COLLEGE OF ENGINEERING

COMPREHENSIVE MASTER PLAN

February 2022

CLARK & ENERSEN

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LEGEND

DEPARTMENTAL ACRONYMS

Petroleum Engineering	PE
Geology & Geological Engineering	GEO&GE
Civil Engineering	CE
Chemical Engineering	CHEM E
Electrical Engineering & Computer Science	EE&CS
Institute for Energy Studies	IES
Mechanical Engineering	MECH E
College of Engineering & Mines	COE
Registrar	REG
Bio Medical Engineering	BIO E

GENERAL ACRONYMS

University of North Dakota	UND
Clark & Enersen	CE
Gross Square Feet	GSF
Net Square Feet	NSF
Net-To-Gross Ratio (i.e. NSF divided by GSF)	NTG
College of Engineering	COE

SPACE TYPES ICONS

- Teaching Laboratories
- Research Laboratories
- Laboratory Support
- Lecture & Classroom
- Office & Administration
- Other

A

EXECUTIVE SUMMARY

INTRODUCTION

This report has been assembled to describe various options for UND College of Engineering to respond to future growth challenges and existing deficiencies in the overall engineering complex. The college of Engineering occupies a complex of interconnected buildings built and joined together over the course of six decades. The facilities and systems that serve them are now are in various states of age and condition and the evolution and enrollment of the various engineering departments has created a situation where the facilities are ill positioned to respond to modern teaching and research as well as planned growth projections within the college. The design team has been asked to investigate the condition of the facilities, quantify departmental growth and distribution across the complex and make recommendations for a long-term master plan for capital improvements to be implemented over time so that the college can respond to a host of coming challenges within it's curriculum.

EXECUTIVE SUMMARY

APPROACH AND PROCESS

The process of analyzing and formulating recommendations for the College of Engineering Masterplan involved three primary steps as follows: (1) Investigation and documentation of existing facilities and systems that make up the current complex. This included examination of existing drawings and documentation as well as on site investigation by architects and engineers to assess the type and condition of finishes, engineered systems, fixed furnishings and accessibility features in the existing complex. (2) Interviews with each department including department heads, faculty, administration and support staff to catalogue intended enrollment growth targets, identify programmatic deficiencies, and collect ideas that would enhance the college's ability to attract students and faculty over the coming decades. (3) Formulation of various planning approaches that would pave the way for the college to meet the demands identified in step 2. This was an iterative process that involved the design team and building committee that met regularly over the duration of the endeavor. All information collected and iterative solutions identified are included in this document.

GOALS AND OBJECTIVES

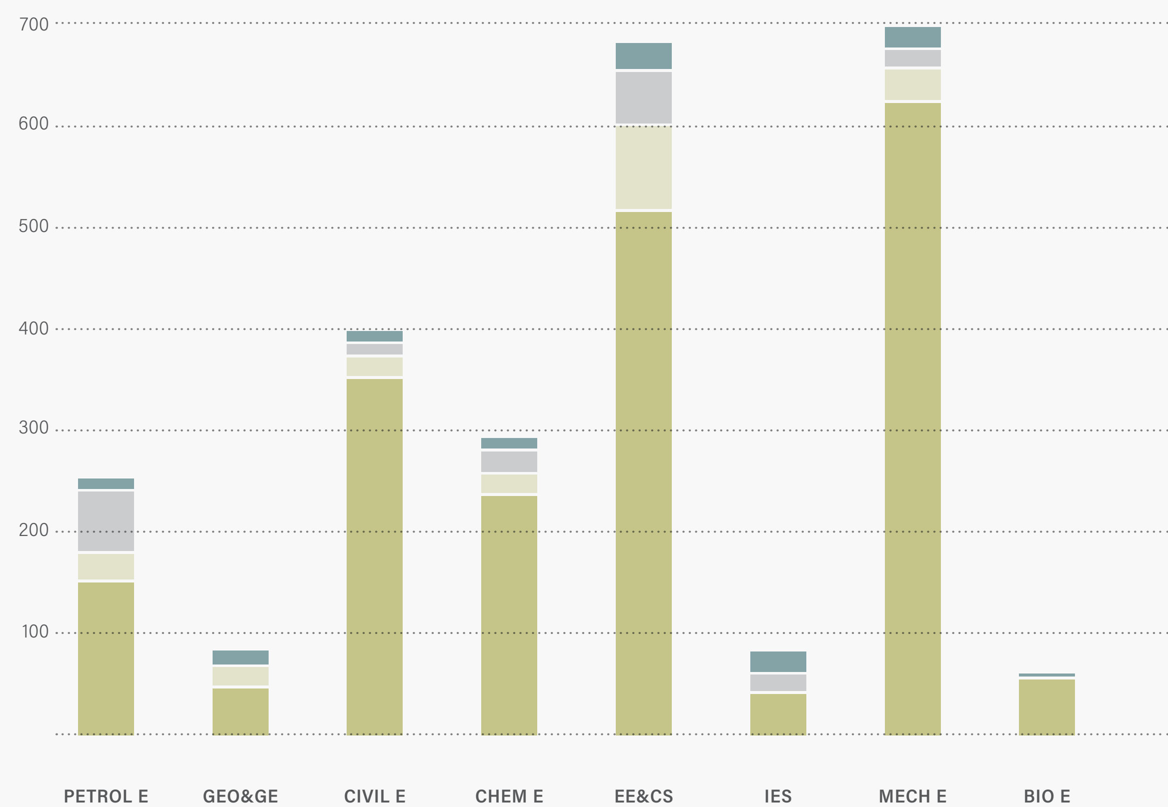
The goals and objectives of the long-range masterplan as delineated in the kick-off included the following primary points:

- Grow on campus enrollment to between 1,500 and 2,000 across all engineering departments
- Create a facility layout that strikes a proper balance between inter departmental collaboration and departmental identity
- Improve connectivity and wayfinding across entire complex
- Rectify all accessibility issues with current facility
- Reorganize complex to co-locate faculty groups
- Create facility that allows for greater optimization and sharing of research space and equipment
- Create a facility that improves ability to recruit both students and faculty
- Increase ability to expand faculty count to improve faculty to student ratio
- Expand access to computer classroom and work spaces
- Improve HVAC and electrical infrastructure

GROWTH ANALYSIS

ENROLLMENT ANALYSIS

The bar graph below shows the current student enrollment and faculty/staff counts for each of the eight primary engineering departments. These numbers were collected during the initial departmental interviews to gain a snap shot in time of the general scope of the college as a whole. Additional breakdowns of the current enrollment and employment numbers are shown in the departmental discussions later in this document. Note that the numbers shown below represent overall raw enrollment numbers and do not breakdown the counts between on-campus and on-line students. As the discussion of growth projections proceeds on the following pages and in the main body of the document, particular attention is paid to the on-campus projections as this will have a greater impact on needed facilities.



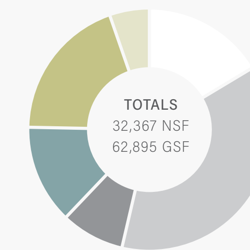
CURRENT COE STUDENT AND FACULTY BREAKDOWN

UNDERGRADUATE MASTERS PHD FACULTY

USE NSF. The graphic below indicates existing square footage identified both by use and building location within the complex.

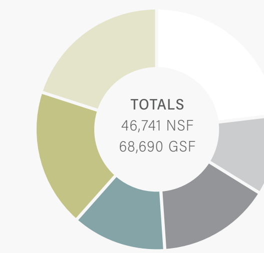
HARRINGTON HALL

TEACHING LAB	5,309
RESEARCH LAB	12,055
LAB SUPPORT	2,739
CLASSROOM	4,273
OFFICE/ADMIN	6,270
OTHER	1,721



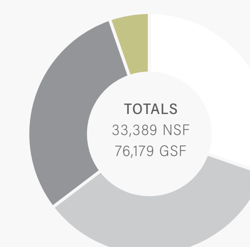
LEONARD HALL

TEACHING LAB	10,285
RESEARCH LAB	4,773
LAB SUPPORT	6,719
CLASSROOM	5,614
OFFICE/ADMIN	10,443
OTHER	8,907



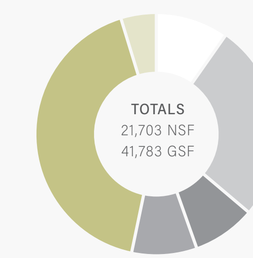
UPSON I

TEACHING LAB	10,124
RESEARCH LAB	11,463
LAB SUPPORT	10,030
CLASSROOM	-
OFFICE/ADMIN	1,772
OTHER	-



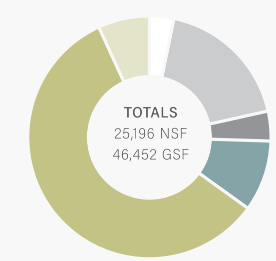
CEC

TEACHING LAB	2,332
RESEARCH LAB	6,321
LAB SUPPORT	2,013
CLASSROOM	2,086
OFFICE/ADMIN	7,817
OTHER	1,134



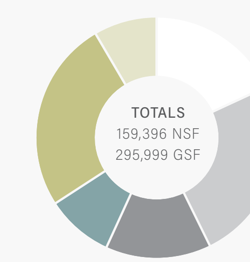
UPSON II

TEACHING LAB	818
RESEARCH LAB	4,603
LAB SUPPORT	1,000
CLASSROOM	2,384
OFFICE/ADMIN	14,666
OTHER	1,725



TOTAL CAMPUS

TEACHING LAB	28,868
RESEARCH LAB	39,215
LAB SUPPORT	22,501
CLASSROOM	14,357
OFFICE/ADMIN	40,968
OTHER	13,487

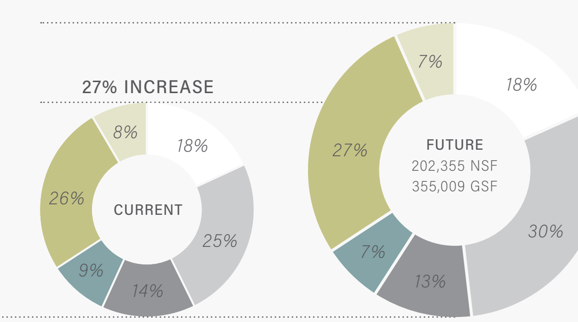


EXISTING BUILDING SPACE BY USE

All numbers represent Net Square Footage (NSF) unless otherwise noted

TOTAL FUTURE CAMPUS

TEACHING LAB	818
RESEARCH LAB	4,603
LAB SUPPORT	1,000
CLASSROOM	2,384
OFFICE/ADMIN	14,666
OTHER	1,725

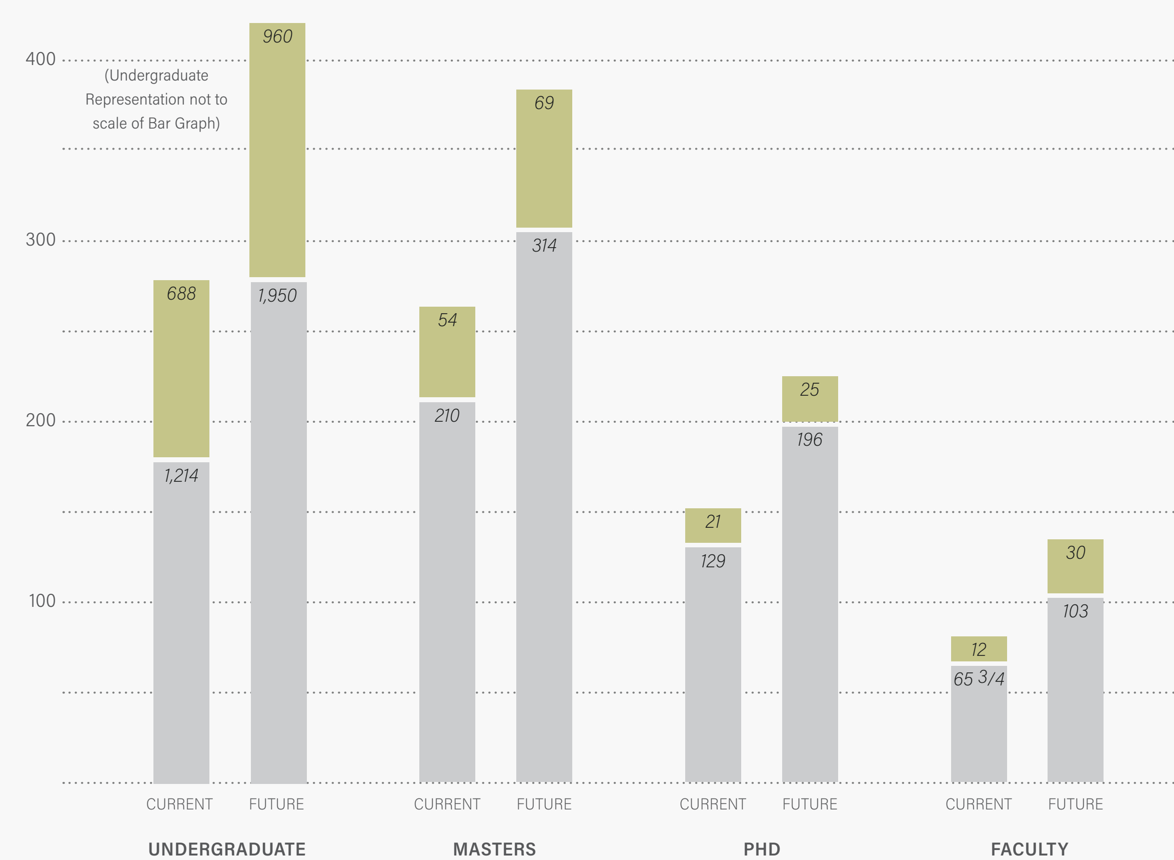


FUTURE SPACE NEEDS ANALYSIS DRIVEN BY STUDENT GROWTH

All numbers represent Net Square Footage (NSF) unless otherwise noted

SPACE NEEDS ANALYSIS

One of the initial steps in the departmental interview process included collecting growth projections and initiatives. The interviews where this information was established included college administration, department chairs and all faculty members. Each of the main engineering departments took part and expressed their individual wishes and these meetings were followed up and further adjusted in subsequent meetings with Dean's office and primary building committee. The graph below shows the anticipated growth projections across the entire college of engineering. This data is further broken down by department and expressed in greater detail in the main body of the masterplan later in this document. Overall growth in all departments is shown for undergraduate students, masters students, PhD students and faculty.



FUTURE COE STUDENT AND FACULTY ANALYSIS

ON CAMPUS ONLINE

DEPARTMENTAL NSF

The existing net square footage numbers in the tabulation shown below were established by extensive building tours and analysis of the existing floor plans. Additional breakdown of the space allocation by department is further delineated later in this document under the departmental description sections. The proposed Net square footage column comes from the current program plan that was created through an iterative process working with the college administration and building committee. The growth in net square footage was determined by identifying needs in the following categories:

- Growth in teaching and research and industrial laboratory space based on expressed needs coming from departmental discussions and reviewed by college administration and the building committee
- Provision of faculty and staff offices in accordance with growth projections (all faculty office spaces were sized according to current university guidelines and in some cases, square footage dedicated to office space was significantly reduced
- Provision of adequate office space for on-campus masters and PhD students in accordance with growth projections
- Growth needs to accommodate new laboratory research and instructional initiatives

DEPARTMENT	EXISTING NSF	PROPOSED NSF	PROPOSED GSF	
Petroleum Engineering	9,199	17,228	30,225	87%
Geology & Geological Engineering	32,063	28,559	50,104	-11%
Civil Engineering	14,373	22,540	39,544	57%
Chemical Engineering	15,232	21,711	38,089	43%
Electrical Engineering & Computer Science	13,812	19,453	34,128	41%
Institute for Energy Studies	7,116	9,935	17,430	40%
Mechanical Engineering	27,617	35,436	62,168	28%
College of Engineering	22,952	24,404	42,814	6%
Registrar	14,362	13,387	23,486	-7%
Biomedical Engineering	2,670	9,702	17,021	263%
Totals	**159,396**	**202,355**	**355,009**	**27%**

B

EXISTING FACILTIES

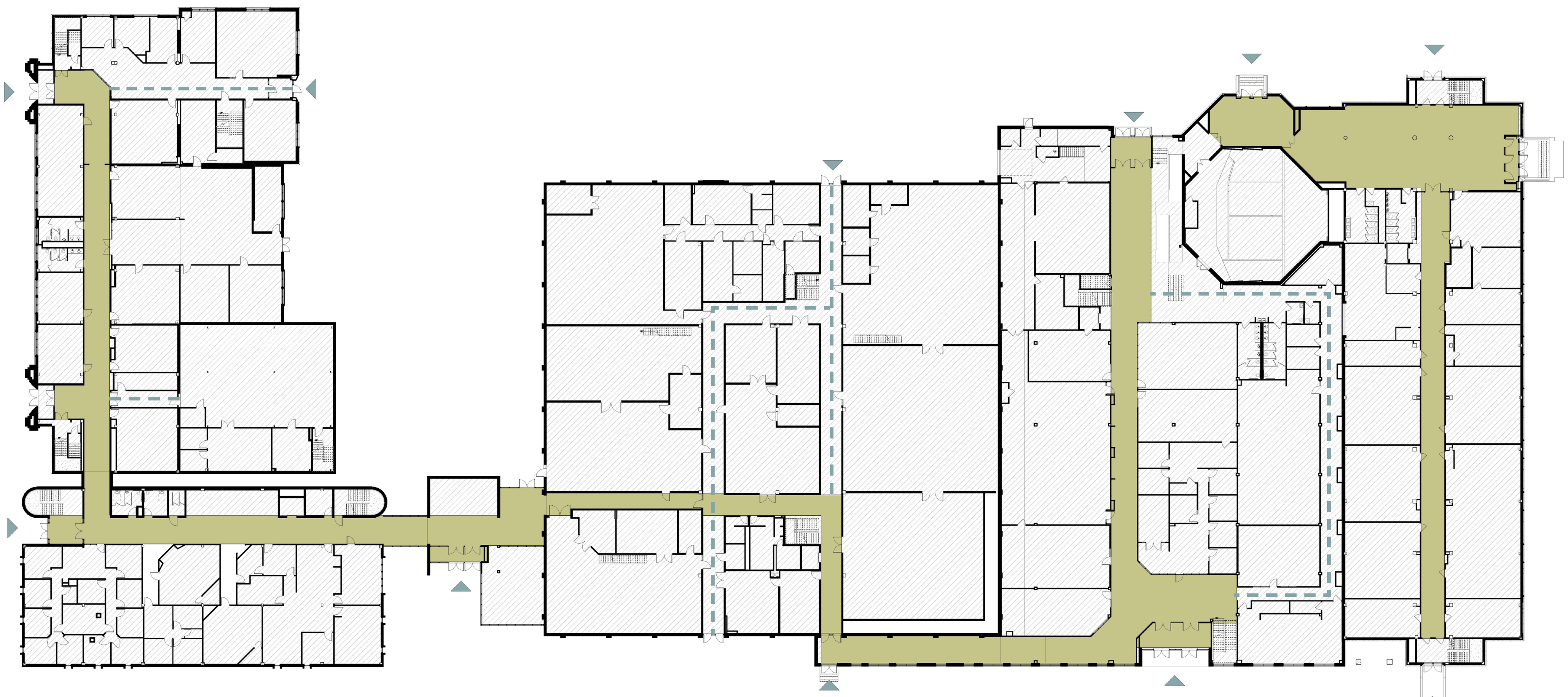
CAMPUS OVERVIEW

The college of Engineering complex includes five interconnected structures that have been built over the course of nearly 70 years. The east and west ends of the complex are the oldest and include Harrington Hall on the west, built in 1952 and Leonard Hall on the east, built in 1964. Upson I is the primary high bay laboratory space serving the college and was originally a stand-alone structure built in between Leonard and Harrington in 1971. In 1974, Upson II was constructed along the south side of Harrington Hall and was subsequently connected to Upson I via a single-story connector. The most recent major addition was the Collaborative Energy Complex, completed in 2016 between Leonard Hall and Upson I.

EXISTING FACILITIES OVERVIEW

WAYFINDING AND CIRCULATION

Wayfinding and general circulation across the engineering complex is not ideal. As the various additions have been added over the years, an east/west pathway has evolved that moves to the north and south in the area of Upson I and emerges into corridor built as part of the CEC construction before turning back to the north to enter Leonard Hall at the north end. The main on grade floors in most of the complex do align with the exception of the transition from CEC into Leonard Hall. The vertical offset in this area is approximately four feet. One of the main impediments to horizontal circulation is the varied story height of the buildings that make up the complex.



CIRCULATION AND ENTRY

PRIMARY CIRCULATION SECONDARY CIRCULATION EXISTING ENTRANCES

1952

62,895 GSF

The tables below show the square footage by use and department for Harrington Hall.

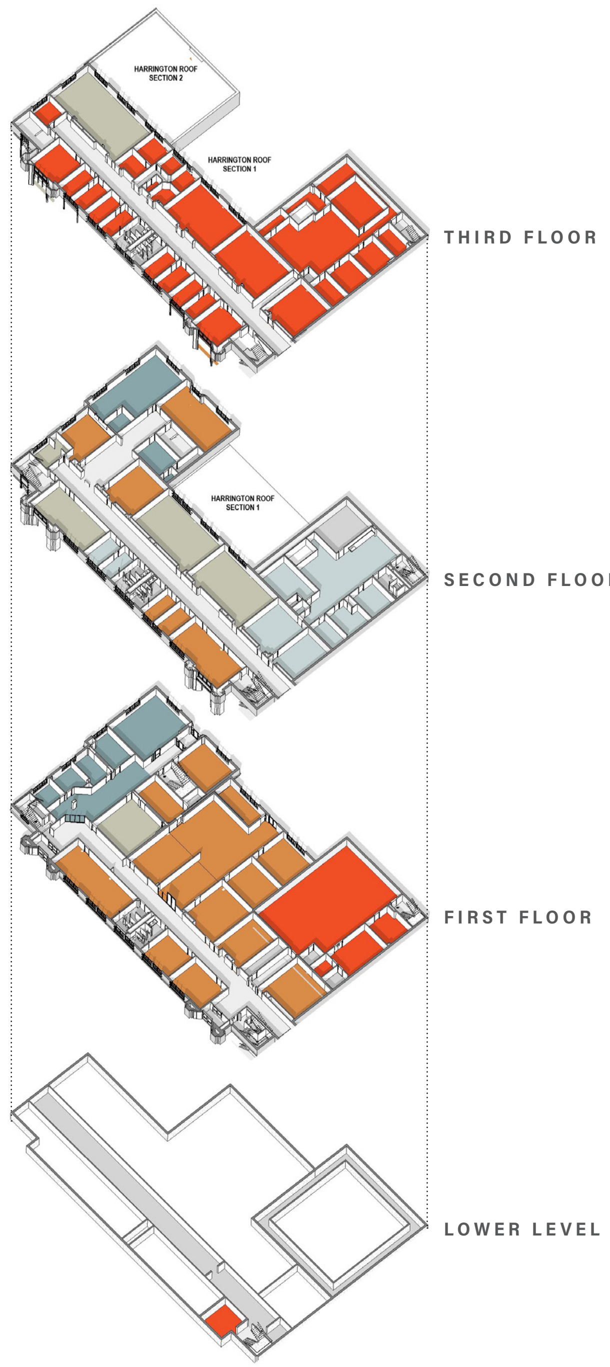
STATS	
# OF LEVELS	4
NSF	32,367 NSF
GSF	62,895 GSF
SPACE TYPES (NSF)	
PE	-
GEO E	-
CIVIL E	1,134 SF
CHEM E	13,751 SF
EE&CS	9,231 SF
IES	-
MECH E	-
BIO E	-
COE	3,978 SF
REG	4,273 SF
USE BREAKOUT	
TEACHING LAB	5,309 SF
RESEARCH LAB	12,055 SF
LAB SUPPORT	2,739 SF
LECTURE	4,273 SF
OFFICE + ADMIN	6,270 SF
OTHER	1,721 SF

HARRINGTON HALL

BUILDING SUMMARY

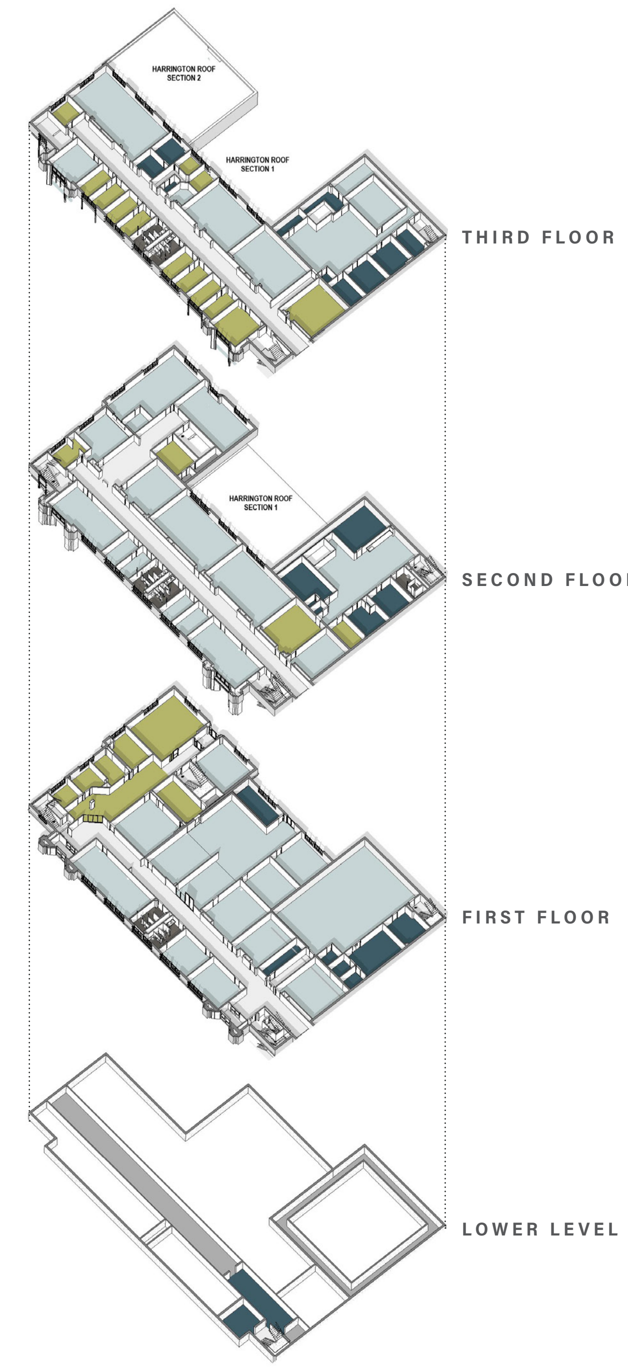
Harrington Hall was constructed in 1952 and is comprised of approximately 62,895 gross square feet. The building is 3 stories above grade with a largely unoccupied basement area that mostly houses mechanical HVAC equipment. It appears that Harrington Hall was the Harrington Hall is the oldest portion of the complex and was one of the original campus buildings dedicated to engineering. The original construction consisted of a cast-in-place concrete structure with a three-story portion along the west and a large single story high bay on the east. Prior to the construction of Upson II, a three-story addition was added to the southeast corner structure, apparently to provide an interconnected series of mezzanines and high bay shafts to accommodate research and teaching in Chemical engineering. The façade is mostly brick with windows lined in stone tracery in a gothic motif, primarily along the west façade. Another major addition occurred in 2008 to north end of Harrington Hall to add office and some teaching space for the JODASS program. Harrington Hall connects directly to Upson II to the south. The floors and main corridor align, but there is a slight ramp up into Upson II (about 8 inches) on several floors.

