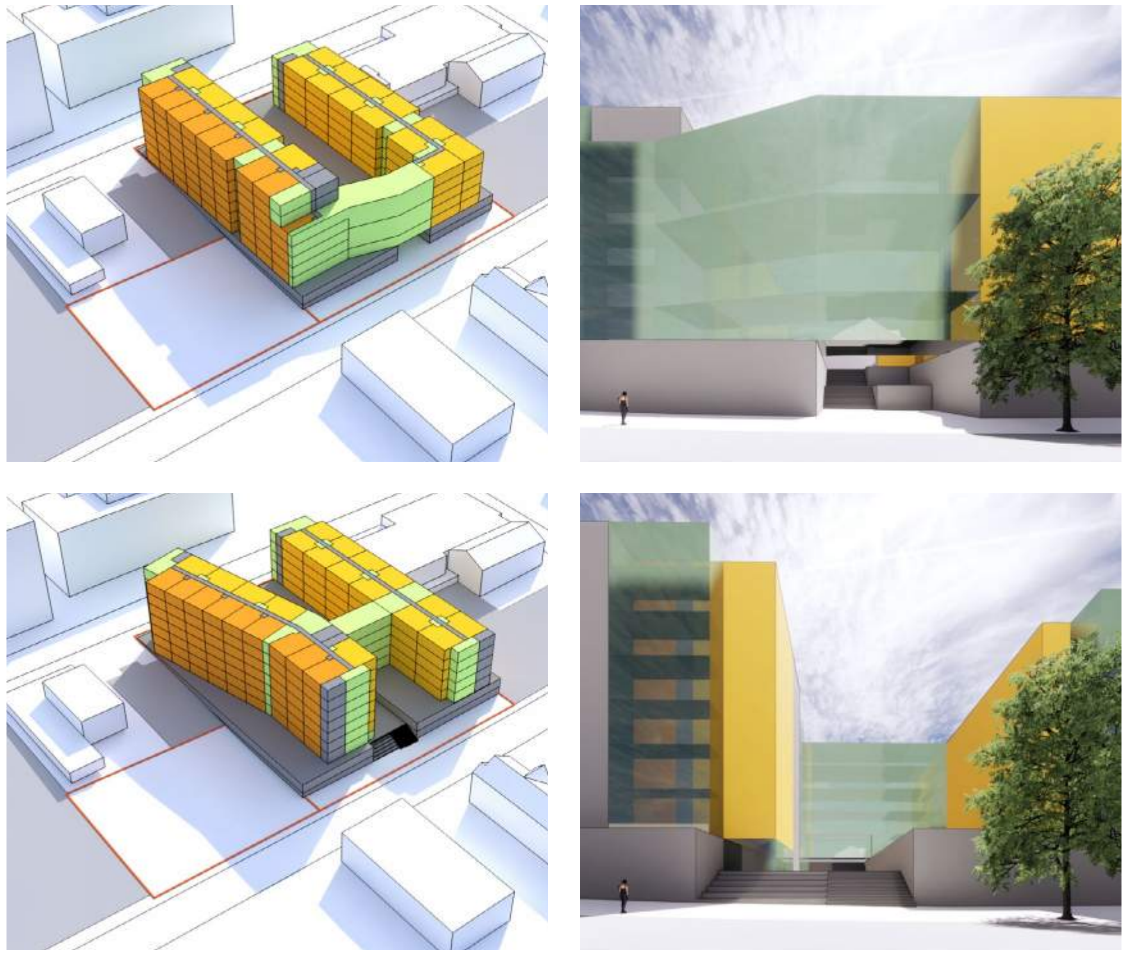
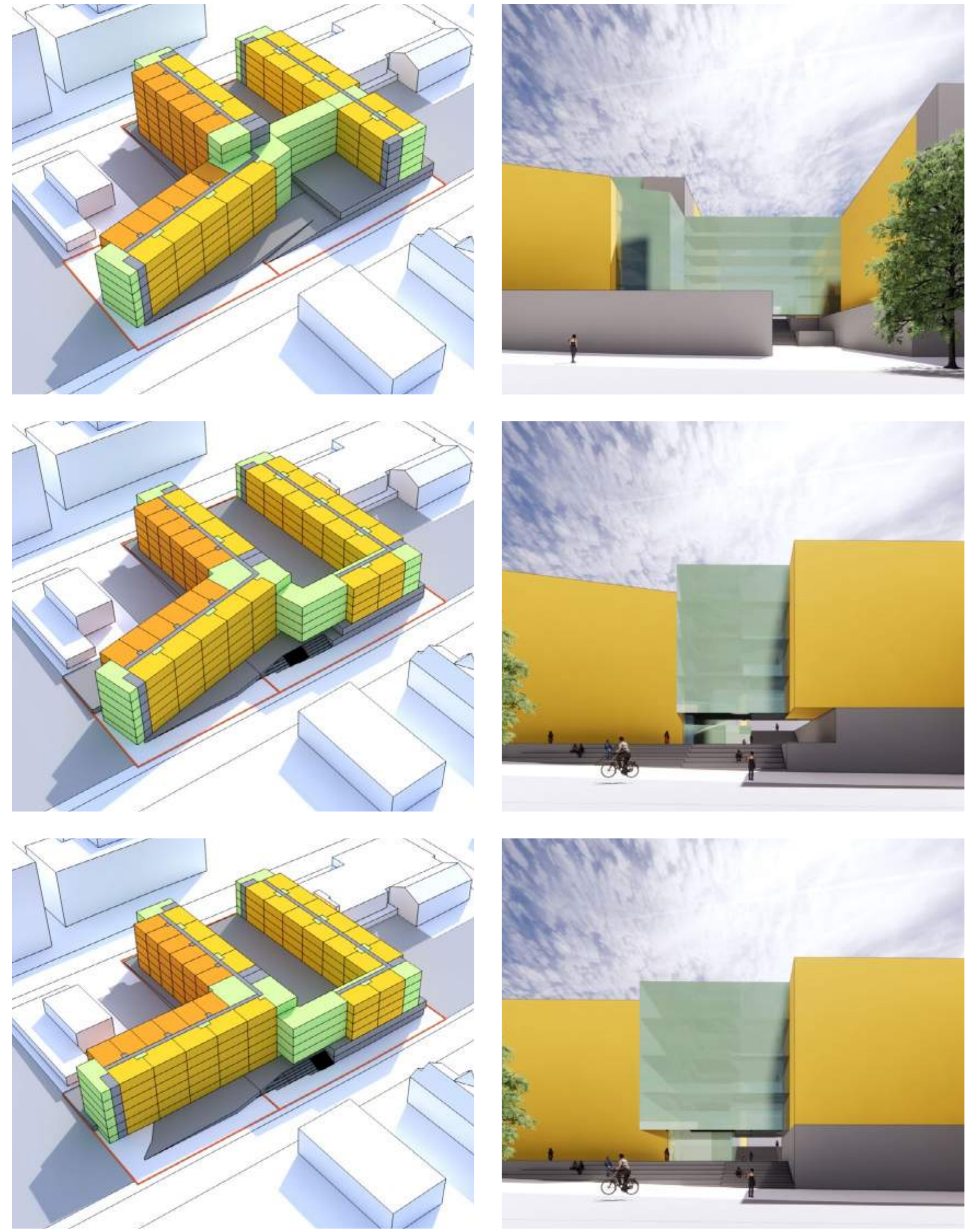
Exhibit D | Programming Process Meeting Summaries