Harrington Hall accommodates shared and dedicated program space for several departments. It is fair to say that among all of the buildings that make up the complex, Harrington Hall hosts the most diverse and wide-reaching collection of departmental spaces. The first floor spaces include several computer and electrical engineering laboratories of various sizes, a registrar scheduled classroom and the first floor of the chemical engineering teaching and research areas that is housed in the southeast three-story addition. The north end of the first floor is occupied by office space for the JODASS program. The second floor of Harrington Hall houses additional JODASS space, electrical engineering teaching laboratories as well as four EE&CS faculty offices, The second level of the Chemical Engineering teaching and research laboratories, a shared senior research projects lab, civil engineering computational spaces and three centrally scheduled classrooms. The third floor of Harrington Hall mostly houses spaces dedicated to Chemical Engineering including research labs, teaching labs and faculty offices.



DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION



USE BREAKOUT LEGEND

- CLASSROOM / LABORATORY SUPPORT
- CLASSROOM / LABORATORY
- HIGH BAY
- OFFICE / ADMINISTRATION
- RESTROOMS
- BUILDING SUPPORT
- CIRCULATION

MECHANICAL AND ELECTRICAL EVALUATION

BUILDING MECHANICAL UTILITIES

5" CI Sanitary sewer exits the west side of the building.
2" domestic water enters the north side of the building.
6" storm sewer exits the north side of the buildings.
6" LP steam main enters the west side of the building.
The 1-1/2" pumped condensate exits the west side of the building.
1-1/4" natural gas enters the west side of the building.

001 MECHANICAL ROOM - BASEMENT *(FIG. 1.1 - 1.4)*

The basement mechanical room contains a 1-1/2" HP steam service, steam pressure reducing station, 1-1/2" pumped condensate return, flash tank, pressure reducing station, sanitary sewer ejector pump, steam/domestic hot water heater, vacuum pump, as well as other various accessories. It appears that much of this equipment is original 1950s version with the exception of the steam pressure reducing station which appears to have been added or upgraded during the LAB 120 renovations. See photos of this area below.

ROOF - MECHANICAL *(FIG. 1.5)*

The roof contains multiple items. Roof mounted exhaust fans, mini split air cooled condensing units, roof drains, abandoned capped curbs, plumbing vents, as well as a chiller. The chiller is located on an old abandoned cooling tower curb.

JODSASS CENTER - FIRST AND SECOND FLOOR

HVAC SYSTEMS:

The HVAC system for this space is provided by a rooftop unit, with VAV boxes with hot water reheat for each zone. Hot water for reheats is created using a steam/heating water converter, condensate pump, and a pair of heating water pumps.

PLUMBING SYSTEMS: New plumbing services were provided for this space.

FIRE PROTECTION: This area is provided with a wet sprinkler system with concealed heads.

120 LAB - FIRST FLOOR *(FIG. 1.6)*

HVAC SYSTEMS: The HVAC system for this space is provide by a dedicated rooftop unit, with VAV boxes with hot water reheat for each of the 6 zones. Equipment appears to be early 2000 version. Hot water for reheats is created using steam/heating water converter, condensate and a pair of heating water pumps located in the basement MER.of Upson II. A new chiller was installed for this system around 2014.

PLUMBING SYSTEMS: Typical, no notable issues.

FIRE PROTECTION: No fire protection was observed.

FIGURE 1.1
Steam Pressure Reducing Station

FIGURE 1.2
Controls Air Compressor

FIGURE 1.3
Sewage Ejector Pump

FIGURE 1.4
Domestic Water Heater

FIGURE 1.5
Mini Split ACCUs

FIGURE 1.6
Lab 120 HVAC

160 LAB - FIRST FLOOR *(FIG. 1.7 - 1.9)*

HVAC SYSTEMS: This area was constructed as part of the 1969 Upson I project. This area is served by a dedicated air handling unit (AHU-12). This area is very compact and maintenance for this equipment is very tight. This unit is provided with steam heating. The cooling for this air handling unit is provided by a chiller mounted on the roof. There is a dedicated exhaust system that serves a jet turbine engine that was installed in 2010. This exhaust system exits the lab and runs up the exterior of the building to 15' above the adjacent roof.

PLUMBING SYSTEMS: Typical, no notable issues.

FIRE PROTECTION: No fire protection was observed.

FIRST FLOOR - WEST SIDE

HVAC SYSTEMS: In general, most of this floor is heated with perimeter steam unit ventilators and steam perimeter radiation. The controls are predominantly pneumatic.

PLUMBING SYSTEMS: The plumbing fixtures appear to have been replaced at some point and are in good working condition. The drain, waste, and vent piping as well as the domestic water piping within the ceilings and walls were not accessible at the time of our visit. It is assumed that most of the piping is original to the building.

FIRE PROTECTION: No fire protection was observed.

SECOND FLOOR *(FIG. 1.10)*

HVAC SYSTEMS: The northwest portion of this floor appears to be mostly original equipment. Steam unit ventilators, and perimeter radiation provide heating. No cooling is provided in these areas. The south west and southeast portions are provided with heating and cooling from an air handling unit installed in the penthouse mechanical room of Upson II. This is a multizone unit that serves various areas of both Harrington and Upson II. The large middle classroom 218 is provided the newer Trane PTAC units for HVAC.

PLUMBING SYSTEMS: Typical, no notable issues.

260 LAB - SECOND FLOOR *(FIG. 1.11 - 1.15)*

HVAC SYSTEMS: This area was constructed as part of the 1969 Upson I project. It was updated with new HVAC in 1997. This space is served by a dedicated make up air unit (AHU-13). There are 7 individual terminal coils for 7 different zone controls. This lab is served by a single roof mounted exhaust fan that is connected to 4 fume hoods. This fan also has a heat recovery coil in the main exhaust duct trunk. The make-up air unit is served heating water and chilled water. Heating water is created through a steam/heating water heat exchanger located in the mechanical room 260D. The chilled water equipment is actually located in a penthouse located on the roof of Upson II. A new chiller was installed for this system around 2014.

PLUMBING SYSTEMS: Acid waste sinks are located in this lab.

FIRE PROTECTION: No fire protection was observed.

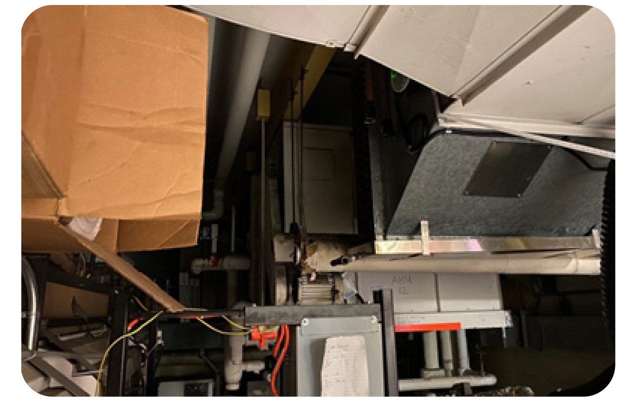


FIGURE 1.7
Lab 160 AHU-12 End View

FIGURE 1.8
Lab 160 AHU-12 Side View

FIGURE 1.9
AHU-12 Chiller

FIGURE 1.10
Steam Pressure Reducing Station

FIGURE 1.11
Steam Pressure Reducing Station

FIGURE 1.12
Steam Pressure Reducing Station

THIRD FLOOR *(FIG. 1.16 - 1.17)*

HVAC SYSTEMS: It appears that most of this floor has the original heating equipment. Steam unit ventilators and perimeter radiation provide heat. There is little to no ventilation in this floor. Lab 321 has 3 large fume hoods. These would be served by 3 roof mounted exhaust fans with risers. The offices 322-323 are provided with individual split system air conditioners.

PLUMBING SYSTEMS: It should be noted that there is little to no water pressure in the men's restroom. This may be indicative of piping issues. The lab areas on the west end are provided with acid waste, natural gas, compressed air, and vacuum piping.

FIRE PROTECTION: No fire protection was observed.

360 LAB - THIRD FLOOR *(FIG. 1.18)*

HVAC SYSTEMS: This area was constructed as part of the 1969 Upson I project. This area is served by a dedicated air handling unit (AHU-14). This unit uses steam as a heat source. No cooling was observed for this unit.

PLUMBING SYSTEMS: Other than the pressure issue listed above, no other issues were noted.

FIRE PROTECTION: No fire protection was observed.

ELECTRICAL - FULL BUILDING

ELECTRICAL SYSTEM: The electrical system is a 1600A 208/120V service located in room #2 of the basement. An arc flash study was performed on this equipment; however, it does not indicate when this work was done. The panel doesn't look very old, but we cannot confirm the age of the panelboard.

LIGHTING: The majority of the lights are standard T8 2x4 fixtures or 1x4 flush mounted fixtures. In the main display area, there are accent lights.

FIRE ALARM: The notification devices are fairly new, we were not able locate the fire alarm panel.

DATA: A combination of surface raceway and flush mounted data was installed in offices and classrooms.

FIGURE 1.13
Typical Fume Hood

FIGURE 1.14
Chilled Water Pumps located in Upson II Penthouse

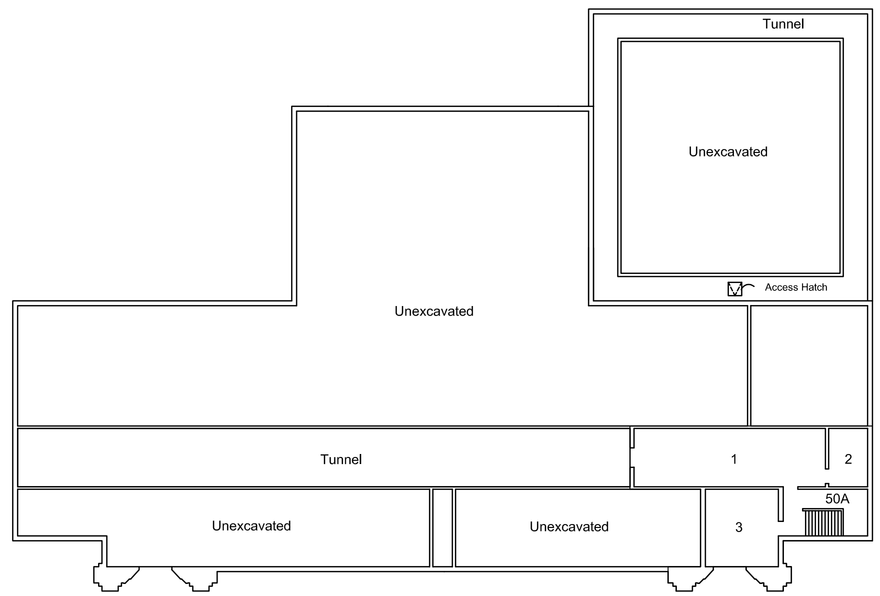
FIGURE 1.15
New Chiller (2014) for Lab 160 MAU AHU-13

FIGURE 1.16
Lab 321 Hoods

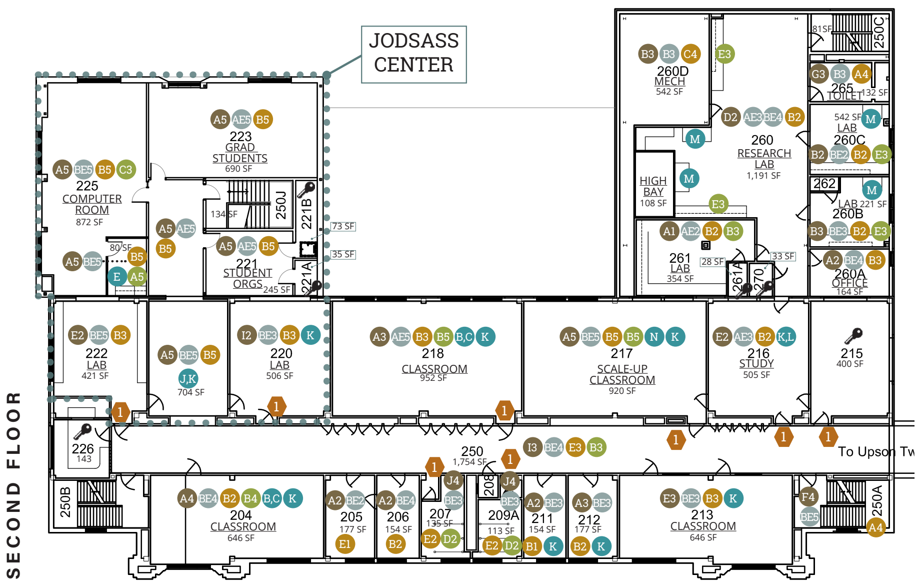
FIGURE 1.17
Lab 321 Hood Exhaust Fans

FIGURE 1.18
Lab 320 AHU-14

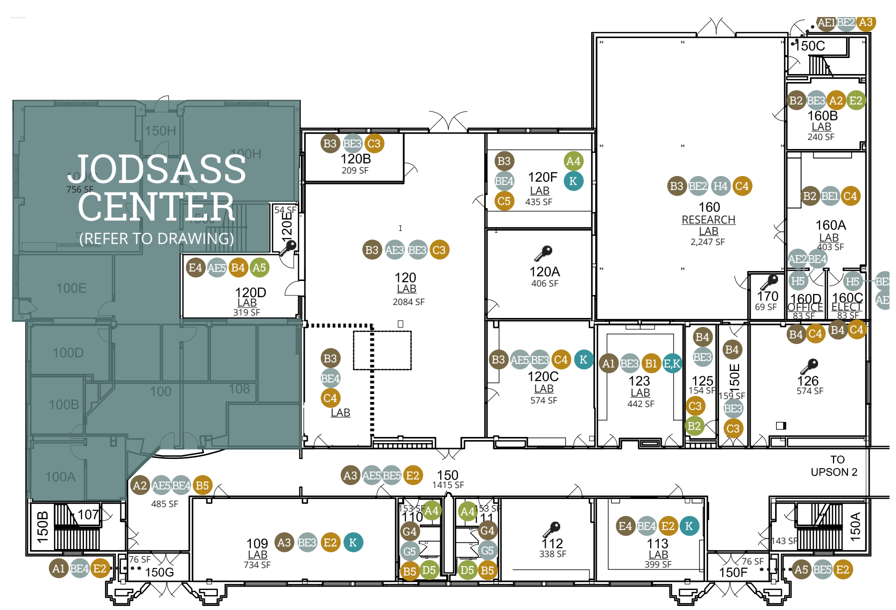
LOWER LEVEL



SECOND FLOOR



FIRST FLOOR



THIRD FLOOR

KEYNOTE LEGEND

1 CODE ISSUE: ADA ACCESSIBILITY
2 CODE ISSUE: EGRESS PATHWAY

INTERIOR CONDITIONS
5=BEST 1=WORST

NO ACCESS

A# FLOOR COVERING (TYPE + CONDITION)
A: CARPET
B: EXP CONCRETE
C: SHEET VINYL
D: EPOXY
E: VCT
F: LVT
G: CERAMIC TILE
H: RUBBER
I: ASBESTOS TILE
J: TERRAZZO
K: RAISED FLOOR

A# WALLS (TYPE + CONDITION)
A: DRYWALL
B: CMU
C: BRICK
D: CONCRETE
E: PAINT
F: WOOD
G: CERAMIC TILE
H: EXP BRICK
I: PLASTER/STUCCO
J: BURNISHED CMU
K: GLAZED CMU
L: STONE
M: ACOUSTIC TILE

A# CEILINGS (TYPE + CONDITION)
A: GYP BOARD
B: ACT
C: EXPOSED
D: WOOD
E: ADHERED TILE

A# CASEWORK (TYPE + CONDITION)
A: PLAM
B: WOOD
C: DISPLAY CASE
D: TLT PARTITION
E: STEEL

A EQUIPMENT (TYPE + CONDITION)
A: COPY MACHINE
B: VIDEO SCREEN
C: PROJECTOR
D: SMARTBOARD
E: REFRIGERATOR
F: -80 C FREEZER
G: -20 C FREEZER
H: -4 C FREEZER
I: LASER TABLE
J: CONFERENCE TV
K: WHITE BOARD
L: VENDING MACHINE
M: LAB HOOD
N: SCALE-UP

1974

46,452 GSF

The tables below show the square footage by use and department for Upson II.

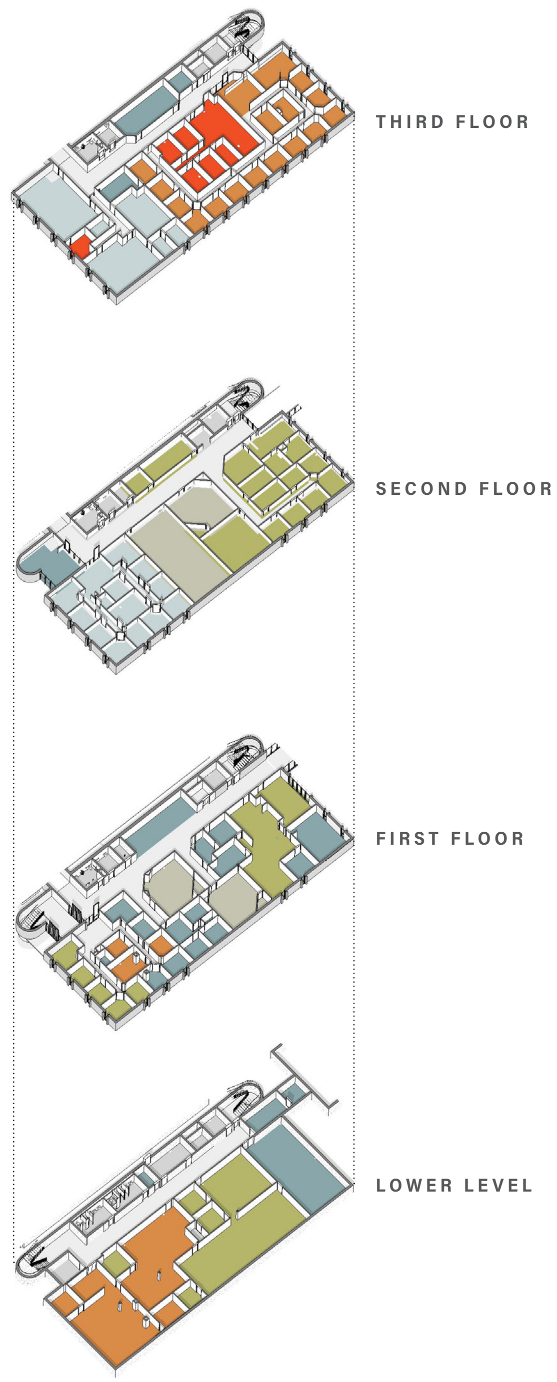
STATS	
# OF LEVELS	4
NSF	25,196 NSF
GSF	46,452 GSF
SPACE TYPES (NSF)	
PE	-
GEO E	-
CIVIL E	3,995 SF
CHEM E	1,098 SF
EE&CS	2,902 SF
IES	-
MECH E	5,008 SF
BIO E	2,670 SF
COE	7,060 SF
REG	2,463 SF
USE BREAKOUT	
TEACHING LAB	818 SF
RESEARCH LAB	4,603 SF
LAB SUPPORT	1,000 SF
LECTURE	2,384 SF
OFFICE + ADMIN	14,666 SF
OTHER	1,725 SF

UPSON II

BUILDING SUMMARY

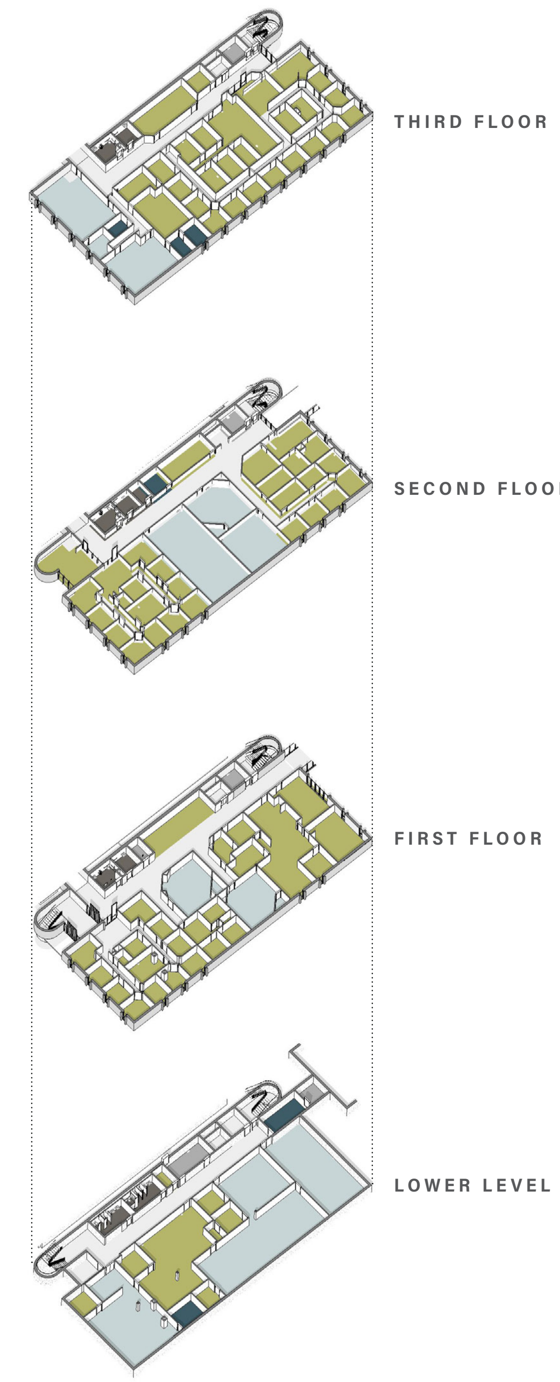
Upson II was constructed in 1974 and is comprised of approximately 46,452 gross square feet. It includes three stories above grade plus an occupied basement. The structure occupies a narrow footprint with a cast-in-place concrete structure and brick façade with narrow aluminum framed windows and is inconsistent with the context of the adjoining Harrington Hall. Upson II mostly aligns and connects with all three floors of Harrington Hall and connects to the rest of the complex only at the ground level.

The basement of Upson II houses laboratory space for the Bio-engineering program and the Mechanical Engineering department as well as a shared core facility for imaging instrumentation. The Dean's office for the College of Engineering and Mines is located on the first floor along with two, small underutilized classrooms and a portion of the faculty offices for Mechanical Engineering. The second floor is organized similarly to the first with two additional small classrooms and the majority of the faculty offices for Mechanical and Civil Engineering. The third floor includes the faculty offices for Electrical Engineering & Computer Science as well as faculty offices for Chemical Engineering. The third floor also includes two teaching / research laboratories for environmental engineering associated with the Chemical Engineering department and some space for graduate students in that program.



DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION



USE BREAKOUT LEGEND

- CLASSROOM / LABORATORY SUPPORT
- CLASSROOM / LABORATORY
- HIGH BAY
- OFFICE / ADMINISTRATION
- RESTROOMS
- BUILDING SUPPORT
- CIRCULATION

MECHANICAL SITE EVALUATION

BUILDING MECHANICAL UTILITIES

6" CI Sanitary sewer exits the west side of the building.

3" domestic water is connected to a 4" water main in the basement of Harrington hall on the north side of Upson II.

6" storm sewer exits the south side of the buildings.

2" HP steam main enters the west side of the building.

2" pumped condensate exits the west side of the building.

1-1/4" natural gas is connected to second floor Unit B located in Harrington Hall.

1" compressed air is connected to second floor Unit B located in Harrington Hall.

19 MECHANICAL ROOM - BASEMENT MIDDLE *(FIG. 2.1 - 2.3)*

There is a 9 zone multizone air handling unit in this space (AHU-3). This unit is provided with low pressure steam heating and chilled water cooling. This unit serves the entire basement area. There is a condensate pump and a sump pump also located in this room.

25 MECHANICAL ROOM - BASEMENT WEST *(FIG. 2.4 - 2.5)*

HVAC SYSTEMS: This area contains the steam and condensate service for the building, and a condensate pump.

PLUMBING SYSTEMS: This area contains a large base mounted sewage ejector pump.

FIRE PROTECTION: No fire protection was observed.

401 MECHANICAL PENTHOUSE *(FIG. 2.6 - 2.8)*

HVAC SYSTEMS: The penthouse contains two air handlers. AHU-1 is a dual duct (hot deck/cold deck) VAV system. This air handler serves first, second, and third floors. These floors have dual duct VAV Boxes. The second air handler AHU-2 serves portions of Harrington Hall and is discussed in other areas of this report. Each unit is provided with hot water heating and chilled water cooling. Heating water is provided through a steam/heating water heat exchanger and a pair of pumps. Chilled water is provided by a roof mounted chiller and a pair of pumps.

PLUMBING SYSTEMS: No issues were noted.

FIRE PROTECTION: No fire protection was observed.

BASEMENT FLOOR

HVAC SYSTEMS: This area is served by AHU-3. As described above, the area is provided with heating and cooling from the 9 zone multizone unit.

PLUMBING SYSTEMS: The main bathroom groups in the hallway have been upgraded. No issues were noted.

FIRE PROTECTION: No fire protection was observed.

FIRST FLOOR

HVAC SYSTEMS: This entire floor is served with dual duct VAV boxes with hot deck and cold deck ductwork. There are multiple zones throughout this space. The return air is handled through light troffers in the ceiling, they do not have typical return air grilles. The perimeter rooms are also provided with radiation along the exterior walls.

PLUMBING SYSTEMS: The plumbing fixtures appear to have been updated at some point. They appear to be in good working order.

FIRE PROTECTION: No fire protection was observed.

SECOND FLOOR

HVAC SYSTEMS: This entire floor is served with dual duct VAV boxes with hot deck and cold deck ductwork. There are multiple zones throughout this space. The return air is handled through light troffers in the ceiling, they do not have typical return air grilles. The perimeter rooms are also provided with radiation along the exterior walls.

PLUMBING SYSTEMS: The plumbing fixtures appear to have been updated at some point. They appear to be in good working order. The lab areas on the west end are provided with acid waste, natural gas, compressed air, and vacuum piping.

FIRE PROTECTION: No fire protection was observed.

THIRD FLOOR

HVAC SYSTEMS: This entire floor is served with dual duct VAV boxes with hot deck and cold deck ductwork. There are multiple zones throughout this space. The return air is handled through light troffers in the ceiling, they do not have typical return air grilles. The perimeter rooms are also provided with radiation along the exterior walls. There are two rooms on the west end of this floor with fume hoods and dedicated exhaust fans on the roof.

PLUMBING SYSTEMS: The plumbing fixtures appear to have been updated at some point. They appear to be in good working order. The lab areas on the west end are provided with acid waste, natural gas, compressed air, and vacuum piping.

FIRE PROTECTION: No fire protection was observed.

FIGURE 2.1
AHU-3 Multizone Air Handler

FIGURE 2.2
AHU-3 Multizone Air Handler

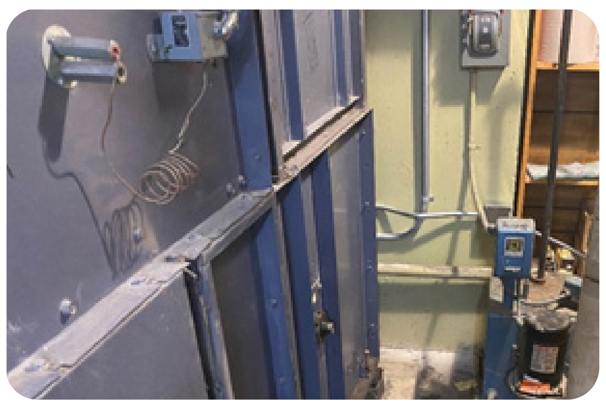


FIGURE 2.3
Condensate Pump

FIGURE 2.4
Condensate Pump

ELECTRICAL - FULL BUILDING

ELECTRICAL SYSTEM: The electrical system was updated at one point to have a standby generator for the entire building. The main reason for this was to backup the State of ND servers located in the basement of this building. The servers have since been relocated to a different building. The existing generator is rated at 500KW 208/120V 3PH Diesel fueled with 400-gallon tank. In 2015 the additional cooling for the servers was also removed from the generator load.

LIGHTING: A majority of the rooms are standard T8 2x4 fixtures. The rooms appear to be well lit.

FIRE ALARM: The existing fire alarm panel is a Simplex 4020. It is located in RM 168 on first floor.