Massing Options for Site "A" only presented for discussion. Above, in the left column are massing axon views from Oak Street and in the right column are conceptual entry views to the plaza from Oak Street.

(top row) Site A Option 01; (bottom row) Site A Option 02.



Massing Options for Site "A" and "B" presented for discussion. Above, in the left column are massing axon views from Oak Street and in the right column are conceptual entry views to the plaza from Oak Street.

(top row) Site A+B Option 01; (middle row) Site A+B Option 02; (bottom row) Site A+B Option 03.

PROGRAMMING MEETINGS | 07.01-22.2021

Summary

To conserve available land for future development projects and reduce the impact that the new residential development has on the existing Metro building, UTC made the decision to reduce the proposed project site boundary. In effect, the proposed new building will need to increase in scale and density to accommodate the required bed count for the project on the reduced site area. The minimum viable bed count target for the project is 600 beds.

The purpose of these meetings was to seek alignment on the preferred updated massing strategies within the reduced site boundaries.

Site A Option Set

The boundary of Site A is the central portion of the original site. The massing studies for Site A explore the location of the central Neighborhood program between two residential wings - either central to the plaza or along the Oak Street edge.

Site A+B Option Set

The boundary of Site B is the western portion of the original site. The massing studies for combined Site A and Site B explore the eastern residential wing extending in an L-shape onto Site B. The two residential wings are connected by central Neighborhood program. Due to the increased site area for this option set, the scale is reduced while still meeting the bed count targets.

Key Takeaways:

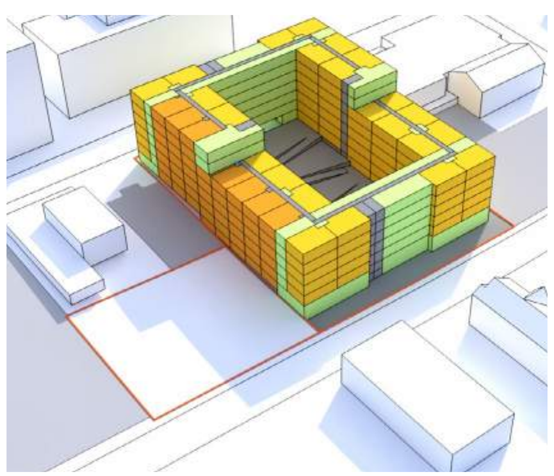
- For Site A, Option 02 was preferred due to the central Neighborhood being pulled into the plaza and off Oak Street. The building scale along Oak Street feels more appropriate and supports the pedestrian quality of the street.
- For Site A+B, Option 03 was preferred due to the orthogonal massing of the eastern residential wing.
- For Site A only, it is difficult to meet the minimum bed count target of 600 beds while maintaining a preferred ratio of 33% shared beds and 67% private beds.

Appendix

Exhibit D | Programming Process Meeting Summaries

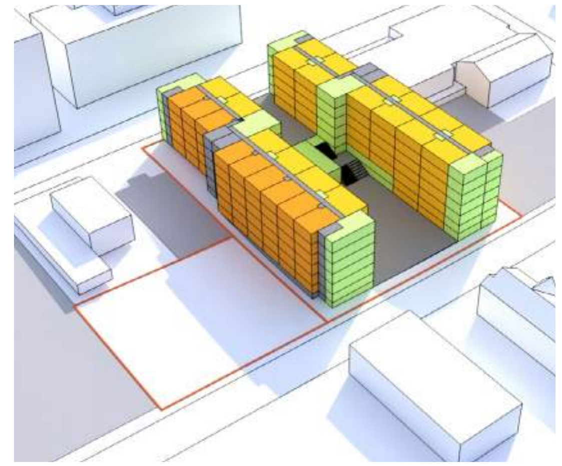







Massing Options presented for discussion. Above, in the left column are massing axon views from Oak Street and in the right column are conceptual entry views to the plaza from McCallie Avenue.

(top row) Site A Option 01; (middle row) Site A Option 02; (bottom row) Site A Option 03.




(top row) Site A Option 04; (bottom row) Site A+B Option 01.

PROGRAMMING MEETING | 07.29.2021

Summary

The design team was asked to study removing the parking program from the proposed project site. Within the reduced site boundaries, many of the efficiencies of the parking podium layout were lost; the forced density was leading to much more complex building solutions. It was determined that a separate site parcel could be identified for the parking program by UTC, allowing the proposed project site to be dedicated solely to residential programming.

The purpose of this meeting was to seek alignment on new massing strategies with the parking program removed from the proposed residential project site.