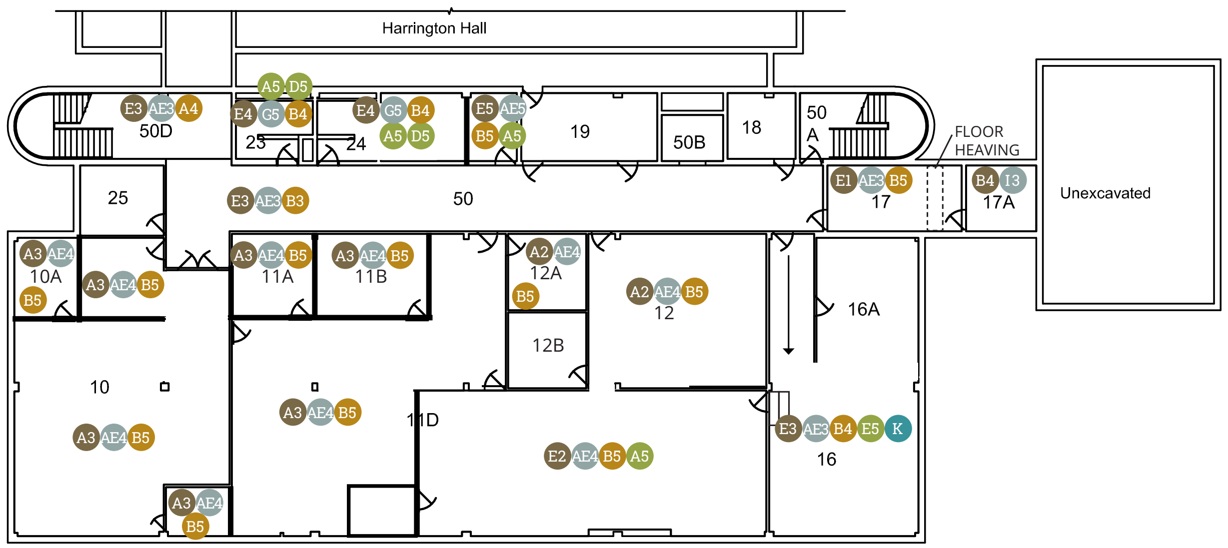
DATA: A combination of surface raceway and flush mounted data was installed in offices and classrooms.

FIGURE 2.5
Sewage Pump

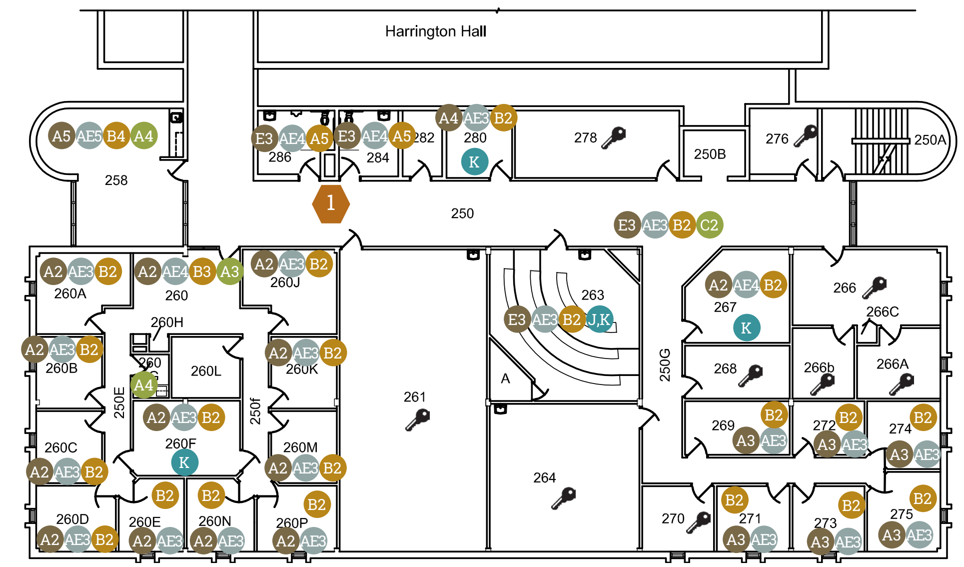
FIGURE 2.6
Air Handler AHU-1

FIGURE 2.7
Air Handler AHU-1

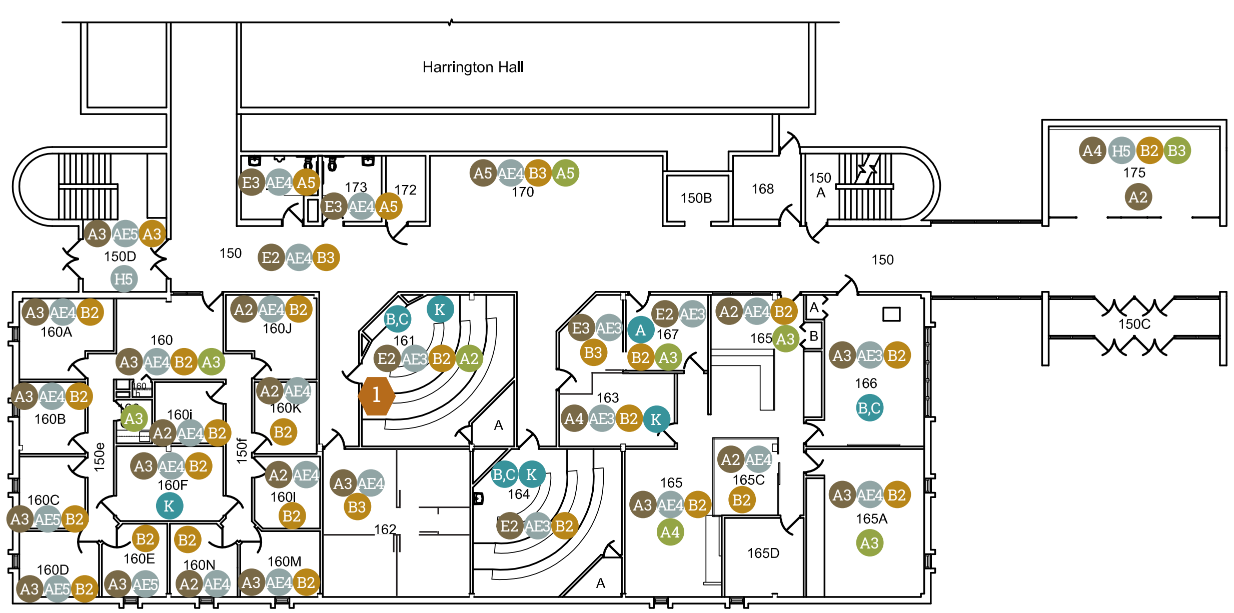
FIGURE 2.8
Chiller



LOWER LEVEL



SECOND FLOOR



FIRST FLOOR

THIRD FLOOR

KEYNOTE LEGEND

1 CODE ISSUE: ADA ACCESSIBILITY
2 CODE ISSUE: EGRESS PATHWAY

INTERIOR CONDITIONS
5=BEST 1=WORST

NO ACCESS

A# FLOOR COVERING (TYPE + CONDITION)
- A: CARPET
- B: EXP CONCRETE
- C: SHEET VINYL
- D: EPOXY
- E: VCT
- F: LVT
- G: CERAMIC TILE
- H: RUBBER
- I: ASBESTOS TILE
- J: TERRAZZO
- K: RAISED FLOOR

A# WALLS (TYPE + CONDITION)
- A: DRYWALL
- B: CMU
- C: BRICK
- D: CONCRETE
- E: PAINT
- F: WOOD
- G: CERAMIC TILE
- H: EXP BRICK
- I: PLASTER/STUCCO
- J: BURNISHED CMU
- K: GLAZED CMU
- L: STONE
- M: ACOUSTIC TILE

A# CEILINGS (TYPE + CONDITION)
- A: GYP BOARD
- B: ACT
- C: EXPOSED
- D: WOOD
- E: ADHERED TILE

A# CASEWORK (TYPE + CONDITION)
- A: PLAM
- B: WOOD
- C: DISPLAY CASE
- D: TLT PARTITION
- E: STEEL

A EQUIPMENT (TYPE + CONDITION)
- A: COPY MACHINE
- B: VIDEO SCREEN
- C: PROJECTOR
- D: SMARTBOARD
- E: REFRIGERATOR
- F: -80 C FREEZER
- G: -20 C FREEZER
- H: -4 C FREEZER
- I: LASER TABLE
- J: CONFERENCE TV
- K: WHITE BOARD
- L: VENDING MACHINE
- M: LAB HOOD
- N: SCALE-UP

1971
76,179 GSF

The tables below show the square footage by use and department for Upson I.

STATS	
# OF LEVELS	2
NSF	33,389 NSF
GSF	76,179 GSF
SPACE TYPES (NSF)	
PE	-
GEO E	-
CIVIL E	9,244 SF
CHEM E	383 SF
EE&CS	-
IES	-
MECH E	22,609 SF
BIO E	-
COE	1,153 SF
REG	-
USE BREAKOUT	
TEACHING LAB	10,124 SF
RESEARCH LAB	11,463 SF
LAB SUPPORT	10,030 SF
LECTURE	-
OFFICE + ADMIN	1,772 SF
OTHER	-

UPSON I

BUILDING SUMMARY

Upson I was constructed in 1971 and is comprised of approximately 76,179 gross square feet. It is a two story structure and was originally constructed to provide the bulk of the high bay, industrial teaching and research space for the Mechanical and Civil Engineering programs. Approximately two-thirds of it's footprint is a single tall story for high bay space along the eastern and western thirds while the center third of the building accommodates a mezzanine level with various medium and small sized spaces that serve as teaching laboratories and small graduate office and storage spaces. The façade of the building has very few windows and provides overhead sectional doors into the high bay spaces along the west side, creating large vehicle and equipment entrances for the high bay spaces. The high bay spaces along the east side of the facility do not have sufficient overhead door access.

The first floor high bay spaces generally accommodate Mechanical Engineering operations along the west side of the first floor and Civil Engineering spaces along the east. A large portion of the high bay spaces are served on each side by three bridge cranes that can move north and south over the top of the existing concrete masonry partitions separating the large high bay spaces. The center portion of the first floor provides storage and support space such as small lab alcoves, a welding shop and a laser laboratory. The second floor mezzanine area has a single, double loaded corridor running north and south and provides space for Mechanical Engineering teaching and research labs along with small office spaces for Civil and Mechanical Engineering graduate students as well as research spaces that are shared among various departments and programs.

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

USE BREAKOUT LEGEND

- CLASSROOM / LABORATORY SUPPORT
- CLASSROOM / LABORATORY
- HIGH BAY
- OFFICE / ADMINISTRATION
- RESTROOMS
- BUILDING SUPPORT
- CIRCULATION

MECHANICAL SITE EVALUATION

BUILDING MECHANICAL UTILITIES

6" CI Sanitary sewer exits the north side of the building.

6" domestic water service enters the building on the north side. This service runs around the entire building and also feeds Upson II and Harrington Hall.

8" storm sewer exits the southeast side of the building.

4" HP steam main enters the east side of the building.

2" pumped condensate exits the east side of the building.

4" natural gas enters the north side of the building. This service runs around the entire building and also feed Upson II and Harrington Hall.

2" compressed air enters the west side of the building.

005 MECHANICAL ROOM - BASEMENT *(FIG. 3.1 - 3.5)*

This room contains a steam pressure reducing station, steam/heating water converter, heating water pumps, vacuum pump, domestic hot water generator, 4" domestic water meter, air compressors, large in-line return/exhaust fan, and various other accessories. You can also access a series of lower level storage areas and a tunnel to the 4" 125# HP steam and 2" pumped condensate service from this space. There are three large base mounted pumps also installed in this room. These pumps are most likely used for a specific research project.

204 MECHANICAL ROOM - SECOND FLOOR NORTH *(FIG. 3.6 - 3.7)*

This room contains air handlers (AHU-10) and (AHU-11). These units are single zone and provided with steam heating and chilled water cooling. These units were installed new in 2020.

201B MECHANICAL ROOM - SECOND FLOOR SOUTH *(FIG. 3.8 - 3.11)*

This room contains all new equipment. Air handler (AHU-9), return fan, steam pressure reducing station, steam heat exchanger, heating pumps, air compressor, and various accessories. All of this equipment was new and installed in 2020.

ROOF - MECHANICAL *(FIG. 3.12 - 3.14)*

The roof contains typical mechanical equipment. Roof drains, roof hoods, a few exhaust fans, and two additional rooftop air handlers. The York RTU was new in 2020, the Trane RTU is older, around 2010.

FIGURE 3.1
Domestic Hot Water Generator, Steam Heat Exchanger, Heating Water Pumps

FIGURE 3.2
Heating Pumps

FIGURE 3.3
Steam / Heating Water Heat Exhanger

FIGURE 3.4
Return / Exhaust Fan

FIGURE 3.5
Research Project Pumps

FIGURE 3.6
Air Handler AHU-10

FIGURE 3.7
Air Handler AHU-11

FIGURE 3.8
Air Handler AHU-9

FIGURE 3.9
Return Air Fan

FIGURE 3.10
Steam Heat Exchanger

FIGURE 3.11
Pumps

FIGURE 3.12
Roof

FIGURE 3.13
York Rooftop Unit

FIGURE 3.14
Trane Rooftop Unit

FIGURE 3.15
Air Handling Unit AHU-4

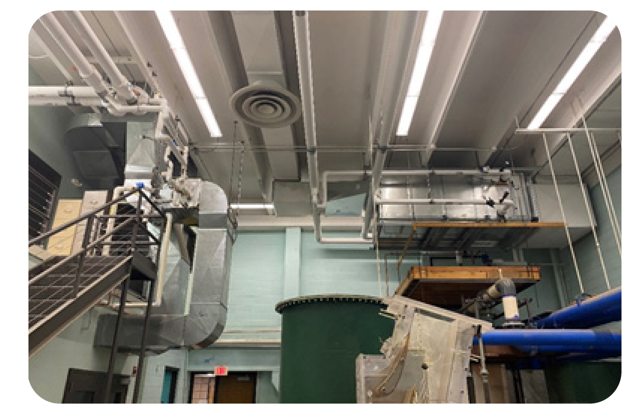


FIGURE 3.16
Ductwork from York to 100A-100C

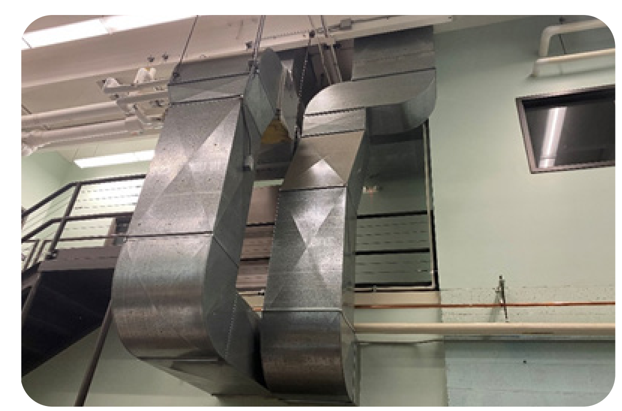


FIGURE 3.17
Ductwork from York RTU to 100A - 100C

FIGURE 3.18
Air Handling Unit AHU-5

100 RESEARCH - FIRST FLOOR *(FIG. 3.15)*

HVAC SYSTEMS: This area is served by a single zone air handling unit (AHU-4) suspended from the ceiling. This unit was installed in 2020. This unit provides heating and cooling using steam and chilled water.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

100A - 100C RESEARCH - FIRST FLOOR *(FIG. 3.16 - 3.17)*

HVAC SYSTEMS: This area is served by a single zone roof mounted air handling unit (York). This unit was installed in 2020. This unit provides heating and cooling using steam and chilled water. The coils for the heating and cooling are installed in the space below the roof.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

102 SHOP - FIRST FLOOR *(FIG. 3.18)*

HVAC SYSTEMS: This area is served by a single zone air handling unit suspended from the roof structure (AHU-5). This system brings in fresh air from the roof as well as return air in from the space. This unit was installed in 2020. This unit provides heating and cooling using steam and chilled water.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

104 SHOP - FIRST FLOOR *(FIG. 3.19)*

HVAC SYSTEMS: This area is served by a single zone air handling unit suspended from the roof structure (AHU-6). This system brings in fresh air from the roof as well as return air in from the space. This unit was installed in 2020. This unit provides heating and cooling using steam and chilled water.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

104 SHOP - FIRST FLOOR *(FIG. 3.20)*

HVAC SYSTEMS: This area is served by a single zone air handling unit installed in MER 204 (AHU-10). This system brings in fresh air from the roof as well as return air in from the space. This unit was installed in 2020. The unit provides heating and cooling using steam and chilled water. There is also a central exhaust fan in the middle of the room at the roof level.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

150 CIVIL OFFICES / KILN - FIRST FLOOR *(FIG. 3.21 - 3.24)*

HVAC SYSTEMS: This area is served by a single zone rooftop air handling unit installed on the roof (RTU). This system brings in fresh air from the roof and provide make up air for the welding shop 105 and the wood shop 111. This unit was installed in 2020. The unit provides heating and cooling using steam and chilled water. There are also two original 1969 exhaust fans on the roof. One each for the welding shop and wood shop.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

150 CIVIL OFFICES / KILN - FIRST FLOOR *(FIG. 3.25)*

HVAC SYSTEMS: This area is served by a single zone air handling unit installed in MER 204 (AHU-11). This system brings in fresh air from the roof as well as return air in from the space. This unit was installed in 2020. The unit provides heating and cooling using steam and chilled water. There is also a central exhaust fan mounted on the roof that provides exhaust for various rooms in this area.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

112 HIGH BAY - FIRST FLOOR *(FIG. 3.26 - 2.28)*

HVAC SYSTEMS: This area is served by a single zone air handling unit suspended from the roof structure (AHU-1). This system brings in fresh air from the roof as well as return air in from the space. This unit was installed in 2020. This unit provides heating and cooling using steam and chilled water. There is also a central exhaust fan in the middle of the room at the roof level. This area also contains a large hood and exhaust system. At this time, it appears that the exhaust system is abandoned. A Curing Room is also set up in this space. This room contains a series of misting heads to control humidity.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

113 HIGH BAY - FIRST FLOOR *(FIG. 3.29)*

HVAC SYSTEMS: This area is served by a single zone air handling unit suspended from the roof structure (AHU-2). This system brings in fresh air from the roof as well as return air in from the space. This unit was installed in 2020. This unit provides heating and cooling using steam and chilled water. There is also a central exhaust fan in the middle of the room at the roof level.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

114 HIGH BAY - FIRST FLOOR *(FIG. 3.30)*

HVAC SYSTEMS: This area is served by a single zone air handling unit suspended from the roof structure (AHU-3). This system brings in fresh air from the roof as well as return air in from the space. This unit was installed in 2020. This unit provides heating and cooling using steam and chilled water. There is also a central exhaust fan in the middle of the room at the roof level. An additional dedicated engine exhaust fan is also provided along the east wall.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

SECOND FLOOR *(FIG. 3.31)*

HVAC SYSTEMS: The central portion of the first floor, between the large exterior labs, is served by AHU-9 which is located in MER 201B. This includes rooms 201 - 222, etc. This air handler is a dual duct unit with three separate sets of hot deck/cold deck mains. Each individual room is provided with a dual duct VAV box and provides individual zone control. There is no indication that these VAV boxes have been upgraded, they would be original to the 1969 building.

PLUMBING SYSTEMS: Typical HW,CW, gas, compressed air as expected in this type of space.

FIRE PROTECTION: No fire protection was observed.

ELECTRICAL - FULL BUILDING

ELECTRICAL SYSTEM: The electrical service is a 480V 3-Phase 800A service, it was installed in 1970. The main distribution panel is in the basement with a transformer mounted between the 480V 3 Phase service and the 208V 3 Phase distribution. The 208V 3Phase has a bolted pressure switch shown on the left in Figure 1. Clearance between walls and other equipment does not meet current spacing requirements. Additional distribution is located on the other side of the sections shown in Figure 1, see Figure 2 for back side.

LIGHTING: The existing lighting appears to be adequate for each of the spaces.

FIRE ALARM: The existing fire alarm panel is a Simplex 4020. It is located in the corridor outside of room 101 on the first floor.

DATA: A combination of surface raceway and flush mounted data was installed in offices and classrooms.

FIGURE 3.19
Air Handling Unit AHU-6

FIGURE 3.20
Air Handling Unit AHU-10

FIGURE 3.21
York Rooftop Unit

FIGURE 3.22
Welding and Wood Shop Exhaust Fans

FIGURE 3.23
Welding Area

FIGURE 3.24
Wood Shop Area

FIGURE 3.25
Air Handling Unit AHU-11

FIGURE 3.26
Air Handling Unit AHU-1

FIGURE 3.27
Hood

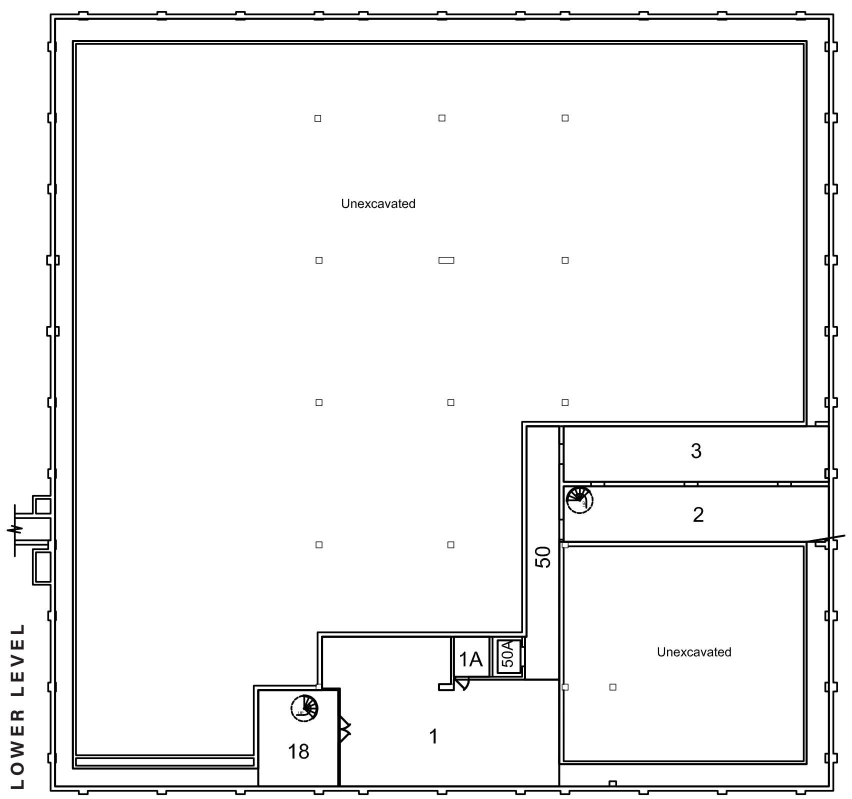
FIGURE 3.28
Curing Room

FIGURE 3.29
Air Handler AHU-2

FIGURE 3.30
Air Handler AHU-3

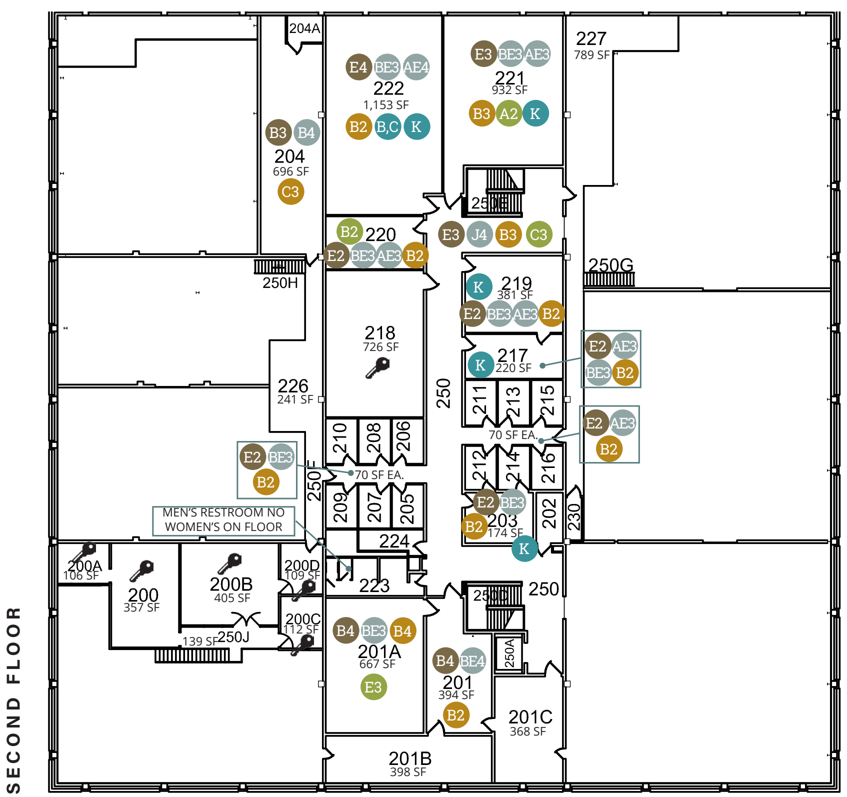
FIGURE 3.31
Air Handler AHU-9

LOWER LEVEL



FIRST FLOOR

SECOND FLOOR



KEYNOTE LEGEND

1 CODE ISSUE: ADA ACCESSIBILITY
2 CODE ISSUE: EGRESS PATHWAY

INTERIOR CONDITIONS
5=BEST 1=WORST

NO ACCESS

A# FLOOR COVERING (TYPE + CONDITION)
A: CARPET
B: EXP CONCRETE
C: SHEET VINYL
D: EPOXY
E: VCT
F: LVT
G: CERAMIC TILE
H: RUBBER
I: ASBESTOS TILE
J: TERRAZZO
K: RAISED FLOOR

A# WALLS (TYPE + CONDITION)
A: DRYWALL
B: CMU
C: BRICK
D: CONCRETE
E: PAINT
F: WOOD
G: CERAMIC TILE
H: EXP BRICK
I: PLASTER/STUCCO
J: BURNISHED CMU
K: GLAZED CMU
L: STONE
M: ACOUSTIC TILE

A# CEILINGS (TYPE + CONDITION)
A: GYP BOARD
B: ACT
C: EXPOSED
D: WOOD
E: ADHERED TILE

A# CASEWORK (TYPE + CONDITION)
A: PLAM
B: WOOD
C: DISPLAY CASE
D: TLT PARTITION
E: STEEL

A EQUIPMENT (TYPE + CONDITION)
A: COPY MACHINE
B: VIDEO SCREEN
C: PROJECTOR
D: SMARTBOARD
E: REFRIGERATOR
F: -80 C FREEZER
G: -20 C FREEZER
H: -4 C FREEZER
I: LASER TABLE
J: CONFERENCE TV
K: WHITE BOARD
L: VENDING MACHINE
M: LAB HOOD
N: SCALE-UP

1964

68,690 GSF

The tables below show the square footage by use and department for Leonard Hall.

STATS	
# OF LEVELS	4
NSF	46,741 NSF
GSF	68,690 GSF

SPACE TYPES (NSF)	
PE	2,229 SF
GEO E	32,063 SF
CIVIL E	-
CHEM E	-
EE&CS	1,679 SF
IES	-
MECH E	-
BIO E	-
COE	3,144 SF
REG	7,626 SF

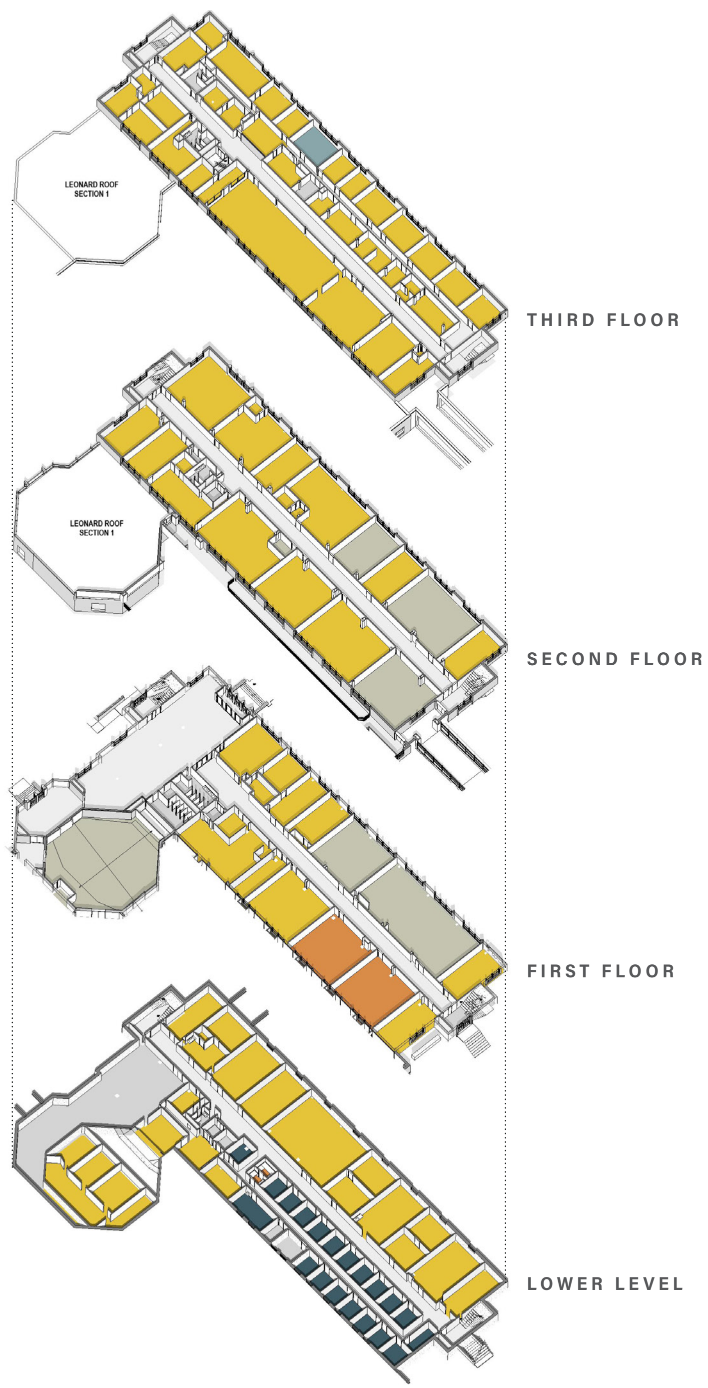
USE BREAKOUT	
TEACHING LAB	10,285 SF
RESEARCH LAB	4,773 SF
LAB SUPPORT	6,719 SF
LECTURE	5,614 SF
OFFICE + ADMIN	10,443 SF
OTHER	8,907 SF

LEONARD HALL

BUILDING SUMMARY

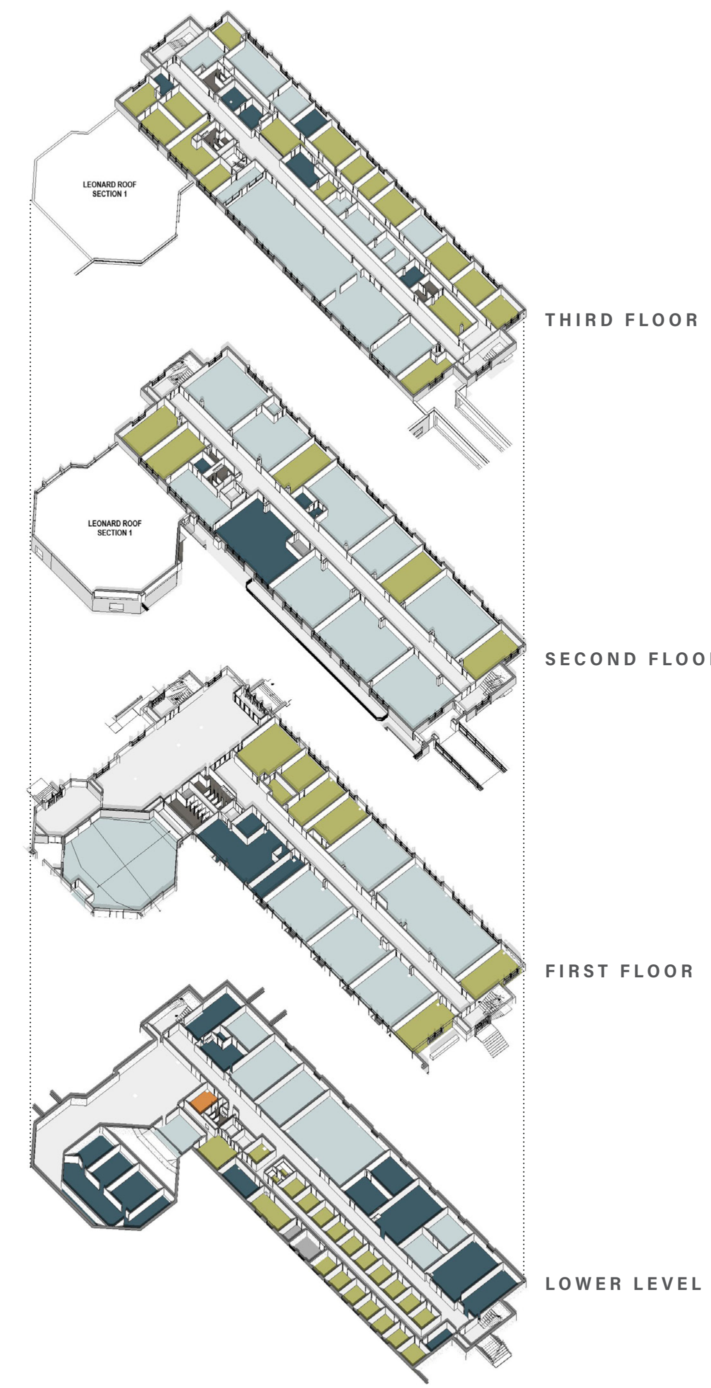
Leonard Hall was constructed in 1964 and is comprised of approximately 68,690 gross square feet in a historic structure including a basement, three floors above grade and third floor clerestory and small penthouse. It was originally built as the home of the Geology Department and the masonry exterior and interior masonry construction near the main entrance and in the main lobby are in laid with various fossils and geological specimens. All four floors are organized along a single double loaded corridor with the exception of the third floor that has a secondary corridor along the eastern half of the floor plate. The structure is cast in place concrete. The structure also houses a large lecture hall on the northwest corner of the original structure.

Most of the building is assigned to the Geology and Geological Engineering Department with a few exceptions. The eastern half of the basement layout provides a large amount of storage and industrial wet lab space to serve as storage and prep space for the Geology department's large collection of fossil and geological specimens as well as field equipment storage and some geology teaching and research space. The west half the basement floor provides a series of small rooms that are largely dedicated to graduate student office space for the Petroleum Engineering program. The north end of the first floor provides the main east entrance into the engineering complex. The lobby space in this area was originally designed as a display and open museum space that is still used in the same manner today with numerous fossil and geological specimens. The double loaded corridor extending south rom this area provides access to two of the larger registrar classrooms in the complex as well as two classrooms that have been assigned to the Electrical Engineering program for use as computational teaching and research laboratories. The balance of the space is assigned to Geology and Geological Engineering and includes teaching labs and faculty offices. The faculty offices for Geology on this floor and for the floors above were originally designed to be used as office space as well as faculty research space which creates faculty offices for this program that are in some cases as large as 400 net square feet. This is well outside of the current norm and campus standards for net assignable square feet for office space. The second floor of Leonard Hall includes three additional medium sized classrooms that are centrally scheduled by the registrar with the balance of the spaces assigned to the Geology and Geological Engineering department to accommodate teaching and research labs as well as additional large faculty offices. The third floor of Leonard Hall is almost entirely assigned to Geology and Geological Engineering to accommodate some of the smaller laboratory spaces in the program, additional large faculty offices and the FD Holland Jr Geology and Geological Engineering Library. The library occupies roughly one third of the assignable square footage of the floor and includes a relocated steel library stack mezzanine over a portion of the space to expand storage capacity.



DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION



USE BREAKOUT LEGEND

- CLASSROOM / LABORATORY SUPPORT
- CLASSROOM / LABORATORY
- HIGH BAY
- OFFICE / ADMINISTRATION
- RESTROOMS
- BUILDING SUPPORT
- CIRCULATION

MECHANICAL AND ELECTRICAL SITE EVALUATION

BUILDING MECHANICAL UTILITIES

There are two sanitary sewer services the exit the west side of the building. 5"CI and 4"CI.

There are two acid waste services the exit the west side of the building. 4"CI and 4"CI.

There are two storm sewer services the exit the west side of the building. 5"CI and 5"CI.

4" domestic water service enters the building on the north side toward the large lecture bowl.

3" HP steam main enters the south end of the large lecture bowl.

2" pumped condensate exits the south end of the large lecture bow.

2" natural gas enters the building on the north side toward the large lecture bowl.

002 MECHANICAL ROOM - BASEMENT *(FIG. 4.1-4.6)*

This room contains three air handlers (AHU-1, AHU-2, AHU-3), heating pumps, two steam/heating water heat exchangers, steam and condensate entrance, steam pressure reducing station, domestic water service, and various accessories. The air handlers were installed in 2020. They are served with hot water heating and chilled water cooling. The heating pumps and other remaining equipment appear to be original to the building in 1963. AHU-1 is a single zone unit and serves the basement with ventilation. AHU-2 is a single zone unit and serves the first floor with ventilation. AHU-3 is a single zone unit and serves the large lecture bowl #100 with ventilation. There is also a water-cooled chiller in this room.

PENTHOUSE AND ROOF - MECHANICAL *(FIG. 4.7-4.8)*

This penthouse contains an air handler (AHU-4). This unit is a dual duct VAV unit with hot deck/cold deck supply ductwork. This ductwork serves dual duct VAV boxes on the third floor. This unit is provided with heating water and DX for cooling. The roof area contains an air-cooled condensing unit and a fluid cooler. Both the air handler and the air-cooled condensing unit were replaced in 2020. The air-cooled condensing unit serves AHU-4. The fluid cooler must serve the chiller in the basement mechanical room which would serve AHU-1, AHU-2, and AHU-3. There is also a dual duct VAV box that serves the Library #326.

BASEMENT AREAS

HVAC SYSTEMS: This area is served by a dedicated air handler AHU-1. It is provided with hot water heating and chilled water cooling. The supply duct mains are routed down the main corridors with a supply grille feeding just inside the rooms. The return is drawn wild through a large wall grill in the main corridor. Each individual room is provided with perimeter radiation heating. There are no individual cooling zone controls. Besides the air handler, the rest of the heating equipment appears to be original to the 1963 building.

PLUMBING SYSTEMS: Typical for this type of space.

FIRE PROTECTION: No fire protection was observed.

FIRST FLOOR AREAS *(FIG. 4.9-4.11)*

HVAC SYSTEMS: The northern portion of this level is served by a dedicated air handler AHU-2. It is provided with hot water heating and chilled water cooling. The supply duct mains are routed down the main corridor with supply grilles in the ceiling of the north end rooms. The return is drawn wild through a large wall grill on the north end wall near the north stairs. Each individual room is provided with perimeter radiation heating and a few unit ventilators. Besides the unit ventilators, there are no other individual cooling zone controls for this end. Besides the air handler, the rest of the heating equipment appears to be original to the 1963 building. The south end of this level is provided with unit ventilators which provides a means of ventilation. These unit ventilators use heating hot water for heat, and chilled water for cooling. Some of the rooms are also provided with mini-split air conditions, either on the wall or in the ceiling. These rooms are 108, 110, and 112. There are reports that the unit ventilators no longer function properly and most likely no longer provide ventilation as originally intended. During the 2014 CEC project, fresh air was ducted to the west side unit ventilators because this new building covered outside air access.

PLUMBING SYSTEMS: Typical for this type of space. These fixtures appear to be original to the building.

FIRE PROTECTION: Fire protection was provided in this room under the CEC project in 2014.

SECOND FLOOR AREAS *(FIG. 4.12-4.15)*

HVAC SYSTEMS: This level is served by exterior unit ventilators. These unit ventilators us heating hot water for heat, and chilled water for cooling. The unit ventilators provide a source of fresh air to each space. This fresh air is pulled through the individual rooms and out into the corridor. From there it is exhausted out the north end of the corridor through a wall grille and an exhaust fan. The unit ventilators appear to be original to the 1963 building.

PLUMBING SYSTEMS: Typical for this type of space. These fixtures appear to be original to the building. Gas and compressed air are provided to lab type areas.

FIRE PROTECTION: No fire protection was observed.

201 LAB - SECOND FLOOR *(FIG. 4.16)*

HVAC SYSTEMS: This room is heated and cooled using a unit ventilator. This room also has a fume hood with a dedicated exhaust fan.

PLUMBING SYSTEMS: Typical lab type fixtures are provided in this room. They appear to be original to the building. Gas and compressed air are also provided at the labs.

FIRE PROTECTION: No fire protection was observed.

209 LAB - SECOND FLOOR

HVAC SYSTEMS: This room is heated and cooled using a unit ventilator. This room also has a fume hood with a dedicated exhaust fan.

PLUMBING SYSTEMS: Typical lab type fixtures are provided in this room. They appear to be original to the building. Gas and compressed air are also provided at the labs

FIRE PROTECTION: No fire protection was observed.

212 LAB - SECOND FLOOR *(FIG. 4.17)*

HVAC SYSTEMS: This room is heated and cooled using a unit ventilator. This room also has a fume hood with a dedicated exhaust fan.

PLUMBING SYSTEMS: Typical lab type fixtures are provided in this room. They appear to be original to the building. Gas and compressed air are also provided at the labs

FIRE PROTECTION: No fire protection was observed.

THIRD FLOOR

HVAC SYSTEMS: This area is served by AHU-4 located in the penthouse. This unit is a hot deck/cold deck unit which serves multiple dual duct VAV boxes throughout this level. The main supply ductwork is routed above the main corridor. Each individual space is provided with a dual duct VAV box for individual zone control. The perimeter rooms are also provided with hot water radiation. Return air is drawn through a large wall grille in the corridor and up into the penthouse where it is wild back to the air handler. Looking at the available drawings, most of the VAV boxes would be original to the building.

PLUMBING SYSTEMS: Typical for this type of space.

FIRE PROTECTION: No fire protection was observed.

326 LIBRARY - THIRD FLOOR

HVAC SYSTEMS: This area is served by AHU-4 located in the penthouse. There is a single dual duct VAV box that is dedicated to this space to control the heating and cooling

PLUMBING SYSTEMS: Typical for this type of space.

FIRE PROTECTION: No fire protection was observed.

ELECTRICAL - FULL BUILDING

ELECTRICAL SYSTEM: In 2015 a new 208V 3PH 2000A service was added in room 26 of the basement. This new service back fed the existing service located in room 48 of the basement.

LIGHTING: The existing lighting appears to be adequate for each of the spaces.

FIRE ALARM: The existing fire alarm panel is a Simplex 4100U, it is located in room 48 of the basement.

FIGURE 4.1
Air Handler AHU-1

FIGURE 4.2
Air Handler AHU-2

FIGURE 4.3
Air Handler AHU-3

FIGURE 4.4
Steam Heat Exchangers

FIGURE 4.5
Heat Water Pumps

FIGURE 4.6
Domestic Water Generator

FIGURE 4.7
Air Cooled Condensing Unit

FIGURE 4.8
Fluid Cooler

FIGURE 4.9
Typical Supply Register

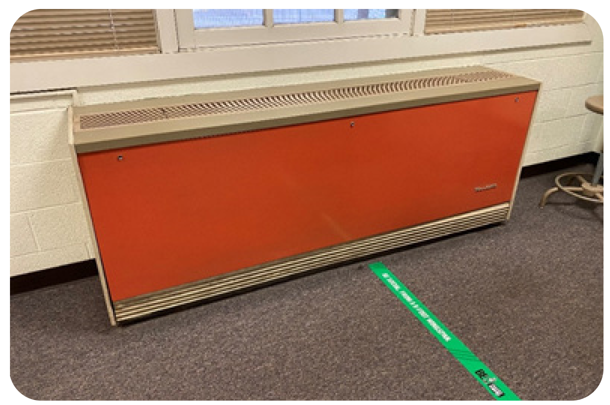


FIGURE 4.10
Typical Unit Ventilators

FIGURE 4.11
Typical Ceiling Mounted Mini-Split Cooling Cassette

FIGURE 4.12
Typical Unit Ventilator

FIGURE 4.13
Typical Unit Ventilator

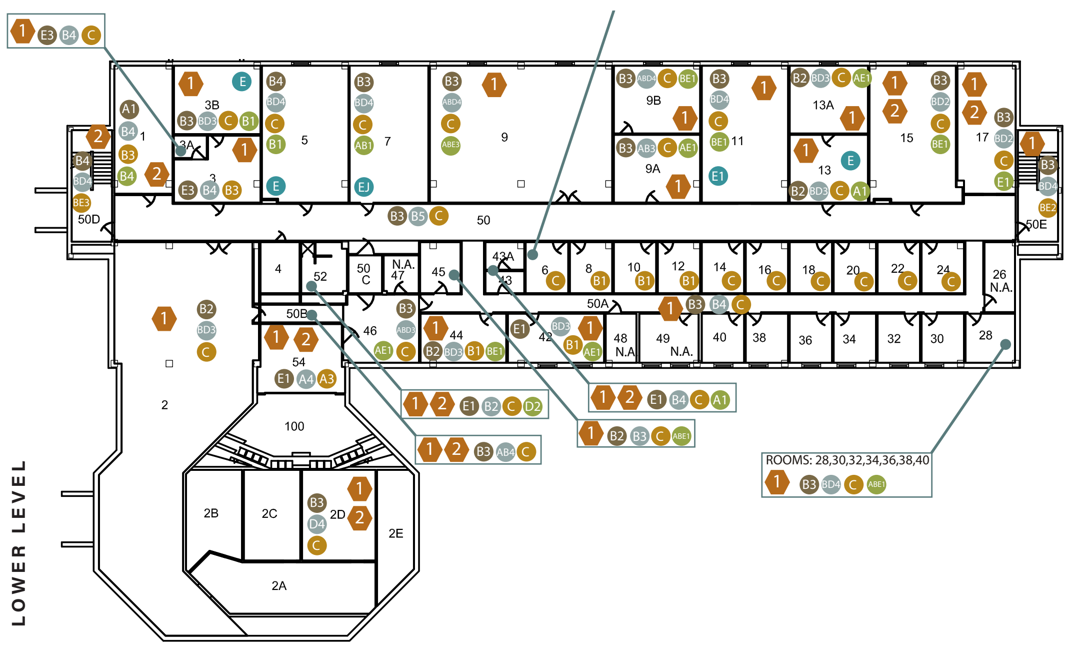
FIGURE 4.14
Typical Wall Hung Water Closet

FIGURE 4.15
Typical Wall Hung Lavatories

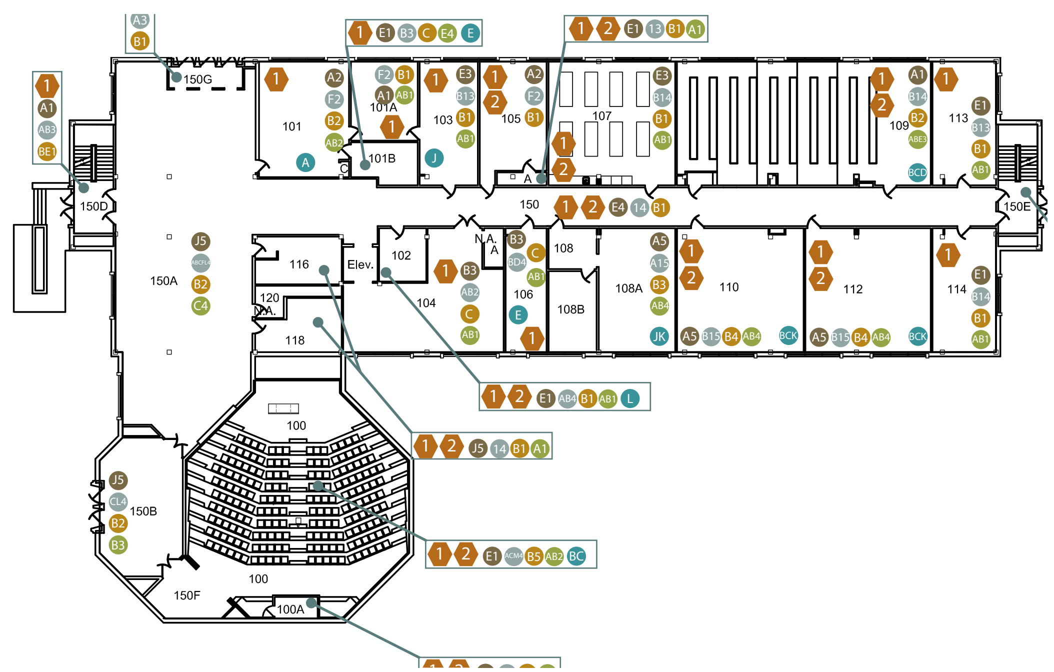
FIGURE 4.16
Fume Hood

FIGURE 4.17
Fume Hood

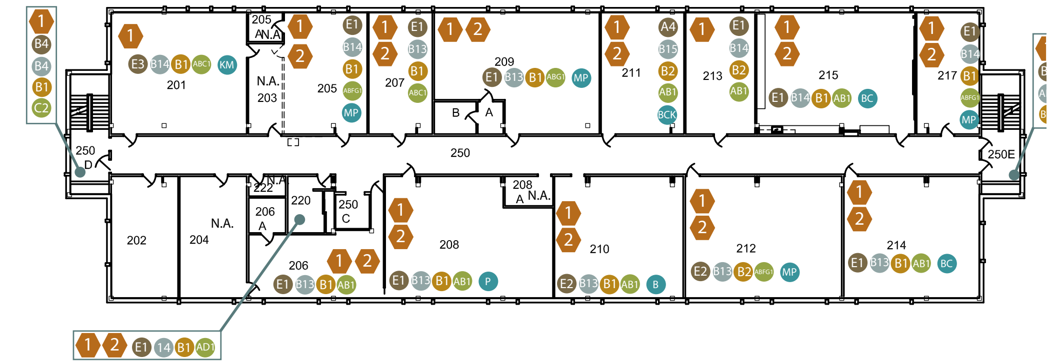
LOWER LEVEL



FIRST FLOOR



SECOND FLOOR



THIRD FLOOR

KEYNOTE LEGEND

1 CODE ISSUE: ADA ACCESSIBILITY

2 CODE ISSUE: EGRESS PATHWAY

INTERIOR CONDITIONS

5=BEST 1=WORST

NO ACCESS

A# FLOOR COVERING (TYPE + CONDITION)

- A: CARPET
- B: EXP CONCRETE
- C: SHEET VINYL
- D: EPOXY
- E: VCT
- F: LVT
- G: CERAMIC TILE
- H: RUBBER
- I: ASBESTOS TILE
- J: TERRAZZO
- K: RAISED FLOOR

A# WALLS (TYPE + CONDITION)

- A: DRYWALL
- B: CMU
- C: BRICK
- D: CONCRETE
- E: PAINT
- F: WOOD
- G: CERAMIC TILE
- H: EXP BRICK
- I: PLASTER/STUCCO
- J: BURNISHED CMU
- K: GLAZED CMU
- L: STONE
- M: ACOUSTIC TILE

A# CEILINGS (TYPE + CONDITION)

- A: GYP BOARD
- B: ACT
- C: EXPOSED
- D: WOOD
- E: ADHERED TILE

A# CASEWORK (TYPE + CONDITION)

- A: PLAM
- B: WOOD
- C: DISPLAY CASE
- D: TLT PARTITION
- E: STEEL

A EQUIPMENT (TYPE + CONDITION)

- A: COPY MACHINE
- B: VIDEO SCREEN
- C: PROJECTOR
- D: SMARTBOARD
- E: REFRIGERATOR
- F: -80 C FREEZER
- G: -20 C FREEZER
- H: -4 C FREEZER
- I: LASER TABLE
- J: CONFERENCE TV
- K: WHITE BOARD
- L: VENDING MACHINE
- M: LAB HOOD
- N: SCALE-UP

2016

41,183 GSF

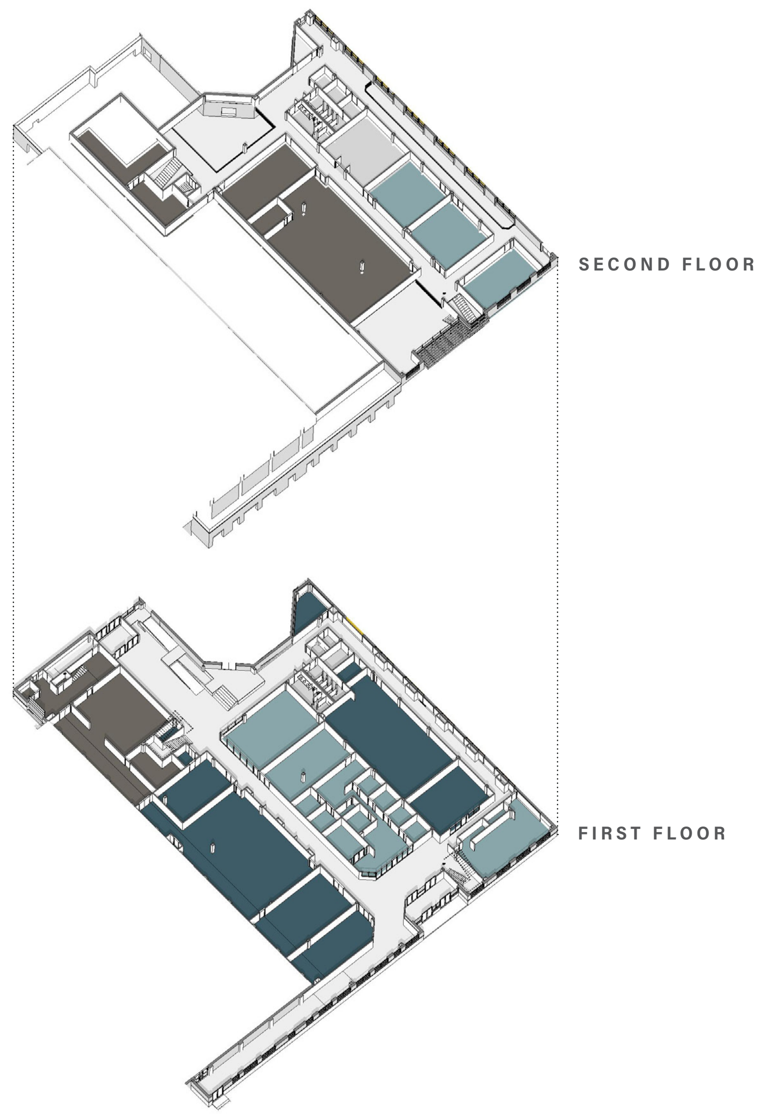
The tables below show the square footage by use and department for Collaborative Energy Center.