Site A Option Set

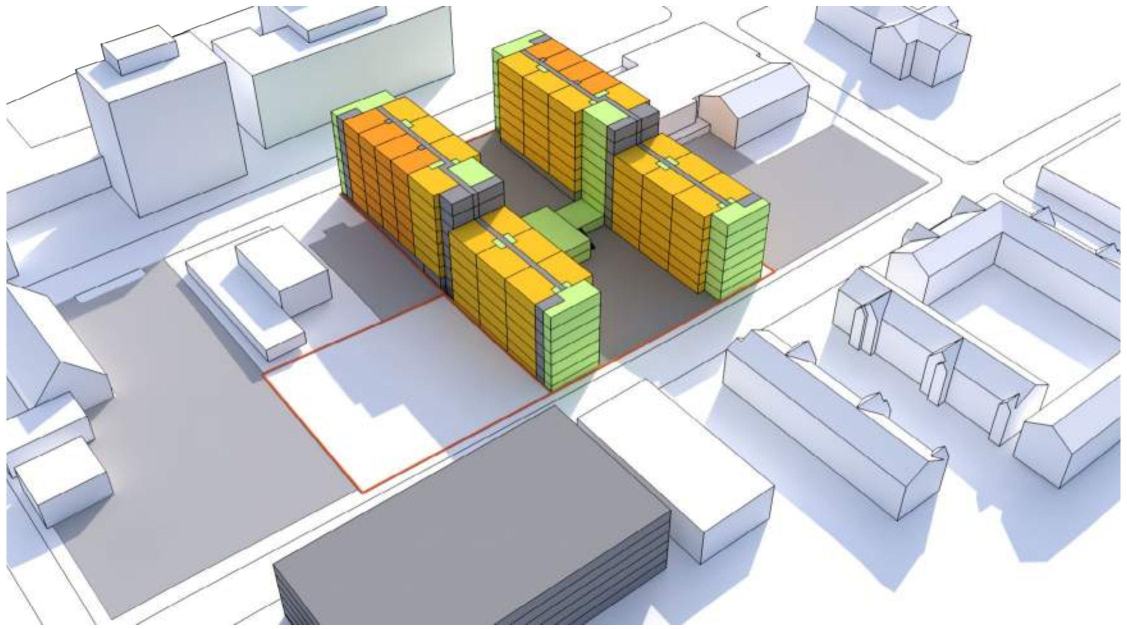
The massing studies for Site A explore the potential for an increased bed count with the parking podium removed. New building layouts are feasible without the constraints of the parking podium.

Site A+B Option

The massing study for combined Site A and Site B continues to explore the eastern residential wing extending in an L-shape onto Site B.

Key Takeaways:

- For Site A, Option 04 addresses the original vision for the New Residence Hall with visually separate residential wings framing the public plaza. This massing study would also support a residential college or LLC model, as it breaks down the building into two smaller communities.
- UTC generally prefers using Site A only and to not add a separate wing over Site B; this preserves Site B for future use.



SITE A | PREFERRED OPTION A | 784 Beds; 71% Private / 29% Shared; 329 GSF/bed

SITE A+B | PREFERRED OPTION B | 800 Beds; 68% Private / 32% Shared; 321 GSF/bed

PROGRAMMING MEETING | 08.19.2021

Summary

The purpose of this meeting was to seek alignment on new massing strategies with the parking program removed from the proposed residential project site.

Option A

Option A, the preferred massing option for Site A only, is two visually separate residential wings connected by a ground-level lobby integrated into the public plaza. This massing option maximizes the height of the building (seven (7) stories off either street elevation to avoid the building from being classified as a high-rise by code).

Option B

Option B, the preferred massing option for Site A+B, is similar to Option A: two visually separate wings connected by a ground-level lobby integrated into the public plaza. The eastern wing takes an L-shaped form, extending onto Site B. The height is not maximized in this option; the building is only five (5) stories at McCallie Avenue. The reduced height allows the building to be more contextually appropriate, while still meeting the bed count target.