STATS	
# OF LEVELS	2
NSF	21,703 NSF
GSF	41,183 GSF
SPACE TYPES (NSF)	
PE	6,970 SF
GEO E	-
CIVIL E	-
CHEM E	-
EE&CS	-
IES	7,116 SF
MECH E	-
BIO E	-
COE	7,617 SF
REG	-
USE BREAKOUT	
TEACHING LAB	2,332 SF
RESEARCH LAB	6,321 SF
LAB SUPPORT	2,013 SF
LECTURE	2,086 SF
OFFICE + ADMIN	7,817 SF
OTHER	1,134 SF

COLLABORATIVE ENERGY CENTER

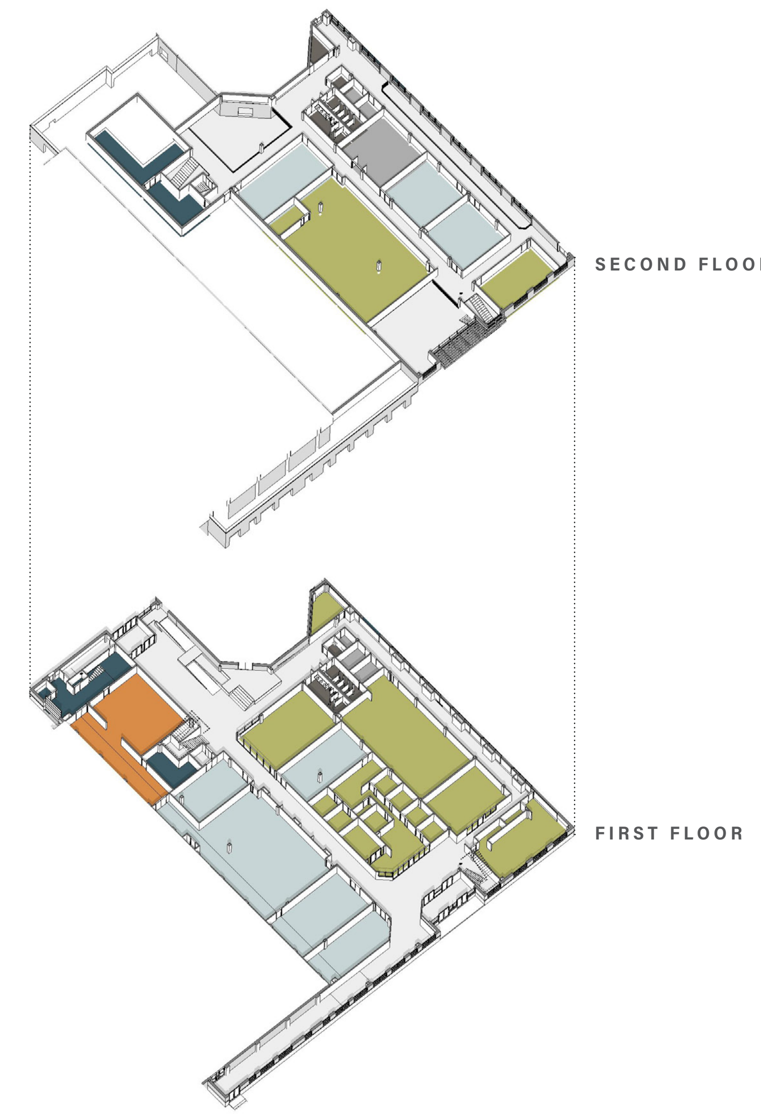
BUILDING SUMMARY

The Collaborative Energy Center was constructed in 20016 and is comprised of approximately 41,183 gross square feet. It is the most recent addition to the complex and is a steel framed, two story addition constructed between Leonard Hall and Upson I, in some cases with the existing exterior façade and windows used as the interior wall surface. It is the only building within the complex that was built without a basement level. It was built primarily to provide space for the Petroleum Engineering program and the Institute for Energy Studies. The first floor provides space for Petroleum Engineering teaching and research laboratories and associated open faculty office space. It also provides shared research and student projects space as well as the lower level of the Institute for Energy Studies High Bay research lab. A connecting overhead door connects a fabrication bay to the northeast high bay space in Upson I. The main floor aligns with the adjacent space in Upson I and is offset from the adjoining Leonard Hall by approximately 4'-0". The second floor of the facility connects with the second floor of Leonard Hall at the south end of the structure, but does not communicate with any upper story space in Upon I. The second floor of the Collaborative Energy Center includes space for IES graduate students and a small shared wet laboratory as well as teaching and classroom spaces scheduled by the college and the executive training room.



DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION



USE BREAKOUT LEGEND

- CLASSROOM / LABORATORY SUPPORT
- CLASSROOM / LABORATORY
- HIGH BAY
- OFFICE / ADMINISTRATION
- RESTROOMS
- BUILDING SUPPORT
- CIRCULATION

MECHANICAL AND ELECTRICAL SITE EVALUATION

BUILDING MECHANICAL UTILITIES

This building was constructed between two existing buildings and built over a rerouted 12" HP steam and 6" condensate main that serves the entire campus.

6" sanitary sewer exits the north end of the building.

10" storm sewer exits the south end of the building.

8" rain leader (storm sewer) also exits the south end of the building. This line serves Upson I.

3" domestic water service enters the building at the northwest corner.

3" HP steam taps off the campus main in the north end basement mechanical room.

2" pumped condensate taps into the campus main in the north end basement mechanical room.

2" natural gas enters the building on the north end.

6" fire protection service enters the northwest corner of the building.

MECHANICAL ROOM - BASEMENT

HVAC SYSTEMS: This area contains the steam and condensate service, steam pressure reducing station, flash tank, condensate pump, condensate meter, and various accessories. All of this equipment was installed in 2014.

PLUMBING SYSTEMS: Typical plumbing systems for these types of spaces. Sump pumps SP-2, SP-3 are provided for lower level floor drains and drain tile. These were new in 2014.

FIRE PROTECTION: Area is provided with a wet pipe fire protection system. Fire protection is also provided throughout the steam tunnel.

213 MECHANICAL ROOM - SECOND FLOOR *(FIG. 5.1)*

HVAC SYSTEMS: This area contains a steam/heating water heat exchanger, heating water pumps, chilled water pumps, glycol make up units, domestic water heater, and two energy recovery units (AHU-6 and AHU-7). Energy recovery units AHU-6 and AHU-7 exhaust air from the building, recover energy, and preheat/precool outside air before it is fed back to AHU-1 and AHU-2. AHU-6 tempers AHU-1. AHU-7 tempers for AHU-2. Heating water and chilled water is pumped from this room out to the various other roof mounted air handlers.

PLUMBING SYSTEMS: Typical plumbing systems for these types of spaces.

FIRE PROTECTION: Area is provided with a wet pipe fire protection system.

ROOF - MECHANICAL *(FIG. 5.2 - 5.4)*

HVAC SYSTEMS: The building is broken up into different space and usages. AHU-1, AHU-2, AHU-3, AHU-4 serve this building. Most of the mechanical equipment is located on the roof, with a few units inside mechanical rooms.

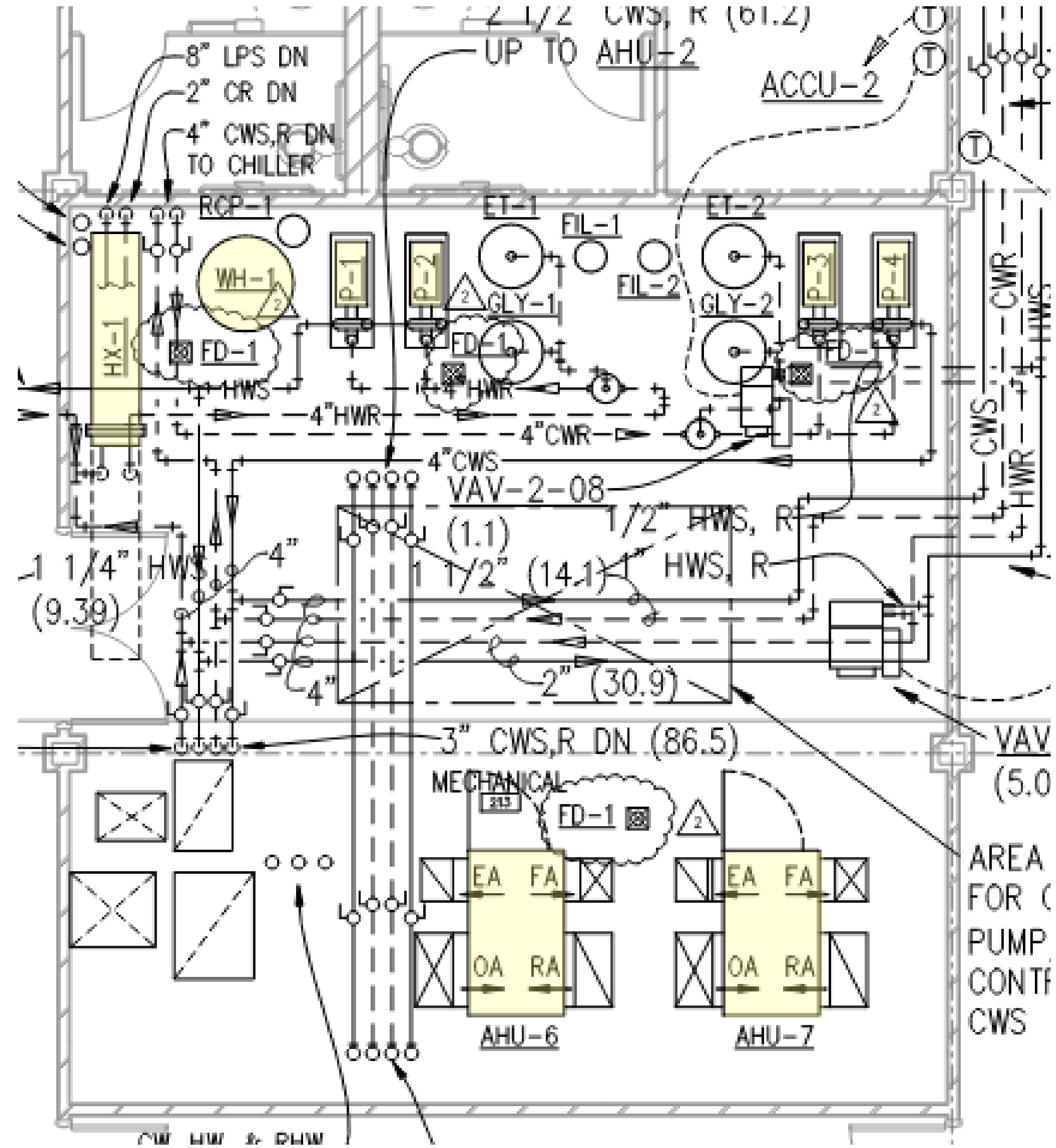


FIGURE 5.1
213 MER Equipment Layout

AHU-1 serves all the classrooms. This rooftop unit is provided with hot water heating and chilled water cooling. This unit serves multiple single duct VAV boxes with hot water reheats.

AHU-2 serves all the administration offices. This rooftop unit is provided with hot water heating and chilled water cooling. This unit serves multiple single duct VAV boxes with hot water reheats.

AHU-3 serves all the Petroleum Engineering Lab. This rooftop unit is provided with hot water heating and chilled water cooling. This unit serves various single duct VAV boxes with hot water reheats.

AHU-4 serves all the High Bay. This rooftop unit is provided with hot water heating and chilled water cooling. This unit serves various single duct VAV boxes with hot water reheats.

AHU-5 serves all the unit ventilators within Leonard Hall. This rooftop unit is provided with hot water heating and chilled water cooling. This unit simply provides tempered outside air to the unit ventilators that were covered up with this new building.

CHILLER CH-1 is a roof mounted air-cooled chiller. This chilled provides chilled water to all the air handlers for this building. The chilled water pumps are located in the second floor mechanical room.

PLUMBING SYSTEMS: Typical plumbing systems for these types of spaces.

FIRE PROTECTION: Area is provided with a wet pipe fire protection system.

SECOND FLOOR

HVAC SYSTEMS: All the spaces are provided with single duct VAV boxes with hot water reheat. The perimeter rooms are provided with hot water finned tube radiation. The VAV boxes that serve classroom type spaces are served by AHU-1. The VAV boxes that serve administration type spaces are served by AHU-2. All VAV boxes are provided with an Occupied/Standby/Unoccupied mode based on space occupancy sensors and time of day scheduling.

PLUMBING SYSTEMS: Typical plumbing systems for these types of spaces.

FIRE PROTECTION: Area is provided with a wet pipe fire protection system.

134 HIGH BAY - FIRST FLOOR

HVAC SYSTEMS: The high bay is served by AHU-4. All the spaces are provided with single duct VAV boxes with hot water reheat. Two dedicated roof mounted exhaust serve two hoods (HD-2, HD-3) in this area. The high bay itself was provided with basic HVAC. Any special provisions required for special research projects need to be provided as required. They are not part of the basic house system.

PLUMBING SYSTEMS: Typical plumbing systems for these types of spaces. Medical gas piping systems are also provided in this area.

FIRE PROTECTION: Area is provided with a wet pipe fire protection system.

136 SAMPLE PREP - FIRST FLOOR

HVAC SYSTEMS: This room is served by AHU-4. It is provided with a single duct VAV boxes with hot water reheat. A dedicated roof mounted exhaust fan serves a hood (HD-4) in this area.

PLUMBING SYSTEMS: Typical plumbing systems for these types of spaces. Medical gas piping systems are also provided in this area.

FIRE PROTECTION: Area is provided with a wet pipe fire protection system.

136 SAMPLE PREP - FIRST FLOOR

HVAC SYSTEMS: The high bay is served by AHU-3. All the spaces are provided with single duct VAV boxes with hot water reheat. A dedicated roof mounted exhaust serves one hood (HD-1) in this area.

PLUMBING SYSTEMS: Typical plumbing systems for these types of spaces. Medical gas piping systems are also provided in this area.

FIRE PROTECTION: Area is provided with a wet pipe fire protection system.

240 IES LAB - SECOND FLOOR *(FIG. 5.5 - 5.6)*

HVAC SYSTEMS: The IES Lab is served by AHU-2. This space is provided with a single duct VAV box with hot water reheat. Two dedicated roof mounted exhaust fans serve hood (HD-2) and hood (HD-3) in this room.

PLUMBING SYSTEMS: Typical plumbing systems for these types of spaces. Medical gas piping systems are also provided in this area. The domestic water is generated by a steam/water instantaneous water heater.

FIRE PROTECTION: Area is provided with a wet pipe fire protection system.

FIGURE 5.2
Typical Unit Ventilator

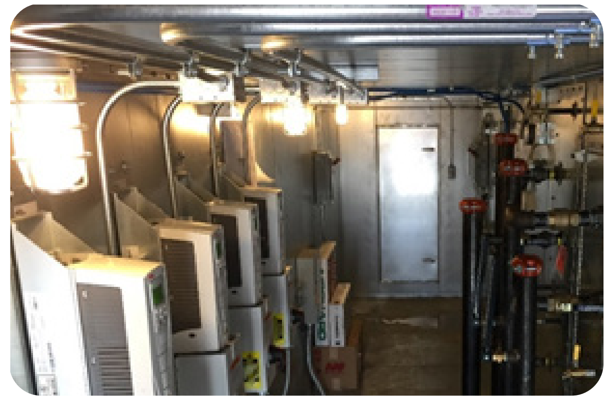


FIGURE 5.3
Typical Wall Hung Water Closet

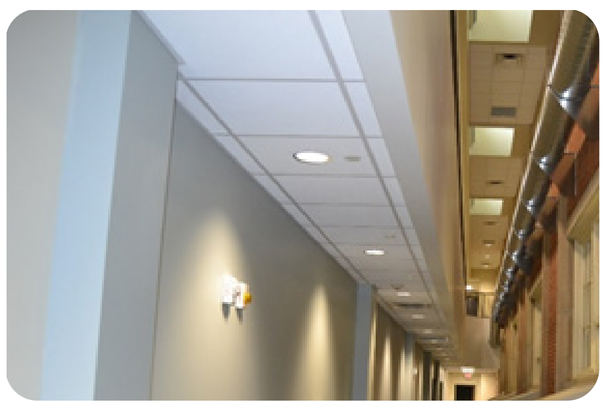


FIGURE 5.4
Typical Wall Hung Lavatories

FIGURE 5.5
Fume Hood

FIGURE 5.5
Fume Hood

C

SPACE EVALUATION

INTRODUCTION

As part of this study, all departments within the College of Engineering and Mines participated in a series of interviews to discuss the current state of the department and project growth needs, both in terms of student and faculty counts as well as laboratory and office space to accommodate this growth and future expansion anticipated by new initiatives in the various programs. The following is a brief listing of those findings that were use d to formulate the long-term goals for the facilities.

PE

PETROLEUM ENGINEERING

DEPARTMENT SUMMARY

The tables below show the net square footage, enrollment and full-time faculty numbers for both the current and future state associated within the Petroleum Engineering department to achieve the programmatic changes identified on the right. The tables on the following pages provide a listing of current and future space allocation throughout the complex to serve the department.

The Petroleum Engineering Department is primarily housed in the Collaborative Energy Center and the basement of Leonard Hall. The current enrollment in this program includes 140 undergraduate students, 20 master's students and 60 PhD candidates with 7 full-time faculty positions. This enrollment typically ranks fourth in the nation among all petroleum engineering programs. The undergraduate student enrollment is projected to grow from 140 to 200 students in the near future while the graduate and PhD programs are planned to remain close to current levels into the future. With this growth, it is anticipated that 2 to 3 new faculty hires will be required for a total 10 full time positions.

The total net square footage within the existing engineering complex that is dedicated to Petroleum Engineering totals approximately 9,200 nsf. The department also utilizes a remote high bay site at a former power plant that provides additional industrial lab space that is approximately 10,200 square feet. The college uses this space for research involving large drill rigs and full-scale extraction equipment. The possibility of planning for new space to accommodate this full-scale equipment on campus as part of an expanded engineering complex was discussed, but it was decided that at this time, it would be difficult and potentially unsafe to provide access into the heart of campus for this purpose.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF
TEACHING LABORATORIES	2,332	4,962
RESEARCH LABORATORIES	2,480	4,658
LABORATORY SUPPORT	-	-
LECTURE AND CLASSROOM	-	-
OFFICE AND ADMINISTRATION	4,387	7,608
OTHER	-	-
TOTAL	**9,199**	**17,288**

PROGRAMMATIC CHANGES

1. Petroleum Engineering Teaching Lab (146) is doubled in size
2. New Computational Laboratory
3. Industrial Drill Laboratory
4. Existing Wet Research Laboratory is doubled
5. Faculty Office count grows from 7 to 10
6. Visiting Faculty Offices are added
7. Staff and Administrative Office count grows from 2 to 10
8. PhD Office count to accommodate 60 occupants (existing shown for approximately 48 occupants)

87% Increase

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	140 / -	200 / -	
MASTERS STUDENTS (C/O)	20 / -	20 / -	
PHD STUDENTS (C/O)	60 / -	60 / -	
FACULTY	7	10 (+ 10 FT)	
NSF PER STUDENT ON CAMPUS	42 NSF	60 NSF	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Teaching Laboratories							
Virtual Reality Laboratory	140	605	1	605	605	0	1,061
PE Teaching Laboratory	146	1,000	1	2,178	2,178	1,178	3,821
Drill Simulation Laboratory	148	727	1	727	727	0	1,275
Industry Partner Computational Laboratory	New	0	1	1,452	1,452	1,452	2,547
Research Laboratories							
Hess Innovation Laboratory	144	2,480	1	2,480	2,480	0	4,351
New PE Research Laboratory	New	0	1	2,178	2,178	2,178	3,821
Drill Research High Bay	-	0	0	0	0	0	0
Office & Administrative							
Department Chair Office	113K	203	1	170	170	-33	298
Faculty Office	113C	124	0	0	0	-124	0
Faculty Office	113D	115	0	0	0	-115	0
Faculty Office	113E	116	0	0	0	-116	0
Faculty Office	113F	117	0	0	0	-117	0
Faculty Office	113G	114	0	0	0	-114	0
Faculty Office	113H	109	0	0	0	-109	0
Faculty Office	113J	109	0	0	0	-109	0
Faculty Office	New	0	10	120	1,200	1,200	2,105
Visiting Faculty Office	New	0	2	120	240	240	421
Staff / Administrative Offices	113A	123	0	0	0	-123	0
Staff / Administrative Offices	113B	115	0	0	0	-115	0
Staff / Administrative Offices	New	0	10	100	1,000	1,000	1,754
PhD Office	6	110	0	0	0	-110	0
PhD Office	8	110	0	0	0	-110	0
PhD Office	10	112	0	0	0	-112	0
PhD Office	12	110	0	0	0	-110	0
PhD Office	14	112	0	0	0	-112	0
PhD Office	16	110	0	0	0	-110	0
PhD Office	18	112	0	0	0	-112	0
PhD Office	20	110	0	0	0	-110	0
PhD Office	22	112	0	0	0	-112	0
PhD Office	24	110	0	0	0	-110	0
PhD Office	28	125	0	0	0	-125	0
PhD Office	30	108	0	0	0	-108	0
PhD Office	32	108	0	0	0	-108	0
PhD Office	34	108	0	0	0	-108	0
PhD Office	36	108	0	0	0	-108	0
PhD Office	38	108	0	0	0	-108	0
PhD Office	40	108	0	0	0	-108	0
PhD Office	42	244	0	0	0	-244	0
PhD Office	45	104	0	0	0	-104	0
PhD Office Cubicles	113 no.	715	0	0	0	-715	0
PhD Open Office	New	0	60	80	4,800	4,800	8,421
Student Work Space	113 so.	198	1	198	198	0	347
TOTALS		**9,199**			**17,228**	**8,029**	**30,225**

GEO E

GEOLOGY + GEOLOGICAL ENGINEERING

DEPARTMENT SUMMARY

The tables below show the net square footage, enrollment and full-time faculty numbers for both the current and future state associated within the Geology and Geological Engineering department to achieve the programmatic changes identified on the right. The tables on the following pages provide a listing of current and future space allocation throughout the complex to serve the department.

The Geology and Geological Engineering Department is primarily housed in Leonard Hall. The current enrollment in this program includes 45 undergraduate students and 15 master's students with 10 full-time faculty positions. This department differs from most others within the college in that it's curriculum includes a major earth science division that provides instruction to a broad portion of the campus (Geology 101 which serves 100 to 150 students per semester in multiple sections). Total enrollment in the program was 109 students as recently as 2015. It is assumed that current enrollment is at a low ebb and will recover quickly in the coming years. The undergraduate student enrollment is projected to grow from 45 to 120 students in the near future while the graduate program is projected to grow from 15 to 40 students. It is assumed that the current faculty count will be able to accommodate the expanded enrollment with little or no growth.

The total net square footage within the existing engineering complex that is dedicated to Geology and Geological Engineering is just over 32,000 nsf. While the department is projecting some growth and certain teaching labs need expansion, the right sizing of existing faculty office spaces creates a projection in net square footage that is actually less than the current totals.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF
TEACHING LABORATORIES	6,129	6,519
RESEARCH LABORATORIES	4,773	5,136
LABORATORY SUPPORT	6,719	4,184
LECTURE AND CLASSROOM	212	212
OFFICE AND ADMINISTRATION	8,214	6,492
OTHER	6,016	6,016
TOTAL	**32,063**	**28,559**

PROGRAMMATIC CHANGES

1. Geology 101 Teaching Laboratory is enlarged and Prep Space added
2. Faculty offices are reduced from 11 spaces to 10 spaces and reduced in size
3. Average existing faculty office space size of those identified is 362 square feet
4. Grad Student / PhD Office space to accommodate 36 occupants (existing shown for approximately 18 occupants)

12% Decrease

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	45 / -	120 / -	
MASTERS STUDENTS (C/O)	15 / -	40 / -	
PHD STUDENTS (C/O)	- / -	- / -	
FACULTY	10	10	
NSF PER STUDENT ON CAMPUS	541 NSF	197 NSF	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Teaching Laboratories							
Instruct / Res. Lab - Environmental Eng.	3B	304	1	304	304	0	533
Instruct / Res. Lab - Geomorphology	9	1,289	1	1,289	1,289	0	2,261
Instruct / Res. Lab - Geo Engineering	13	274	1	274	274	0	481
Instruct / Res. Lab - Hydrology	13A	274	1	274	274	0	481
Geology Computer Laboratory	108	849	1	849	849	0	1,489
Mineralogy Teaching Laboratory	201	921	1	921	921	0	1,616
Instruct / Res. Lab - Microscopy	210	875	1	875	875	0	1,535
Sedimentology Instructional Laboratory	212	1,062	1	1,452	1,452	390	2,547
Computer Teaching Laboratory	315	281	1	281	281	0	493
Research Laboratories							
Research Lab - Geo Eng.	5	608	1	608	608	0	1,067
Geochemistry Research Laboratory	205	809	1	809	809	0	1,419
Mineralogy Research Laboratory	206	595	1	595	595	0	1,044
Paleontology Research & Teaching Laboratory	209	1,123	1	1,123	1,123	0	1,970
Geo Research Laboratory	301	280	1	280	280	0	491
Geo EARL Laboratory (Chem)	303A	459	1	459	459	0	805
Geo EARL Laboratory	303	243	1	243	243	0	426
Geo EARL Laboratory (office)	305	178	1	178	178	0	312
Research Lab	314A	230	1	230	230	0	404
Geo Research Laboratory	322A	248	1	248	248	0	435
Geology 101 Prep Lab	New	0	1	363	363	363	637
Laboratory Support							
Geo Specimen Storage	1	376	0	376	0	-376	0
Field Equipment Storage	11	611	1	611	611	0	1,072
Storage / Shop	44	216	1	216	216	0	379
Geo & Geo Eng Storage	2A	457	0	457	0	-457	0
Geo & Geo Eng Storage	2B	125	0	125	0	-125	0
Geo & Geo Eng Storage	2C	130	0	130	0	-130	0
Geo & Geo Eng Storage	2D	170	0	170	0	-170	0
Geo & Geo Eng Storage	2E	115	0	115	0	-115	0
Rock Prep	3	258	1	258	258	0	453
Rock Prep Storage	3A	37	1	37	37	0	65
Hydrology Equipment	4	142	1	142	142	0	249
Rock Saw Room	9B	301	1	301	301	0	528
Geology Sample Recovery	9A	300	1	300	300	0	526
Geology Field Gear & Collections	15	617	1	617	617	0	1,082
Geo Collections	17	378	0	378	0	-378	0
Paleontology Collections	104	774	0	774	0	-774	0
Instructional Collections	106	274	0	274	0	-274	0
Paleontology Collections	208	1,056	0	1,056	0	-1,056	0
Prep Lab?	304	151	1	151	151	0	265
Prep Lab?	304A	118	1	118	118	0	207
Dark Room	316	113	1	113	113	0	198
High Density Specimen Storage	New	0	1	1,320	1,320	1,320	2,316
Lecture and Classroom							
Instructional Recording Studio	308	212	1	212	212	0	372

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Office & Administrative							
Department Chair Office	103	389	1	170	170	-219	298
Faculty Office	114	426	0	0	0	-426	0
Faculty Office	202	454	0	0	0	-454	0
Faculty Office	204	454	0	0	0	-454	0
Faculty Office	207	430	0	0	0	-430	0
Faculty Office	213	468	0	0	0	-468	0
Faculty Office	313	281	0	0	0	-281	0
Faculty Office	317	281	0	0	0	-281	0
Faculty Office	322B	254	0	0	0	-254	0
Faculty Office	322C	218	0	0	0	-218	0
Faculty Office	324	362	0	0	0	-362	0
Faculty Office	330A	329	0	0	0	-329	0
Faculty Office	New	0	10	120	1,200	1,200	2,105
Visiting Faculty Office	321	236	1	120	120	-116	211
Staff / Administrative Offices	101	564	1	564	564	0	989
Staff / Administrative Offices	101A	286	1	286	286	0	502
Staff / Administrative Offices	101B	143	1	143	143	0	251
Conference Room	105	446	1	446	446	0	782
Lab Director Office	300	165	1	120	120	-45	211
Faculty Lounge	306	269	1	269	269	0	472
Grad Student Offices	217	423	0	0	0	-423	0
Grad Student Offices (2)	309	178	0	0	0	-178	0
Grad Student Offices (2)	311	166	0	0	0	-166	0
Grad Student Offices (2)	312	114	0	0	0	-114	0
Grad Students (5)	319	281	0	0	0	-281	0
FD Holland Jr. Library - Dir. Office	326B	174	1	174	174	0	305
Grad Students / PhD Offices	New	0	36	80	2,880	2,880	5,053
Emeritus Faculty	113	423	1	120	120	-303	211
Other							
Student Study Area	7	554	1	554	554	0	972
Storage / Library	314	233	1	233	233	0	409
Geo Break Area	318	274	1	274	274	0	481
FD Holland Jr. Geo Library	326	1,793	1	1,793	1,793	0	3,146
FD Holland Jr. Library - Workroom	326A	199	1	199	199	0	349
FD Holland Jr. Geo Library - Mezzanine - 1	326	1,297	1	1,297	1,297	0	2,275
FD Holland Jr. Geo Library - Mezzanine - 2	328	315	1	315	315	0	553
FD Holland Jr. Geo Library - Map Room - 1	328	848	1	848	848	0	1,488
FD Holland Jr. Geo Library - Map Room - 2	330	503	1	503	503	0	882
TOTALS		**32,063**			**28,559**	**-3,504**	**50,104**

CIVIL E

CIVIL ENGINEERING

DEPARTMENT SUMMARY

The tables below show the net square footage, enrollment and full-time faculty numbers for both the current and future state associated within the Civil Engineering department to achieve the programmatic changes identified on the right. The tables on the following pages provide a listing of current and future space allocation throughout the complex to serve the department.

The Civil Engineering Department is primarily housed in Upson I and Upson II Halls. The current enrollment in this program has a significant on-line student component and includes 342 undergraduate students (89 on-campus; 253 on-line), 15 master's students and 7 PhD candidates with 7 full-time faculty positions. The enrollment is projected to grow to 360 undergraduate students (one-half on-line), 30 master's students and up to 20 PhD candidates. This enrollment growth will also lead to a full time faculty demand of 12 positions in an effort to improve the faculty to student ratio.

The total net square footage within the existing engineering complex that is dedicated to Civil Engineering is just over 14,000 nsf. The department has identified the need for additional conventional and high bay laboratory space to accommodate new initiatives in teaching and research centered around structural aging and assessment as well as student projects.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF
TEACHING LABORATORIES	6,872	6,872
RESEARCH LABORATORIES	1,340	8,712
LABORATORY SUPPORT	3,139	3,139
LECTURE AND CLASSROOM	-	-
OFFICE AND ADMINISTRATION	2,517	3,312
OTHER	505	505
TOTAL	**14,373**	**22,540**

PROGRAMMATIC CHANGES

1. Addition of 3 major research laboratory spaces:
   - High Bay Research Lab
   - Small Scale Bridge Laboratory
   - MICA (Modern Infrastructure Condition Assessment) Laboratory
2. Faculty Office count grows from 9 to 12
3. Grad Student / PhD Office space to accommodate 16 occupants (existing shown for approximately 12 occupants)

56% Increase

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	89 / 253	180 / 360	
MASTERS STUDENTS (C/O)	15 / -	30 / -	
PHD STUDENTS (C/O)	6 / 1	20 / 4	
FACULTY	7	12	
NSF PER STUDENT ON CAMPUS	130 NSF	97 NSF	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Teaching Laboratories							
Concrete and Asphalt Laboratory	112	3,130	1	3,130	3,130	0	5,491
Steel and Concrete Laboratory	113	3,342	1	3,342	3,342	0	5,863
Computational Laboratory	215	400	1	400	400	0	702
Research Laboratories							
Environmental Engineering Lab 1	362	734	1	726	726	-8	1,274
Environmental Engineering Lab 2	363	606	1	726	726	120	1,274
Industrial Research Laboratory	New	0	1	2,904	2,904	2,904	5,095
Bridge Lab	New	0	1	1,452	1,452	1,452	2,547
MICA Laboratory	New	0	1	2,904	2,904	2,904	5,095
Laboratory Support							
Basement Storage	2	370	1	370	370	0	649
Basement Storage	3	370	1	370	370	0	649
Basement Pump Room	18	380	1	380	380	0	667
Equipment Storage	100A	141	1	141	141	0	247
Surveying Equipment	106I	155	1	155	155	0	272
Asphalt Binding Room	106H	261	1	261	261	0	458
Water Sampling Equipment	106F	41	1	41	41	0	72
Curing Room	112A	103	1	103	103	0	181
Equipment Room	112B	101	1	101	101	0	177
Storage Room	112C	156	1	156	156	0	274
Storage Room	112D	101	1	101	101	0	177
Mezzanine	227	689	1	689	689	0	1,209
Lab Storage	363A	90	1	90	90	0	158
Lab Storage	363B	104	1	104	104	0	182
Prep Lab	364	77	1	77	77	0	135
Office & Administrative							
Department Chair Civil E	260P	120	1	170	170	50	298
Faculty Office	260A	157	0	0	0	-157	0
Faculty Office	260B	110	0	0	0	-110	0
Faculty Office	260C	108	0	0	0	-108	0
Faculty Office	260D	120	0	0	0	-120	0
Faculty Office	260E	105	0	0	0	-105	0
Faculty Office	260J	164	0	0	0	-164	0
Faculty Office	260K	108	0	0	0	-108	0
Faculty Office	260L	96	0	0	0	-96	0
Faculty Office	260M	108	0	0	0	-108	0
Faculty Office	New	0	12	120	1,440	1,440	2,526
CE Reception Area	260	203	1	203	203	0	356
Conference Room	260F	183	1	183	183	0	321
Mail Room	260G	36	1	36	36	0	63
Grad Students	205	70	0	0	0	-70	0
Grad Students	211	72	0	0	0	-72	0
Grad Students	213	72	0	0	0	-72	0
Grad Students	214	70	0	0	0	-70	0
Grad Students	223	229	0	0	0	-229	0
Grad Students	361	386	0	0	0	-386	0
Grad Students / PhD Offices	New	0	16	80	1,280	1,280	2,246
Other							
CE Commons / Student Groups	216	505	1	505	505	0	886
TOTALS		14,373			22,540	8,167	39,544

CHEM E

CHEMICAL ENGINEERING

DEPARTMENT SUMMARY

The tables below show the net square footage, enrollment and full-time faculty numbers for both the current and future state associated within the Chemical Engineering department to achieve the programmatic changes identified on the right. The tables on the following pages provide a listing of current and future space allocation throughout the complex to serve the department.

The Chemical Engineering Department is primarily housed in Harrington Hall and Upson II. The current enrollment in this program has a significant on-line student component and includes 235 undergraduate students (110 on-campus; 125 on-line), 15 master's students (one-half on-line) and 15 PhD candidates (one-half on-line) with 7 full-time faculty positions. The enrollment is projected to grow to 400 undergraduate students (one-half on-line), 24 master's students (one-half on-line) and up to 24 PhD candidates (one-half on-line). This enrollment growth will also lead to a full time faculty demand of 12 positions in an effort to improve the faculty to student ratio to a target value of 25:1.

The total net square footage within the existing engineering complex that is dedicated to Chemical Engineering is just over 15,000 nsf. The department has identified the need for additional wet chemistry research and teaching laboratory space as well as a consolidation and modernization of unit operations instruction laboratories. The existing unit operations labs are located in the aging 3 story expansion on the east side of Harrington Hall and the area is in need of replacement to function efficiently and safely.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF
TEACHING LABORATORIES	3,410	5,156
RESEARCH LABORATORIES	4,953	5,692
LABORATORY SUPPORT	2,426	3,188
LECTURE AND CLASSROOM	-	-
OFFICE AND ADMINISTRATION	3,654	6,886
OTHER	789	789
TOTAL	**15,232**	**21,711**

PROGRAMMATIC CHANGES

1. Expansion of Wet Chemistry Teaching Space
2. Consolidation and expansion of Unit Operations Teaching Laboratories
3. Expansion of Wet Chemistry Research Laboratory Space
4. Faculty Office count grows from 9 to 12
5. Grad Student / PhD Office space to accommodate 48 occupants (existing shown for approximately 7 occupants)

42% Increase

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	110 / 125	200 / 200	
MASTERS STUDENTS (C/O)	8 / 7	12 / 12	
PHD STUDENTS (C/O)	8 / 7	12 / 12	
FACULTY	7	12	
NSF PER STUDENT ON CAMPUS	120 NSF	91 NSF	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Teaching Laboratories							
Wet Chemistry Teaching Laboratory	304	332	2	726	1,452	1,120	2,547
Teaching Laboratory (Unit Ops 3)	316	334	0	0	0	-334	0
Computational Laboratory	320	800	1	800	800	0	1,404
Teaching Laboratory (Unit Ops 1)	321	794	1	1,089	1,089	295	1,911
Teaching Laboratory (Unit Ops 2)	360	1,150	0	0	0	-1,150	0
Unit Operations Teaching Laboratory	New	0	1	1,815	1,815	1,815	3,184
Research Laboratories							
Pilot Scale Systems Research	100B	383	1	383	383	0	672
Chem E Research	160	2,244	1	2,178	2,178	-66	3,821
Wet Chemistry Research	260	1,190	1	1,815	1,815	625	3,184
Hoffman Energetics Laboratory	322B	107	1	107	107	0	188
Research Laboratory	360B	243	1	363	363	120	637
Research Laboratory	360C	238	1	363	363	125	637
Research Laboratory	360E	428	1	363	363	-65	637
Electrolysis Laboratory	362A	120	1	120	120	0	211
Laboratory Support							
Chem E Shop / Tool Storage	160A	403	1	484	484	81	849
Fittings and Material Storage	160B	240	1	242	242	2	425
Chem E Shop Storage	160C	83	1	121	121	38	212
Chemistry Prep	260B	240	1	242	242	2	425
Instrumentation Laboratory	260C	220	1	242	242	22	425
Instrumentation Laboratory	261	350	1	363	363	13	637
Storage	322A	42	1	42	42	0	74
Teaching Lab Prep	360A	164	1	242	242	78	425
Glassware Prep / Chemical Storage	360D	160	1	363	363	203	637
Flue Mezzanine	360F	140	1	242	242	102	425
Chemical Storage	360G	283	1	363	363	80	637
Chemical Storage	360H	101	1	242	242	141	425
Office & Administrative							
Department Chair Chem E	365B	120	1	170	170	50	298
Faculty Office	305	156	0	0	0	-156	0
Faculty Office	307	161	0	0	0	-161	0
Faculty Office	313	168	0	0	0	-168	0
Faculty Office	314	159	0	0	0	-159	0
Faculty Office	315	151	0	0	0	-151	0
Faculty Office	365C	126	0	0	0	-126	0
Faculty Office	365D	126	0	0	0	-126	0
Faculty Office	365E	126	0	0	0	-126	0
Faculty Office	New	0	11	120	1,320	1,320	2,316
Lab Manager's Office	260A	164	1	120	120	-44	211
Department Office	365	499	1	499	499	0	875
Conference Room	325	144	1	144	144	0	253
Mail Room	365A	101	1	101	101	0	177
Grad Students	223	229	0	0	0	-229	0
Faculty Office	308	156	0	0	0	-156	0
Grad Students	312	159	0	0	0	-159	0
Grad Students	322C	118	0	0	0	-118	0
Grad Students	322D	99	0	0	0	-99	0
Grad Students / PhD Offices	New	0	48	80	3,840	3,840	6,737
Break Room	306	161	1	161	161	0	282
Student Lounge	318	531	1	531	531	0	932
Other							
Storage	1	236	1	236	236	0	414
Storage	3	238	1	238	238	0	418
Unused	323	140	1	140	140	0	246
Unused	323A	175	1	175	175	0	307
TOTALS		15,232			21,711	6,479	38,089

EE&CS

ELECTRICAL ENGINEERING + COMPUTER SCIENCE

DEPARTMENT SUMMARY

The tables below show the net square footage, enrollment and full-time faculty numbers for both the current and future state associated within the Electrical Engineering and Computer Science department to achieve the programmatic changes identified on the right. The tables on the following pages provide a listing of current and future space allocation throughout the complex to serve the department.

The Electrical Engineering and Computer Science Department is primarily housed in Harrington Hall and Upson II, but also includes two computational labs in Leonard Hall on the opposite side of the complex. The department supports undergraduate and graduate/PhD majors in several areas including electrical engineering, computer science, data science and cyber security. At present, it also includes bio-medical engineering, but the current plan is for that program to become a stand-alone department (see section on Bio-medical Engineering later in this document). Current enrollment within the department includes 520 undergraduate students and approximately 130 students in various graduate/PhD programs and a current full-time faculty count of 18. The enrollment in EE/CS is projected to grow by approximately 50% in the next 10 years to numbers approaching 750 undergraduate students and 190 students in the graduate and PhD programs with a full-time faculty goal of 30.

The total net square footage within the existing engineering complex that is dedicated to Electrical Engineering and Computer Science is just under 14,000 nsf. The department has identified the need for expanded instructional laboratory space a new computational research facility as well as additional office space for graduate and PhD candidates.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF	PROGRAMMATIC CHANGES
TEACHING LABORATORIES	3,178	3,476	1. Consolidation and slight increase in Teaching Laboratory space 2. New Computational Research Laboratory 3. Faculty Office count grows from 17 to 31 4. Grad Student / PhD Office space to accommodate 40 occupants (existing shown for approximately 25 occupants)
RESEARCH LABORATORIES	6,646	7,733	
LABORATORY SUPPORT	209	209	
LECTURE AND CLASSROOM	-	-	
OFFICE AND ADMINISTRATION	3,779	8,035	
OTHER	-	-	
TOTAL	**13,812**	**19,453**	**21% Increase**

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	520 / -	520 / -	
MASTERS STUDENTS (C/O)	86 / -	125 / -	
PHD STUDENTS (C/O)	45 / -	65 / -	
FACULTY	18	30	
NSF PER STUDENT ON CAMPUS	24 NSF	21 NSF	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Teaching Laboratories							
EE&CS Teaching Laboratory	110	842	0	0	0	-842	0
EE&CS Teaching Laboratory	112	837	0	0	0	-837	0
EE&CS Teaching Laboratory	New	0	1	1,815	1,815	1,815	3,184
EE&CS Embedded Systems Teaching Lab	120C	572	1	572	572	0	1,004
EE&CS Undergraduate Teaching Lab	220	506	0	0	0	-506	0
EE&CS Circuits & Power Teaching Lab	222	421	0	0	0	-421	0
EE&CS Circuits & Power Teaching Lab	New	0	1	1,089	1,089	1,089	1,911
Research Laboratories							
EE&CS Research Laboratory	100H	461	1	461	461	0	809
Power and Energy Research Laboratory	109	734	1	734	734	0	1,288
EE&CS Research Laboratory	112	333	1	333	333	0	584
EE&CS Research Laboratory	113	391	1	391	391	0	686
EE&CS Maker Space	120	2,219	1	2,178	2,178	-41	3,821
EE&CS Research Laboratory	120A	406	1	363	363	-43	637
EE&CS Research Laboratory	120F	434	1	363	363	-71	637
EE&CS Research Laboratory	126	573	1	726	726	153	1,274
EE&CS Research Laboratory	211	153	1	153	153	0	268
EE&CS Research Laboratory	212	177	1	177	177	0	311
EE & CS Computer Laboratory	123	442	1	442	442	0	775
Senior Design Lab	213	323	1	323	323	0	567
Computational Research Laboratory	New	0	1	1,089	1,089	1,089	1,911
Laboratory Support							
EE & CS Maker Space Support	120B	209	1	209	209	0	367
Office & Administrative							
Department Chair Office	366B	269	1	170	170	-99	298
Faculty Office	160I	96	0	0	0	-96	0
Faculty Office	160L	107	0	0	0	-107	0
Faculty Office	366A	125	0	0	0	-125	0
Faculty Office	366C	107	0	0	0	-107	0
Faculty Office	366D	107	0	0	0	-107	0
Faculty Office	366E	117	0	0	0	-117	0
Faculty Office	366G	107	0	0	0	-107	0
Faculty Office	366H	110	0	0	0	-110	0
Faculty Office	366J	110	0	0	0	-110	0
Faculty Office	366K	110	0	0	0	-110	0
Faculty Office	366L	110	0	0	0	-110	0
Faculty Office	366M	110	0	0	0	-110	0
Faculty Office	366N	118	0	0	0	-118	0
Faculty Office	366P	106	0	0	0	-106	0
Faculty Office	366Q	110	0	0	0	-110	0
Faculty Office	366R	130	0	0	0	-130	0
Faculty Office	369	107	0	0	0	-107	0
Faculty Office	New	0	30	120	3,600	3,600	6,316
EE&CS Reception Area	366	270	1	270	270	0	474
Conference Space	160F	183	1	183	183	0	321
Copy Room	366F	120	1	120	120	0	211
GTA Office	120D	319	1	319	319	0	560
Grad Student Offices	205	176	0	176	0	-176	0
Grad Student Offices	206	153	0	153	0	-153	0
Grad Student Offices	223	229	0	229	0	-229	0
Grad Students / PhD Offices	New	0	40	80	3,200	3,200	5,614
Storage	366S	173	1	173	173	0	304
TOTALS		**13,812**			**19,453**	**5,641**	**34,128**

IES

INSTITUTE FOR ENERGY STUDIES

DEPARTMENT SUMMARY

The tables below show the net square footage, enrollment, faculty and research staff numbers for both the current and future state associated within the Institute for Energy Studies to achieve the programmatic changes identified on the right. The tables on the following pages provide a listing of current and future space allocation throughout the complex to serve the department.

The Institute for Energy Studies is housed entirely in the Collaborative Energy Center. It differs significantly from most other departments within the college. Founded in 2010, it is a department that focuses on grant funded research and hosts graduate level programs in energy engineering and environmental engineering. Current research focus areas are in carbon capture, rare earth metals mining and energy storage. The department employs a single full-time faculty member and a research and grant writing staff of 12 In addition, the institute regularly employs graduate and undergraduate students from other departments to assist with it's research initiatives. The enrollment of students pursuing graduate degrees within the institute is expected to grow to as much as 50 in Master's and PhD programs. In addition, the institute expects to grow it's resident research staff to 20 in the future.

The total net square footage currently assigned to the institute is just over 7,000 nsf and includes office space, flexible research laboratories and a research high bay space. Being located in the Collaborative Energy Center, all the space assigned to the institute is relatively new.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF
TEACHING LABORATORIES	-	-
RESEARCH LABORATORIES	2,355	2,918
LABORATORY SUPPORT	2,013	2,367
LECTURE AND CLASSROOM	-	-
OFFICE AND ADMINISTRATION	2,748	4,650
OTHER	-	-
TOTAL	**7,116**	**9,935**

PROGRAMMATIC CHANGES

1. Increase in Equipment Test High-Bay Research space
2. Increase in Fabrication Bay space
3. Staff Office count grows from 7 to 20 (includes office space for new Instructor and Grant Writer positions)
4. Grad Student / PhD Office space to accommodate 26 occupants (existing shown for approximately 20 occupants)

39% Increase

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	- / -	- / -	
MASTERS STUDENTS (C/O)	18 / 17	9 / 9	
PHD STUDENTS (C/O)	- / -	25 / 7	
FACULTY	1 / 12	1 / 20	
NSF PER STUDENT ON CAMPUS	395 NSF	292 NSF	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Research Laboratories							
IES High Bay Equip. Test Laboratory	134	982	1	982	982	0	1,723
IES High Bay Equip. Test Laboratory (Mezz)	234	526	1	1,089	1,089	563	1,911
IES Wet Laboratory	240	847	1	847	847	0	1,486
Laboratory Support							
IES Receiving and Loading	130	542	1	542	542	0	951
Air Compressor	130A	52	1	52	52	0	91
Storage	130B	31	1	31	31	0	54
IES Fabrication Bay	132	735	1	1,089	1,089	354	1,911
IES Sample Processing	136	289	1	289	289	0	507
IES Research Control Room	236	364	1	364	364	0	639
Office & Administrative							
IES Department Chair Office	246A	179	1	170	170	-9	298
IES Instructor's Office	New	0	1	120	120	120	211
IES Grant Writer's Office	New	0	1	120	120	120	211
IES Staff Office	246B	120	0	0	0	-120	0
IES Staff Office	246C	120	0	0	0	-120	0
IES Staff Office	246D	196	0	0	0	-196	0
IES Staff Office	246E	119	0	0	0	-119	0
IES Staff Office	246F	119	0	0	0	-119	0
IES Staff Office	246G	119	0	0	0	-119	0
IES Staff Office	246H	119	0	0	0	-119	0
IES Staff Office	New	0	18	120	2,160	2,160	3,789
Grad Student Cubicles	246	1,657	0	0	0	-1,657	0
Grad Students / PhD Offices	New	0	26	80	2,080	2,080	3,649
TOTALS		**7,116**			**9,935**	**2,819**	**17,430**

MECH E

MECHANICAL ENGINEERING

DEPARTMENT SUMMARY

The Mechanical Engineering Department is primarily housed in Upson I and Upson II Halls. The current enrollment in this program has a significant on-line student component and includes 620 undergraduate students (one-half on-line), 26 master's students (one-half on-line) and 11 PhD candidates with14 full-time faculty positions. The enrollment is projected to grow to 800 undergraduate students (one-half on-line), 36 master's students and up to 16 PhD candidates. This enrollment growth will also lead to a full time faculty demand of 21 positions.

The total net square footage within the existing engineering complex that is dedicated to Mechanical Engineering is over 27,0000 nsf. The department has identified the need for additional space to accommodate heavy equipment and machine space in support of it's existing high bay labs and the addition of a dedicated freshman research projects laboratory.

The tables below show the net square footage, enrollment and full-time faculty numbers for both the current and future state associated within the Mechanical Engineering department to achieve the programmatic changes identified on the right. The tables on the following pages provide a listing of current and future space allocation throughout the complex to serve the department.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF
TEACHING LABORATORIES	3,111	4,968
RESEARCH LABORATORIES	12,390	16,414
LABORATORY SUPPORT	7,542	8,290
LECTURE AND CLASSROOM	-	-
OFFICE AND ADMINISTRATION	4,574	5,764
OTHER	-	-
TOTAL	**27,617**	**35,436**

PROGRAMMATIC CHANGES

1. Expansion of High-Bay Instructional Machine Shop space
2. Increase in Freshman Projects Research Laboratory space
3. Increase in High-Bay Machine Shop space
4. Increase in Welding Shop space
5. Faculty office count grows from 16 to 20
6. Grad Student / PhD Office space to accommodate 32 occupants (existing shown for approximately 22 occupants)

28% Increase

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	310 / 310	400 / 400	
MASTERS STUDENTS (C/O)	13 / 13	18 / 18	
PHD STUDENTS (C/O)	10 / 1	14 / 2	
FACULTY	14	21	
NSF PER STUDENT ON CAMPUS	82 NSF	83 NSF	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Teaching Laboratories							
ME Instructional Measurement Lab	221	931	1	1,089	1,089	158	1,911
ME Computational Laboratory	264	510	1	510	510	0	895
ME Instructional Machine Shop new	New	0	1	1,699	1,699	1,699	2,981
ME Instructional Machine Shop exg	102	1,568	1	1,568	1,568	0	2,751
ME Recording Room	280	102	1	102	102	0	179
Research Laboratories							
ME Research Laboratory (hi-temp/manuf)	12D	1,310	1	1,310	1,310	0	2,298
ME Faculty Research Laboratory	100	2,015	1	2,015	2,015	0	3,535
ME Freshman Projects	101	470	1	726	726	256	1,274
ME Student Projects Laboratory	New	0	1	1,815	1,815	1,815	3,184
Laser Laboratory	105B	426	1	660	660	234	1,158
ME Undergraduate Robotics Lab	106A	366	1	366	366	0	642
ME Faculty Research Laboratory	106C	260	1	260	260	0	456
ME Formula Car Cage	114A	1,110	1	1,110	1,110	0	1,947
ME Student Projects Research Laboratory	114	1,741	1	1,741	1,741	0	3,054
ME Faculty Research Laboratory	115	360	1	360	360	0	632
ME Machine Shop new	New	0	1	1,719	1,719	1,719	3,016
ME Machine Shop exg	104	1,911	1	1,911	1,911	0	3,353
Machine Vision Laboratory	200	357	1	357	357	0	626
Machine Vision Laboratory	200A	105	1	105	105	0	184
Mechanical Testing Laboratory	201A	667	1	667	667	0	1,170
ME Faculty Research Laboratory	201C	368	1	368	368	0	646
Senior Design Lab	213	323	1	323	323	0	567
ME Faculty Research Laboratory	217	220	1	220	220	0	386
ME Faculty Research Laboratory	219	381	1	381	381	0	668
Laboratory Support							
Chemical Storage	12E	108	1	108	108	0	189
Electrical Equipment	12A	135	1	135	135	0	237
Machining Shop	12B	135	1	135	135	0	237
Storage	2	370	1	370	370	0	649
Storage	3	370	1	370	370	0	649
ME 3D Printing	100C	207	1	207	207	0	363
ME High Bay Support	102A	246	1	246	246	0	432
Welding Shop	105	1,232	1	1,980	1,980	748	3,474
Welding Supply	105A	126	1	126	126	0	221
ME Storage / Dock Area	106	2,285	1	2,285	2,285	0	4,009
ME Foundry	106D	332	1	332	332	0	582
Storage	106E	139	1	139	139	0	244
Storage	106G	181	1	181	181	0	318
ME Foundry Support	106K	71	1	71	71	0	125
Storage	106M	187	1	187	187	0	328
Secure Storage	106B	150	1	150	150	0	263
ME Wood Shop	111	479	1	479	479	0	840
ME Vibration Equipment Cage	114B	395	1	395	395	0	693
ME 3D Printing	201	394	1	394	394	0	691
Office & Administrative							
ME Department Chair	270	108	1	170	170	62	298
Faculty Offices	160A	157	0	0	0	-157	0
Faculty Offices	160B	108	0	0	0	-108	0
Faculty Offices	160C	108	0	0	0	-108	0
Faculty Offices	160D	120	0	0	0	-120	0
Faculty Offices	160E	105	0	0	0	-105	0
Faculty Offices	220	260	0	0	0	-260	0
Faculty Offices	266A	126	0	0	0	-126	0
Faculty Offices	266B	100	0	0	0	-100	0
Faculty Offices	267	208	0	0	0	-208	0
Faculty Offices	268	127	0	0	0	-127	0
Faculty Offices	269	129	0	0	0	-129	0
Faculty Offices	271	110	0	0	0	-110	0
Faculty Offices	272	88	0	0	0	-88	0
Faculty Offices	273	108	0	0	0	-108	0
Faculty Offices	274	109	0	0	0	-109	0
Faculty Offices	275	129	0	0	0	-129	0
Faculty Offices	New	0	20	120	2,400	2,400	4,211
Lab Manager's Office	106L	110	1	120	120	10	211
ME Department Office	266	258	1	258	258	0	453
ME Conference Room	278	256	1	256	256	0	449
Grad Student Offices	200B	405	0	0	0	-405	0
Grad Student Offices	200C	111	0	0	0	-111	0
Grad Student Offices	200D	108	0	0	0	-108	0
Grad Student Offices	202	68	0	0	0	-68	0
Grad Student Offices	206	72	0	0	0	-72	0
Grad Student Offices	207	70	0	0	0	-70	0
Grad Student Offices	208	72	0	0	0	-72	0
Grad Student Offices	209	70	0	0	0	-70	0
Grad Student Offices	210	72	0	0	0	-72	0
Grad Student Offices	212	70	0	0	0	-70	0
Graduate Student Cubicles	12	632	0	0	0	-632	0
Grad Students / PhD Offices	New	0	32	80	2,560	2,560	4,491
TOTALS		**27,617**			**35,436**	**7,819**	**62,168**

BIO E

BIOMEDICAL ENGINEERING

DEPARTMENT SUMMARY

The Biomedical Engineering Department is entirely housed in the basement of Upson II. This program has only recently been established as a stand-alone program and at this time only offers graduate degrees. The current enrollment in this program includes 35 graduate students (17 on-line) and a full-time faculty count of 1.75 through joint appointments. In the near future, the department plans to create an undergraduate program accommodating 100 students and to grow its graduate program to 60 student (projecting on-half of those to be on-line). The department expects the faculty count under this enrollment to reach 7 full-time positions.

The total net square footage within the existing engineering complex that is dedicated to Biomedical Engineering is approximately 2,600 nsf. The future needs of the department include expansion of teaching laboratory space as well as significant growth in research space for wet lab, optics and exercise research.