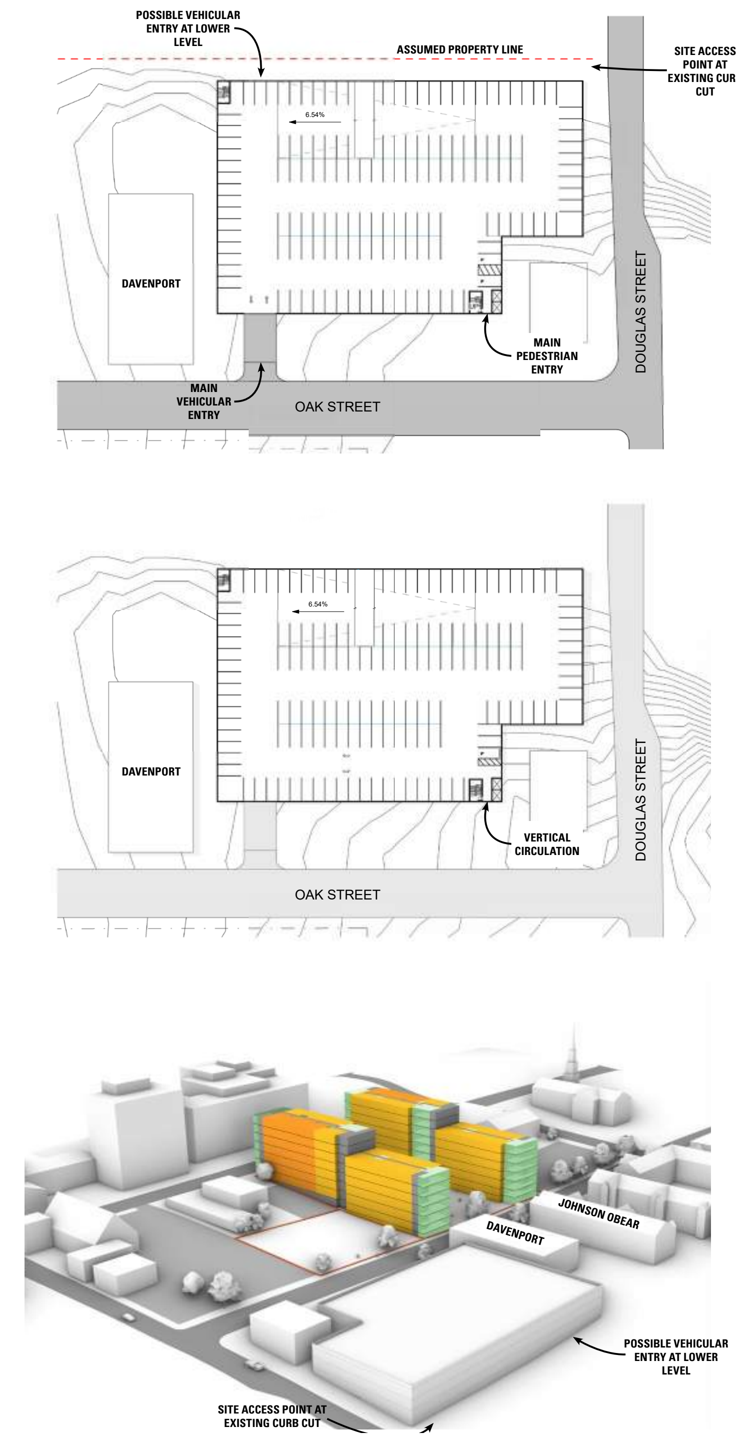
Key Takeaways:

- The team feels that the massing options create a "Gateway" for the university on McCallie Avenue.
- The target number of student beds has increased to 800 based on review of the massing options. The target parking count is 600 spaces.

Appendix

Exhibit D | Programming Process Meeting Summaries

Detailed programming plans presented for feedback prior to final documentation.



Location, scale and layout of separated parking program.

PROGRAMMING MEETINGS | 08.26-09.13.2021

Summary

The purpose of these meetings was to see alignment on all assumptions made for programming prior to moving into the final documentation of the programming process for the New Residence Hall and Parking Garage. Consensus was reached for the preferred massing options; the primary emphasis is on Option A, which gets close to the bed count target of 800 beds and conserves portions of the site for future development.

Detailed programming plans of the New Residence Hall and Parking Garage were reviewed with the team to gather feedback for final documentation and for the cost analysis to be performed.

Key Takeaways:

- The consensus is that the Option B is not providing enough value over Option A, given that it takes up additional land. If Option B was maximized in height (seven (7) stories off either street elevation) the bed count would be approximately 1,000 beds, which is understood to not be feasible within the current budget constraints.

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