The tables below show the net square footage, enrollment and full-time faculty numbers for both the current and future state associated within the Biomedical Engineering department to achieve the programmatic changes identified on the right. The tables on the following pages provide a listing of current and future space allocation throughout the complex to serve the department.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF	PROGRAMMATIC CHANGES
TEACHING LABORATORIES	206	1,452	
RESEARCH LABORATORIES	924	4,356	
LABORATORY SUPPORT	152	484	
LECTURE AND CLASSROOM	-	-	
OFFICE AND ADMINISTRATION	1,388	3,410	
OTHER	-	-	
TOTAL	**2,670**	**9,702**	**360% Increase**

PROGRAMMATIC CHANGES

1. Expansion of Teaching Laboratory
2. Expansion of Research Laboratory Space
3. Creation of Laboratory Space for:
   - Wet Chemistry
   - Optics
   - Exercise
   - Faculty office count grows from 1 to 7
4. Grad Student / PhD Office space to accommodate 30

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	- / -	100 / -	
MASTERS STUDENTS (C/O)	13 / 17	60 / 30	
PHD STUDENTS (C/O)	- / -	- / -	
FACULTY	1.75	7	
NSF PER STUDENT ON CAMPUS	76 NSF	74 NSF	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Teaching Laboratories							
Biomed Eng Teaching Laboratory	10	206	1	1,452	1,452	1,246	2,547
Research Laboratories							
Biomedical Engineering Laboratory	10A	924	1	1,815	1,815	891	3,184
Biomedical Research Wet Laboratory	New	0	1	1,089	1,089	1,089	1,911
Biomedical Optics Laboratory	New	0	1	726	726	726	1,274
Biomedical Exercise Laboratory	New	0	1	726	726	726	1,274
Laboratory Support							
Biomed Lab Storage	10C	152	1	363	363	211	637
Biomedical Secure Records Storage	New	0	1	121	121	121	212
Office & Administrative							
Department Chair Office	New	0	1	170	170	170	298
Faculty Office	New	0	7	120	840	840	1,474
Biomed E Office	11A	149	0	149	0	-149	0
Biomed Eng Grad Office / Conference	11	1,111	0	1,111	0	-1,111	0
Biomed PhD Office	10B	128	0	128	0	-128	0
Grad Students / PhD Offices	New	0	30	80	2,400	2,400	4,211
TOTALS		**2,670**			**9,702**	**7,032**	**17,021**

COE

COLLEGE OF ENGINEERING

DEPARTMENT SUMMARY

In addition to the departmental space tabulations identified earlier, the college also possesses a significant amount of shared program space that includes the Dean's office and administration, core research labs, classrooms, student amenities, storage and the JODASS program. A moderate amount of growth associated with shared core space is anticipated. One of the primary shared research areas requested includes space to accommodate research by several departments involving the use of drones which is shown in the projected table.

The tables below show the net square footage numbers for both the current and future state associated within the core facilities of the College of Engineering and Mines to achieve the programmatic changes identified on the right. The tables on the following pages provide a listing of current and future space allocation throughout the complex to serve these needs.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF	PROGRAMMATIC CHANGES
TEACHING LABORATORIES	1,153	1,153	1. New High-Bay Drone Laboratory (shared space requested by both Civil and EE/CS)
RESEARCH LABORATORIES	3,354	4,806	
LABORATORY SUPPORT	301	301	
LECTURE AND CLASSROOM	2,389	2,389	
OFFICE AND ADMINISTRATION	9,707	9,707	
OTHER	6,048	6,048	
TOTAL	**22,952**	**24,404**	**6% Increase**

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	- / -	- / -	1. Space utilized by all departments inside the College of Engineering
MASTERS STUDENTS (C/O)	- / -	- / -	
PHD STUDENTS (C/O)	- / -	- / -	
FACULTY	- / -	- / -	
NSF PER STUDENT ON CAMPUS	- / -	- / -	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Teaching Laboratories							
Mezzanine Teaching Laboratory?	222	1,153	1	1,153	1,153	0	2,023
Research Laboratories							
Core Imaging Laboratory	16	1,029	1	1,029	1,029	0	1,805
Undergraduate Computer Laboratory	145	760	1	760	760	0	1,333
Mezzanine Research Laboratory	218	726	1	726	726	0	1,274
CEM Computer Laboratory	225	839	1	839	839	0	1,472
Drone Laboratory	New	0	1	1,452	1,452	1,452	2,547
Laboratory Support							
CEM Computer Lab Support	225A	104	1	104	104	0	182
Imaging Prep Laboratory	17	197	1	197	197	0	346
Lecture and Classroom							
Executive Training Room	202	617	1	617	617	0	1,082
Multi-Purpose Classroom	205	732	1	732	732	0	1,284
Multi-Purpose Classroom	209	737	1	737	737	0	1,293
General Classroom (COE)	307	303	1	303	303	0	532
Office & Administrative							
COE Admin. - Reception	165	722	1	722	722	0	1,267
COE Admin. - Deans Office	165A	401	1	401	401	0	704
COE Admin. - Assistants Office	165C	110	1	110	110	0	193
COE Admin - Business Officer Office	165D	143	1	143	143	0	251
COE- Admin Office	165E	177	1	177	177	0	311
COE Dean's Conference Room	166	358	1	358	358	0	628
COE Admin - Support Specialist Office	103	558	1	558	558	0	979
COE Admin Office	103A	102	1	102	102	0	179
COE Admin Office	103C	102	1	102	102	0	179
COE Admin - Online Program Coor. Office	103D	111	1	111	111	0	195
COE Admin - Online Program Support Office	103E	103	1	103	103	0	181
COE Admin Office	103F	103	1	103	103	0	181
COE Admin - Copy Room	103G	251	1	251	251	0	440
COE Admin Office	103H	113	1	113	113	0	198
COE Admin Office	103J	114	1	114	114	0	200
COE Admin Grant Manager's Office	160J	164	1	164	164	0	288
COE Admin. Grant Manager's Office	160K	107	1	107	107	0	188
COE Admin. - Undergrad Program Coor. Office	160M	119	1	119	119	0	209
COE Admin. - Grad Program Coor. Office	160N	109	1	109	109	0	191
COE Admin. - Linux Administrators Office	162	152	1	152	152	0	267
COE Admin. -IT Coor. Office	162C	98	1	98	98	0	172
Office - IT?	162A	107	1	107	107	0	188
Office - IT?	162B	109	1	109	109	0	191
COE Storage	163	109	1	109	109	0	191

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
COE Copy Room	167	143	1	143	143	0	251
Conference Room	371	405	1	405	405	0	711
AE2S Board Room	106	810	1	810	810	0	1,421
AE2S BR Storage	106A	54	1	54	54	0	95
AE2S BR Coats	106B	51	1	51	51	0	89
Reception Area (ME; EE&CS)	160	203	1	203	203	0	356
Jodsaas Center Lobby	100	878	1	878	878	0	1,540
Jodsaas Center Admin Office	100A	136	1	136	136	0	239
Jodsaas Center Admin Office	100B	167	1	167	167	0	293
Jodsaas Center Admin Office	100D	181	1	181	181	0	318
Jodsaas Center Admin Office	100E	250	1	250	250	0	439
Jodsaas Center Conference Room	100G	754	1	754	754	0	1,323
Student Organization Office / Storage	221	242	1	242	242	0	425
Solberg Student Success Center	103B	209	1	209	209	0	367
Kitchenette	20	62	1	62	62	0	109
Lounge - Kitchenette	120	230	1	230	230	0	404
Faculty Lounge	258	390	1	390	390	0	684
Other							
Student Lounge	46	264	1	264	264	0	463
1st Floor Lobby / Museum (Leonard Hall)	150A	2,577	1	2,577	2,577	0	4,521
Big Ideas Gym	141	958	1	958	958	0	1,681
Storage	103K	42	1	42	42	0	74
Vending	102	134	1	134	134	0	235
Storage	1	236	1	236	236	0	414
Closet	160G	35	1	35	35	0	61
Instructional Services Office?	226	191	1	191	191	0	335
COE Hall of Fame	175	393	1	393	393	0	689
Open Lounge	170	350	1	350	350	0	614
Student Study Space	180	695	1	695	695	0	1,219
Unknown	203	173	1	173	173	0	304
TOTALS		**22,952**			**24,404**	**1,452**	**42,814**

REG

REGISTRAR

DEPARTMENT SUMMARY

The current engineering complex includes several teaching spaces that are centrally scheduled by the registrar and are regularly used by the various colleges within the university. These spaces include several medium and small classrooms as well as the main lecture hall at the northwest corner of Leonard Hall. Two of these existing classrooms located in Upson II are underutilized and are shown to be removed from the program.

The tables below show the net square footage numbers for both the current and future state associated within the instructional spaces that are centrally scheduled by the Registrar.

SPACE PROJECTIONS *Net Square Feet (NSF)*	CURRENT NSF	FUTURE NSF	PROGRAMMATIC CHANGES
TEACHING LABORATORIES	2,477	2,477	1. Eliminate two small classrooms that are underutilized (161 & 164 Upson II)
RESEARCH LABORATORIES	-	-	
LABORATORY SUPPORT	-	-	
LECTURE AND CLASSROOM	11,756	10,860	
OFFICE AND ADMINISTRATION	-	-	
OTHER	129	50	
TOTAL	**14,362**	**13,387**	**6% Decrease**

PERSONNEL PROJECTIONS *C/O: On Campus/Online*	CURRENT	FUTURE	NOTES
UNDERGRADUATE STUDENTS (C/O)	- / -	- / -	1. Space utilized by all departments inside the College of Engineering
MASTERS STUDENTS (C/O)	- / -	- / -	
PHD STUDENTS (C/O)	- / -	- / -	
FACULTY	- / -	- / -	
NSF PER STUDENT ON CAMPUS	- / -	- / -	

SPACE SUMMARY

	#	EXT. NSF	QTY	NSF EA.	PROP. NSF	DIFF.	GSF
Teaching Laboratories							
Shared Teaching Laboratory / Classroom	107	847	1	847	847	0	1,486
Shared Teaching Laboratory / Classroom	211	561	1	561	561	0	984
Shared Teaching Laboratory / Classroom	215	1,069	1	1,069	1,069	0	1,875
Lecture and Classroom							
Lecture Hall	100	2,500	1	2,500	2,500	0	4,386
Classroom	108	608	1	608	608	0	1,067
Classroom	109	1,681	1	1,681	1,681	0	2,949
Classroom	161	447	0	0	0	-447	0
Classroom	164	449	0	0	0	-449	0
Classroom	204	646	1	646	646	0	1,133
Classroom	214	918	1	918	918	0	1,611
Classroom (Interactive)	217	925	1	925	925	0	1,623
Classroom	218	949	1	949	949	0	1,665
Classroom (Interactive)	261	1,026	1	1,026	1,026	0	1,800
Classroom	263	462	1	462	462	0	811
Classroom	324	1,145	1	1,145	1,145	0	2,009
Other							
Projection Booth	100A	50	1	50	50	0	88
Projection Booth	161A	43	0	0	0	-43	0
Projection Booth	164A	36	0	0	0	-36	0
TOTALS		**14,362**			**13,387**	**-975**	**23,486**

D

CONCEPTUAL PLANNING

INTRODUCTION

The following pages illustrate the iterative conceptual design process that was engaged as the design team and building committee investigated various ways to make achieve the future facility scope.

CONCEPTUAL DESIGN

INTRODUCTION

Upon completion of the departmental interviews, an initial programmatic scope was established. The initial findings indicated an approximate need of 205,000 in overall net square footage to achieve the enrollment and faculty growth while also providing some additional programmatic space for new initiatives within the college. The existing engineering complex comprises approximately 159,400 net square feet. At the time, this calculation included the scope associated with the remote drill lab. Through the review process with the committee, it was decided that the remote drill lab should remain at its current site as access for the large equipment used there would prove to be difficult and potentially hazardous to maneuver through campus. Later on in the process, it was also decided that new teaching, research and office space should be created to expand the Biomedical Engineering operations as that program is planned in the immediate future to become a stand-alone department. As the program is now envisioned, the complex will need to include 202,355 net square feet and will accommodate space for teaching and research, faculty and grad student office accommodations, student amenities, and the addition of some spaces to respond to emerging initiatives in the engineering curriculum. There were also some reductions reflected in the overall net square footage including reduction in the size of some spaces and the elimination of some underutilized spaces such as old classrooms. Assuming a net to gross conversion of 57%, it was determined that the overall gross square footage to meet the future goals of the combined college of engineering and mines would need to be approximately 355,000 gross square feet. The detailed take off of the existing plans indicated that the current complex is comprised of 259,400 gross square feet creating the need for an additional 95,600 gross square feet within the complex to be achieved through targeted additions and renovations over the next 10 to 15 years.

The following pages illustrate the iterative conceptual design process that was engaged as the design team and building committee investigated various ways to make achieve the future facility scope.

DESIGN CONSIDERATIONS

The aim of the design process centered around the goals and objectives established in the early kick-off meetings for the project. These concepts guided the design process once the program need was established and included the following major features.

ENROLLMENT: Expand enrollment with a focus on on-campus participation. The overall enrollment in the fall of 2020 was approximately 2,200 which included roughly 47% on-campus enrollment. The committee set the goal for on-campus enrollment at 1,500 to 2,000 over the next 10 to 15 years which would represent an approximate increase of between 45% and 93%. It is assumed that over the course of this time frame, on-line enrollment will continue to be in the 50% range of overall enrollment.

DEPARTMENTAL GROWTH: All departments expect steady growth well into the future which should be reflected in the goals of the facility maser plan. Mechanical Engineering is the largest program and that is expected to remain the case, but the fastest growing program is Electrical Engineering and Computer Science. Demand for Petroleum Engineering has fallen off in recent years, but moderate growth should be accommodated as future booms in the energy industry are anticipated. Biomedical Engineering will become it's own department in near future and should be poised for significant expansion. Civil Engineering is an important discipline in North Dakota and the college has determined that it is not meeting local demand. Civil Engineering is currently 75% on-line and that department has set a goal for improving that ratio to accommodate more students on-campus.

FOSTERING COLLABORATION: A proper balance between collaboration and departmental identity should be identified and be readily apparent in the solution. Faculty within departments should be located near one another to foster intra-departmental collaboration. Over the years, some of this co-location has become decentralized, but it has improved in recent years after the construction of the Collaborative Energy Center.

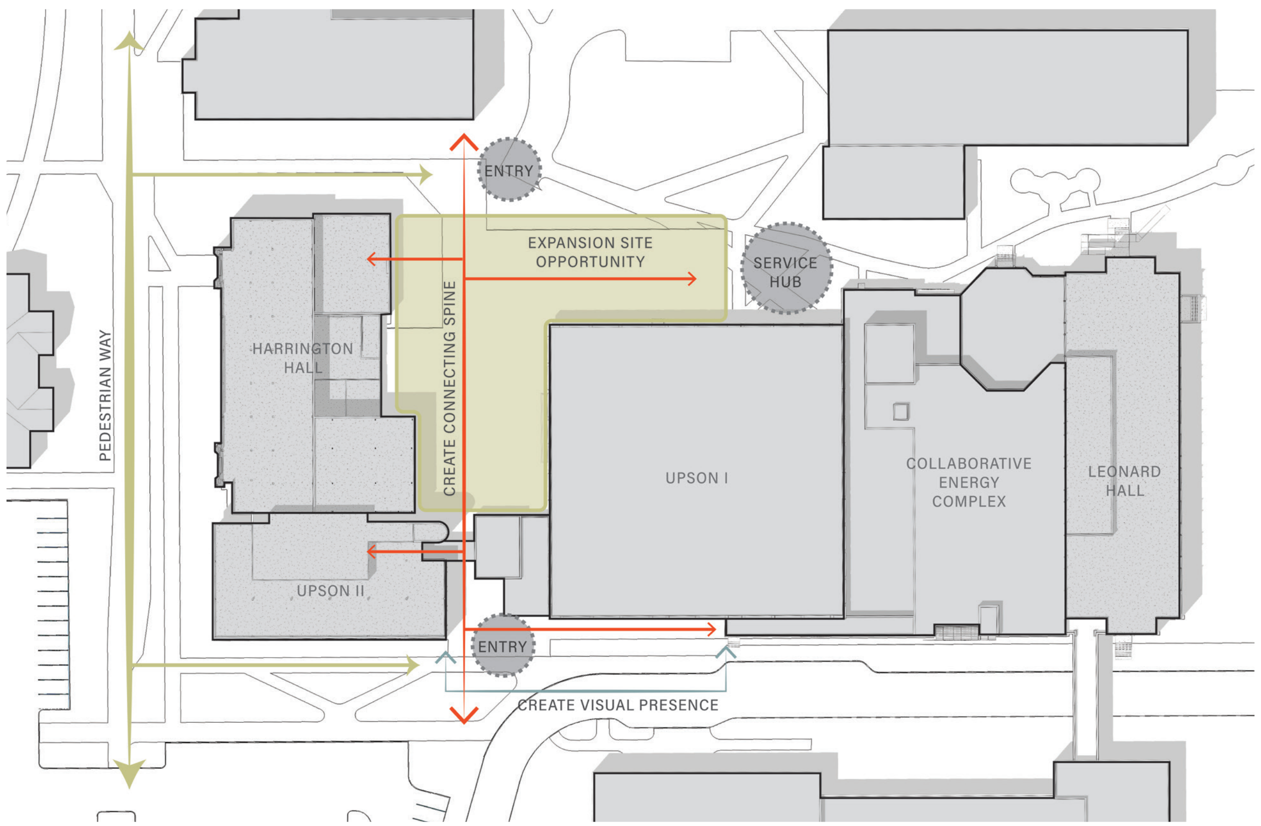
CELEBRATE THE UNIQUENESS OF UND ENGINEERING AND MINES: The college is small enough that students get to know one another and the faculty leading to collaboration and cross pollination. The solution should continue to foster and preserve this family like atmosphere and promote a sense of community. It should also celebrate that portion of the student body that is non-traditional with many students that are older and engaged in re-training.

RESEARCH SPACE: The facility should create an environment where resources are shared among all disciplines and across faculty and students with the goal of increasing undergraduate involvement in research initiatives.

RECRUITMENT AND RETENTION: The facility should be designed with recruitment in mind. The various disciplines within the college should be put on display to help with retention which has always been difficult in engineering, broadly. The entry procession into the complex should celebrate engineering and the vast number of career choices available with an engineering degree should be displayed.

INTERACTION WITH OTHER COLLEGES: The College of Engineering and specific departments within it regularly collaborate with other programs across campus. These collaborations are mostly based in research and will include interface with Aerospace Engineering, the Medical School, the department of Chemistry and the college of Business. The spaces created through the course of masterplan implementation should be situated to take advantage of these arrangements and future detailed designs should seek input from other campus entities that could benefit.

FACULTY: Current faculty count is 65 with a total staff of approximately 100. The faulty counts are too low leading to a poor faculty to student ratio which is close to 1:50 in some departments. This number should be closer to 1:30. A facility master plan should look at ways the faculty/student ratio can be improved over time by providing adequate space not only for faculty offices, but for shared research space to improve opportunities for faculty recruitment.



CONCEPT DIAGRAM

Main goals to create unity among COE campus

CLASSROOM SPACE: The masterplan should provide adequate conventional classroom space, but it should be sized appropriately (several existing registrar scheduled classrooms are too small to be effectively utilized). It should also take into account available classroom space in adjacent buildings in this region of campus and may include enclosed links between Harrington Hall and the Education Building to the north. The large lecture hall in Leonard Hall is widely used and needs to be preserved. Computer classrooms should also be planned that can be used for both instruction and student projects.

HVAC AND ELECTRICAL SYSTEMS UPGRADES: The masterplan should provide for the replacement and upgrade of aging systems for HVAC and electrical systems as the targeted renovations are phased into the plan.

ACCESSIBILITY AND LIFE SAFETY: Accessible entrances, restrooms and class/lab furnishings should be planned throughout so that all accessibility issues are rectified through the course of the masterplan implementation. Any life safety issues and code deficiencies should also be addressed.

APPROACH

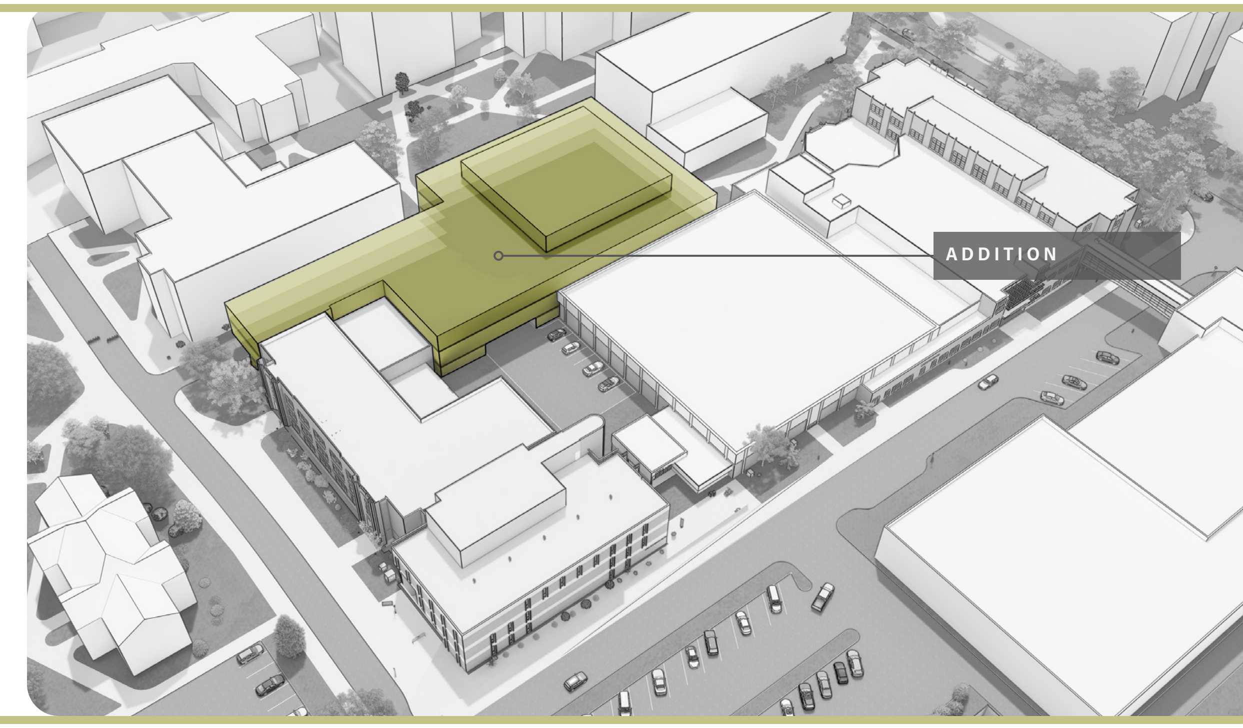
The conceptual design approach included a series of massing studies that were investigated to achieve the following aims:

- Provide the addition of net and gross square footage to achieve the growth identified in the planning phase
- Renovate targeted areas of the building that were most in need to modernization to meet current standards for laboratory safety and modular planning
- Provide swing space sufficient to implement a phased renovation of all areas of the complex in need of modernization and system replacement that would allow the college to operate continuously with no down time
- Create new dynamic space that would aid in recruitment and celebrate the engineering disciplines
- Create a circulation path through the complex that would improve way-finding and continuity
- Provide improved horizontal circulation the upper stories of the complex
- Eliminate programmatic elements that were underused or determined to be unneeded in the future
- Correct spaces that were oversized
- Correct life safety code issues
- Correct accessibility issues

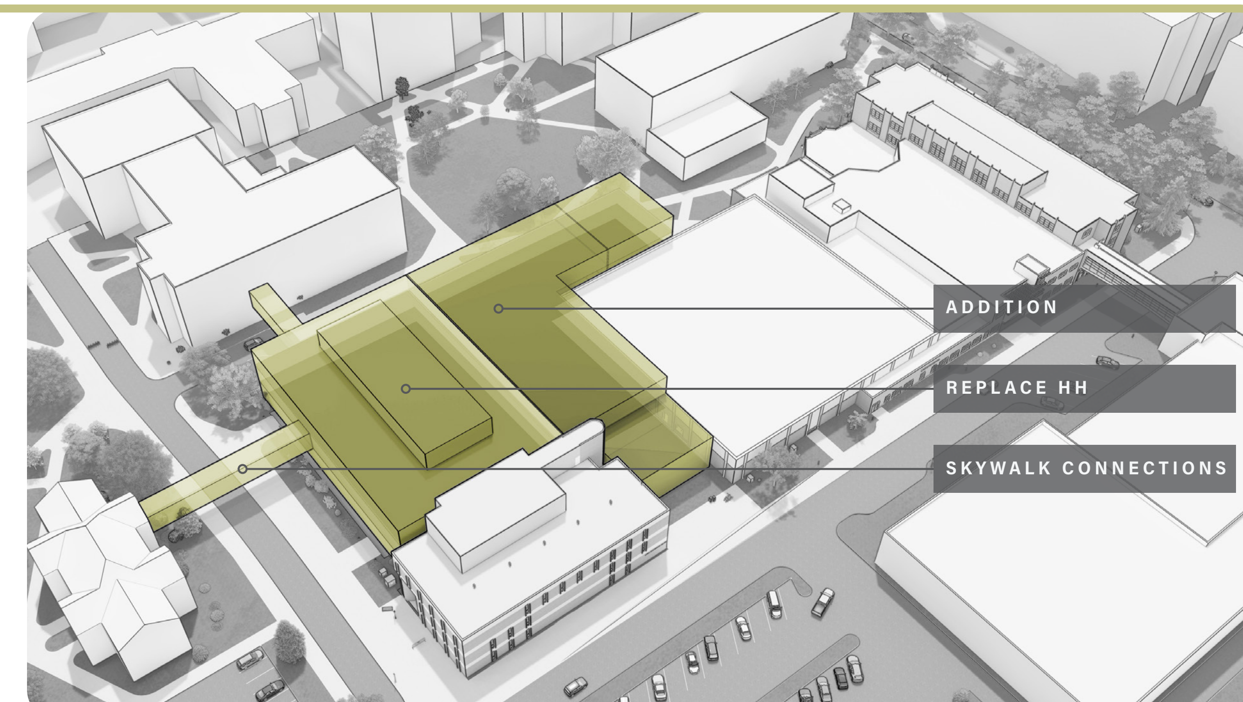
EARLY OPTIONS

The massing iterations described below and illustrated on the following pages show the progression of massing options investigated to meet the project objectives.

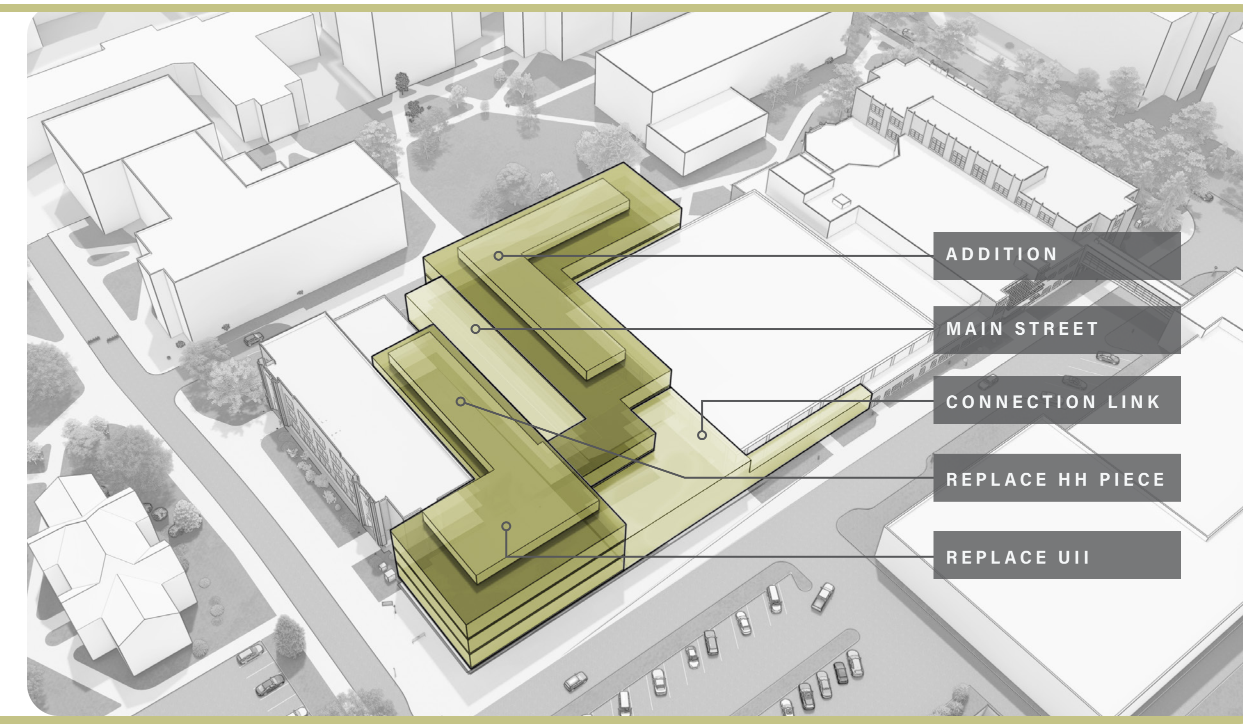
MASSING SERIES 1: Massing Series 1 included the phase 1 construction of new 3 story addition that provided all of the new square footage included in the programming study. The addition was located partially in the existing quad north of the complex and would connect the north side of Harrington Hall and the north side Upson I at both the first and second floors. This option would leave the courtyard between Harrington and Upson I open to serve as a service yard and large scale entrance into the west high bay spaces in Upson I. Once this addition was completed, it would have provided adequate swing space to vacate and renovate the existing areas of the complex that required major renovation in 3 to 4 phases. The total gross square footage of the phase one addition was 82,500 GSF with a footprint of approximately 24,300 GSF and a 9,700 square foot mechanical penthouse.



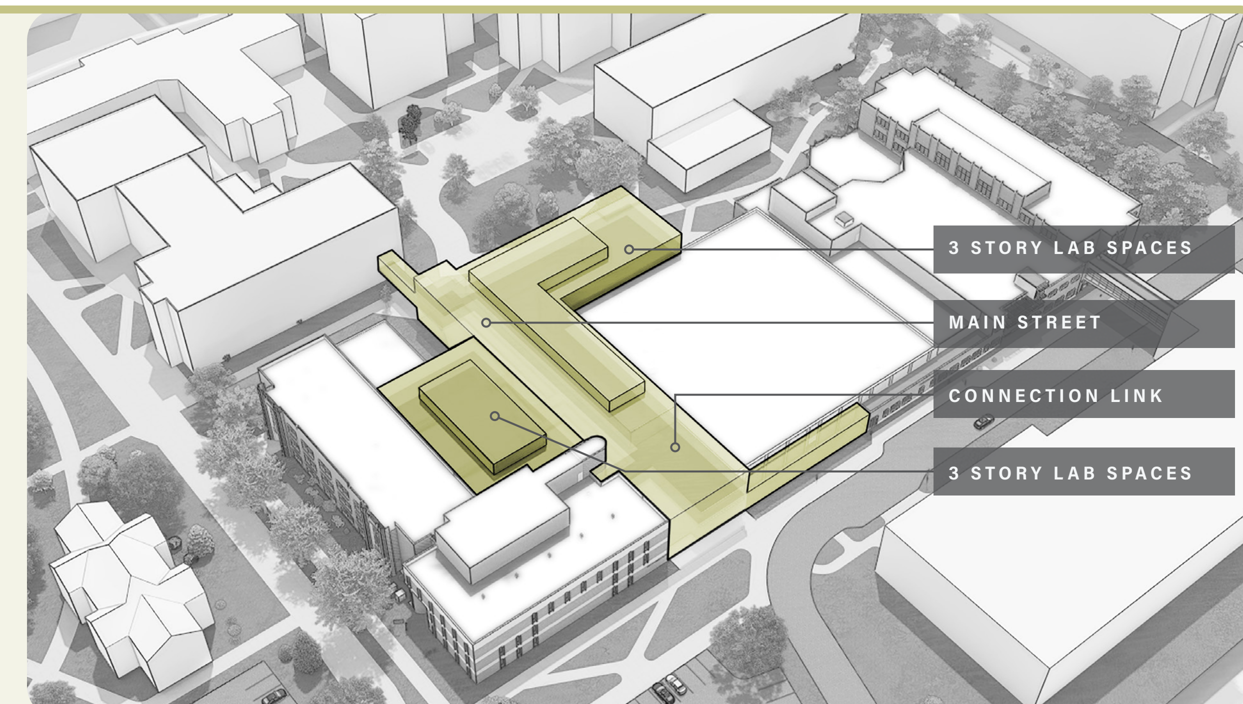
MASSING SERIES 2: Massing Series 2 also included the phase 1 construction of new 2 story addition that provided 44,700 new gross square feet to be located in the area between Harrington and Upson I connecting both existing structures at the first and second floors. This series also included new high bay space in the new addition along the north side of Upson I and called for a new large scale equipment entrance to be located on the north side of the addition providing access to the high bay spaces in Upson I. The phase I addition would then serve as swing space for the demolition and full three story replacement of Harrington Hall in it's entirety with new construction totaling approximately 112,000 gross square feet. When coupled with the phase I addition, the phase II replacement of Harrington Hall would provide the required square footage to meet all scope



MASSING SERIES 3: Massing Series 3 called for a phase I addition between Harrington and Upson I followed by the demolition of the east side of Harrington Hall to include the single story industrial lab and three story chemical engineering addition. This demolished area of Harrington Hall would then be replaced by a new three story addition as part of phase 2 construction. The third phase of this version would then include either the demolition and replacement or significant renovation of Upson II in order to rebuild that portion of the complex to be of a more contextual façade.



MASSING SERIES 4: Massing Series 4 was the massing option that was reviewed and ultimately decided by the building committee to be developed further. It calls for the Phase 1, three story addition between Upson I and Harrington that also extends across a portion of the north face of Upson I. The completion of the first phase of construction provides the swing space to then demolish the east side of Harrington Hall and replace that with a three story addition and create a new entrance into a three story north/south atrium with research and teaching laboratories on both sides. This version also extends and east/west running connection to across the south façade of Upson I to create a more cohesive wayfinding path to better connect the entire complex. Subsequent phases will include the interior renovation of Upson II, light renovation and system replacement in Upson I and major reorganization in Leonard Hall.




UND
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& MINES


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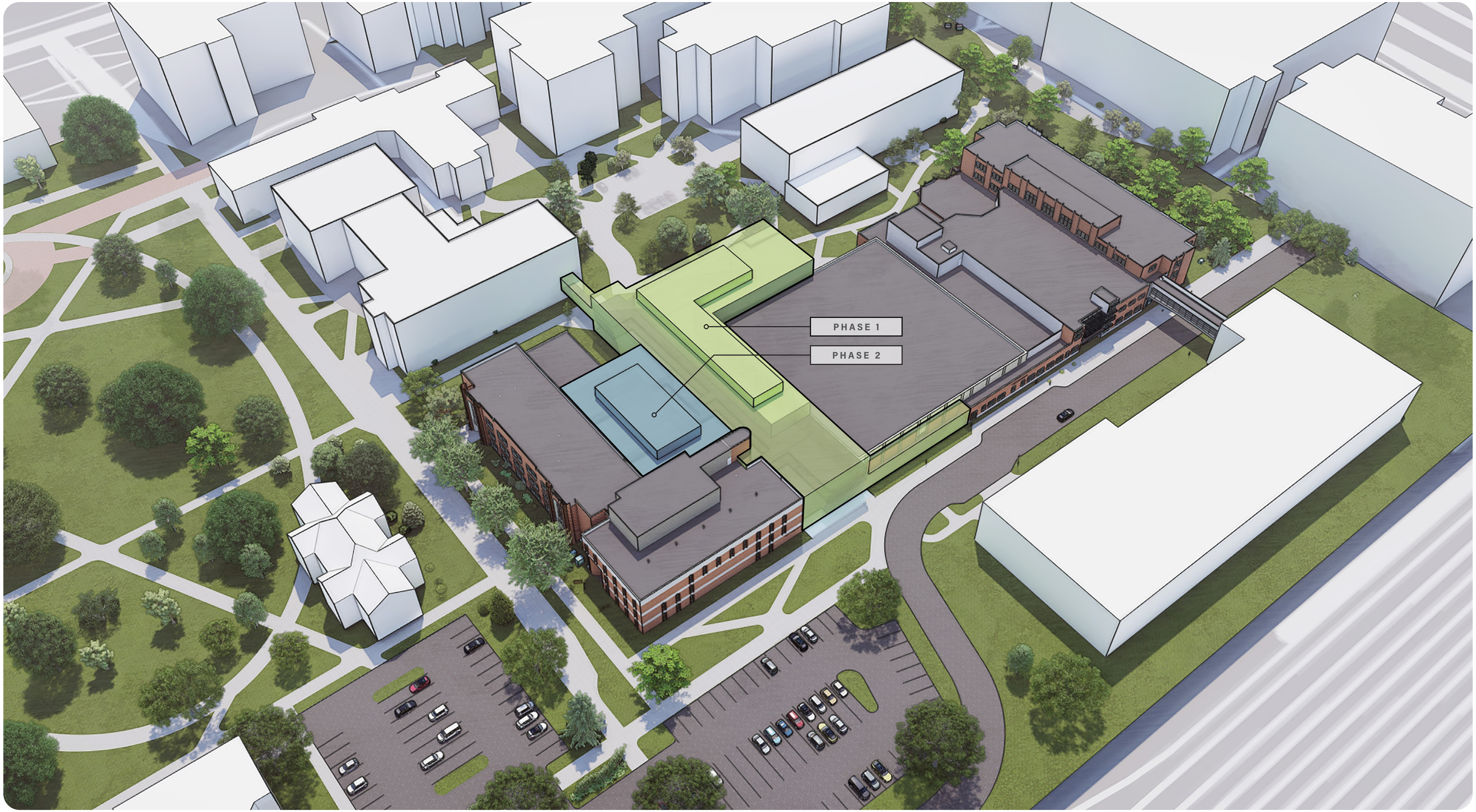
NORTH DAKOTA


PHASE 1
PHASE 2

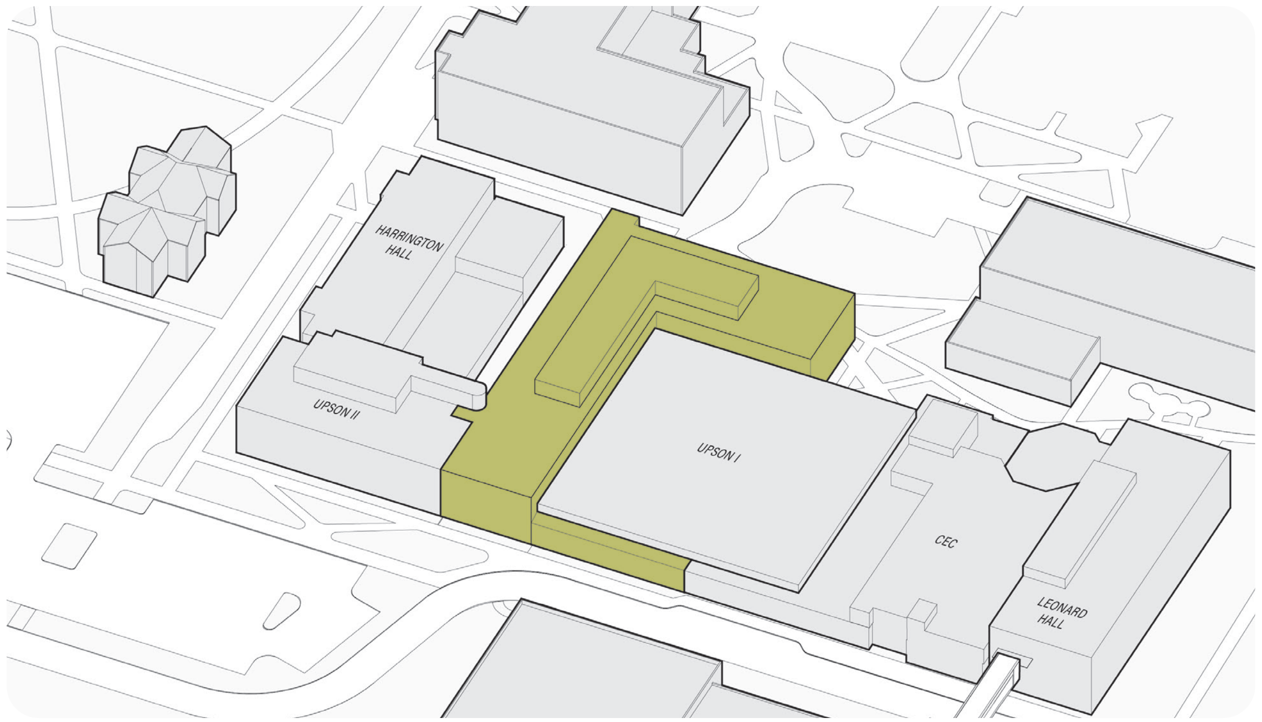

PHASE 2
PHASE 1

E

PHASING AND COSTS

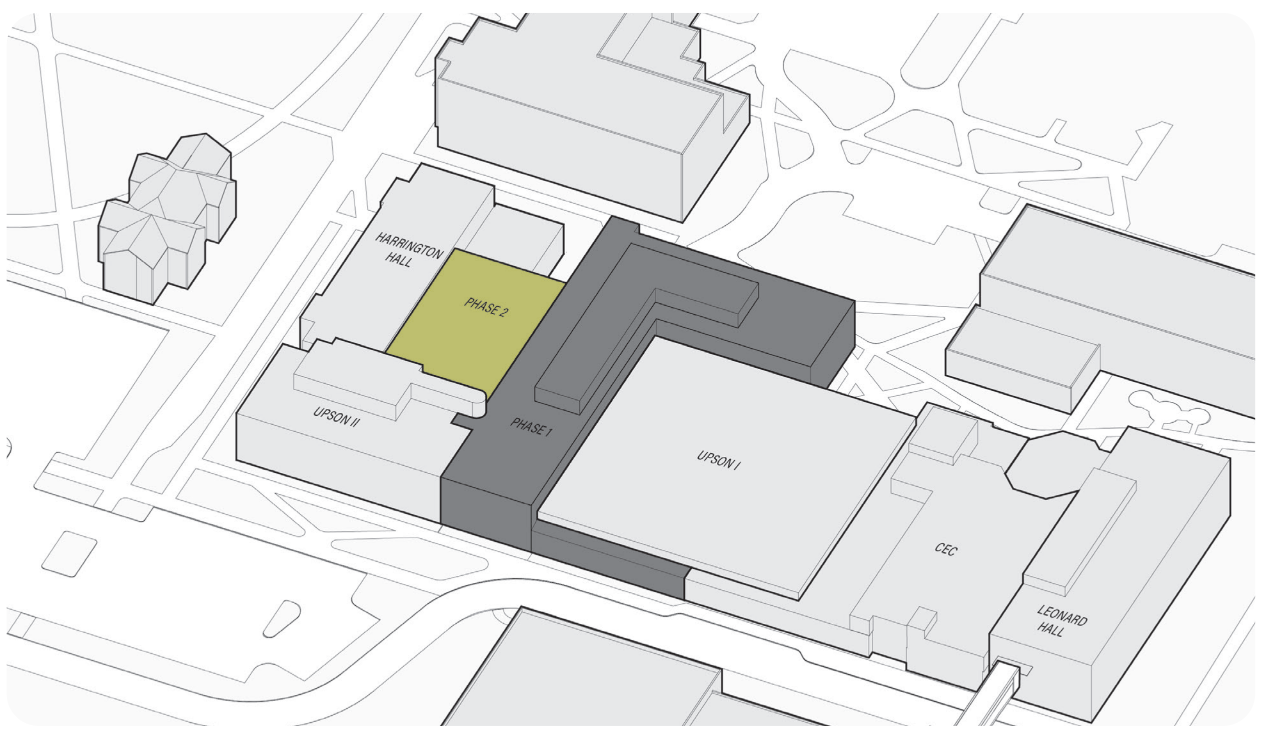
INTRODUCTION

The following pages illustrate the phased approach for the future facility and breaks down opinions of probable cost.



PHASE 1

Addition of 3 Stories of Lab Space and Main Street Link



PHASE 2 DEMO + INFILL

Demo Back Side of Harrington Hall and replace with 3 story laboratory spaces

PHASE 3

Renovate Upson II

PHASE 4

Renovate Remaining Spaces

MECHANICAL NARRATIVE - ALL PHASES

GENERAL

The design and installation of all mechanical systems will be in accordance with relevant portions of the following codes, standards, and publications:

- American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Handbooks and Standards
- American National Standards Institute (ANSI) Standards
- International Building Codes
- International Mechanical Code (IMC)
- International Plumbing Code (IPC)
- National Fire Protection Association (NFPA) Codes
- Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- All codes and standards as established by the University of Nebraska Medical Center

TEMPERATURE AND HUMIDITY PARAMETERS

The following parameters will be used as the basis for the design of the building HVAC systems:

OUTDOOR DESIGN CONDITIONS:

Winter Dry Bulb Temperature	-21.6 Deg. F
Summer Design Dry Bulb Temperature	89.1 Deg. F
Summer Coincident Wet Bulb Temperature	76.4 Deg. F

INDOOR DESIGN CONDITIONS:

Summer / Winter Dry Bulb Temperature

Classrooms/Labs/Offices	*74 / 68 Deg. F*
Mechanical/Electrical Rooms	*85 / 55 Deg. F*
Telecomm Rooms	*74 / 70 Deg. F*
Storage Rooms	*74 / 70 Deg. F*
Stairs/Vestibules	*NA / 65 Deg. F*
All Other Areas	*74 / 70 Deg. F*

Relative Humidity

All Areas	*20-60% RH*

MINIMUM VENTILATION RATES:

Laboratory areas	*Min. 6 ACH (air changes per hour) occupied*
	Min. 4 ACH unoccupied
Chemical storage areas	*Min. 15 ACH*
All other areas	*IMC/ASHRAE requirements*

FUME HOOD AIRFLOW RATES:

Face Velocity	*60 feet per minute (FPM), tested in accordance with ASHRAE 110 to verify proper capture rates*

ELECTRICAL NARRATIVE - ALL PHASES

GENERAL

The design and installation of all electrical systems will be in accordance with relevant portions of the following codes, standards, and publications:

- National Electrical Code; NFPA #70
- National Fire Protection Association (NFPA) Standards
- National Electrical Safety Code (NESC)
- The International Building Code (IBC)
- ASHRAE Standards for the design of energy efficient buildings
- International Energy Conservation Code (IECC)
- International Fire Code
- American National Standards Institute (ANSI) Standards
- National Electrical Manufacturer's Association (NEMA) Standards
- Underwriter's Laboratories, Inc. (UL)
- Illuminating Engineering Society (IES) Lighting Handbook
- Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- All codes and standards as established by the University of North Dakota

GENERAL REQUIREMENTS

The electrical design for this project will include the following considerations:

ELECTRICAL DISTRIBUTION: Selective demolition of existing distribution equipment, conduits, and feeders will be performed based upon the location, age, and condition of the existing equipment. When possible, existing panelboards will be reutilized.

GENERATOR SYSTEM(S): When applicable existing emergency/standby generator distribution will be expanded to provide emergency or standby power to required life safety, and standby loads throughout facilities.

MECHANICAL EQUIPMENT CONNECTIONS: For large mechanical equipment loads, 480V feeds will be provided, when available within the associated facility.

FIRE ALARM SYSTEMS: New fire alarm systems will be provided for the new additions. In buildings to be renovated, the existing fire alarm systems will be upgraded and expanded as required to meet code.

ACCESS CONTROL: Access control and security systems will be provided for the new additions. In buildings to be renovated, the existing systems will be upgraded and extended as required.

PHASE 1

BUILDING ADDITION

PHASE SUMMARY

Phase 1 of the master plan involves the construction of a new addition to the north and west sides of Upson I. A portion of the north wing of the addition will include a new high bay loading area to serve the existing high bay space along the west side of Upson I with one occupied floor above while the balance of the usable square footage will be framed in three conventional stories to align with the floor-to-floor height in Harrington Hall. This first phase will construct a series of research, teaching and support spaces identified in the program as well as a new home for Biomedical Engineering, a replacement for Chemical Engineering's Unit Operations and equipment support labs for Mechanical Engineering. It will also provide swing space to vacate a significant portion of the east side of Harrington Hall for work in Phase 2 and it will vacate all lab spaces in Upson II in preparation for subsequent phases in that portion of the complex. Phase 1 construction will also create a new centralized dock and loading area with overhead door access into both the east and west sides of the Upson I high bay spaces.

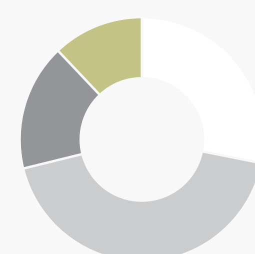
The tables below the phase statistics and use distribution in NSF. The floor plan illustrates the location in the campus and the chart to the right indicates all programmatic spaces included in phase 1.

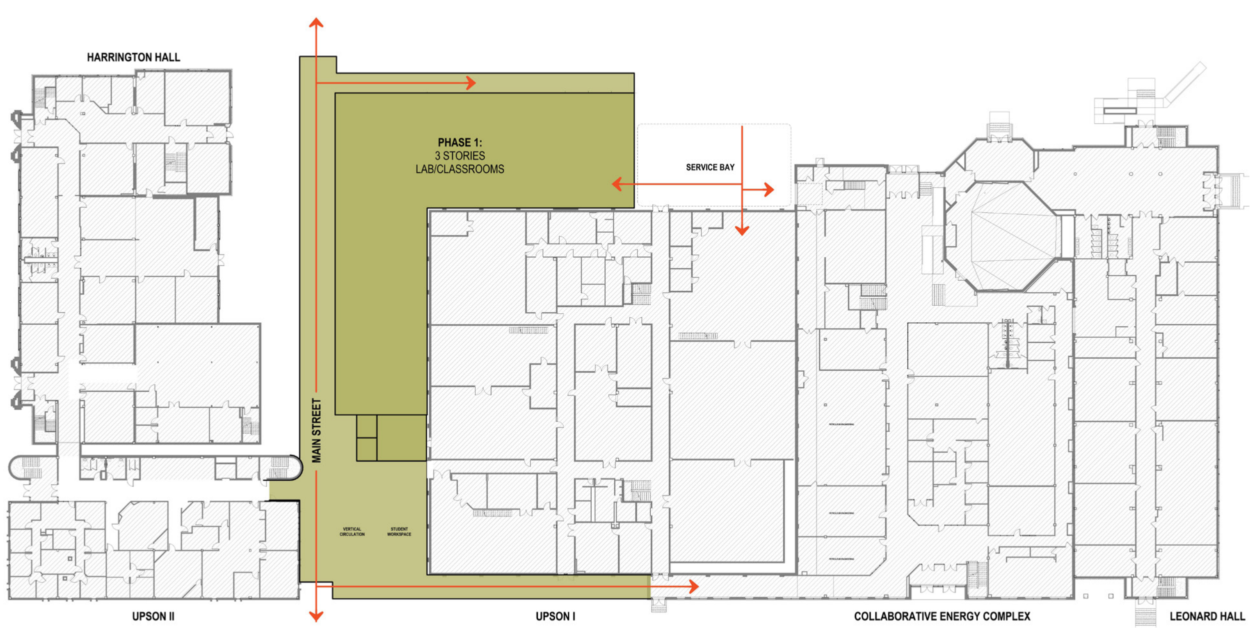
STATS

PHASE NUMBER	1
NUMBER OF LEVELS	3
NET SQUARE FEET	29,286
GROSS SQUARE FEET	51,397
COST	$24,072,763
TYPE	NEW

USE BREAKOUT (NSF)

TEACHING LABORATORY	8,233	28%
RESEARCH LABORATORY	12,609	43%
LABORATORY SUPPORT	4,914	17%
LECTURE + CLASSROOM	0	0%
OFFICE + ADMINISTRATION	3,530	12%
OTHER	0	0%





SPACE IN PHASE 1

	QTY	NSF
PETROLEUM ENGINEERING		2,178
PE Teaching Laboratory	1	2,178
CHEMICAL ENGINEERING		7,864
Teaching Laboratory (Unit Ops 1)	1	1,089
Unit Operations Teaching Laboratory	1	1,815
Wet Chemistry Research	1	1,815
Research Laboratory	1	363
Research Laboratory	1	363
Research Laboratory	1	363
Chem E Shop / Tool Storage	1	484
Fittings and Material Storage	1	242
Chem E Shop Storage	1	121
Chemistry Prep	1	242
Instrumentation Laboratory	1	242
Instrumentation Laboratory	1	363
Flue Mezzanine	1	242
Lab Manager's Office	1	120
ELECTRICAL ENGINEERING/COMPUTER SCIENCE		2,387
EE&CS Maker Space	1	2,178
EE & CS Maker Space Support	1	209
MECHANICAL ENGINEERING		5,703
ME Instructional Machine Shop new	1	1,699
ME Machine Shop new	1	1,719
ME Storage / Dock Area	1	2,285
COLLEGE OF ENGINEERING		1,452
Drone Laboratory	1	1,452
BIOMEDICAL ENGINEERING		9,702
Biomed Eng Teaching Laboratory	1	1,452
Biomedical Engineering Laboratory	1	1,815
Biomedical Research Wet Laboratory	1	1,089
Biomedical Optics Laboratory	1	726
Biomedical Exercise Laboratory	1	726
Biomed Lab Storage	1	363
Biomedical Secure Records Storage	1	121
Department Chair Office	1	170
Faculty Office	7	840
Grad Students / PhD Offices	30	2,400 (80EA)
TOTALS		29,286

MECHANICAL NARRATIVE

SITE EQUIPMENT AND UTILITIES

The building addition will be served by new steam, steam condensate, water, sanitary sewer, storm sewer, and natural gas piping connected to the existing mains located north of the addition and/or west of Harrington Hall. The utilities will be sized to serve Phase 2 of the project.

Existing mechanical equipment and external ductwork/piping in the area to the east of Harrington Hall and Upson II will be removed or relocated to accommodate the building addition.

AIR HANDLING SYSTEMS

The building addition will be served by two different types of air handling units (AHUs). In general, laboratory spaces will be served by 100% outside air (OA) AHUs, while non-laboratory spaces will be served by recirculating AHUs. Each AHU will operate in a variable air volume (VAV) mode to minimize energy use. To the extent possible, all AHUs will be located in the penthouse.

The components of each 100% AHU will be as follows (listed in direction of airflow):

COMPONENT	COMMENTS
Outside air dampers	*Low-leak dampers, airflow measurement*
Prefilter bank	*MERV 8, 2" plated filters*
Final filter bank	*MERV 14, 12" cartridge*
Heat recovery coil bank	*Runaround water coil, glycol for freeze protection*
Preheat coil bank	*Heating water coil*
Supply fan(s)	*Fan array with VFD*
Humidifier grid	*Steam dispersion grid*
Cooling coil bank	*Chilled water coil*
Sound attenuator	*36" sound attenuating section*
Discharge dampers	*Low-leak dampers*

The components of each recirculating AHU will be as follows (listed in direction of airflow):

COMPONENT	COMMENTS
Return fan(s)	*Fan array with VFD*
Return/relief mixing box	*Low-leak dampers*
Return/outside air mixing box	*Low-leak dampers, 100% economizer capabilities, airflow measurement on outside air*
Prefilter bank	*MERV 8, 2" plated filters*
Final filter bank	*MERV 14, 12" cartridge*
Preheat coil bank	*Heating water coil*
Supply fan(s)	*Fan array with VFD*
Cooling coil bank	*Chilled water coil*
Sound attenuator	*36" sound attenuating section*
Discharge dampers	*Low-leak dampers*

Outside air will be introduced to each of the AHUs via louvers in the mechanical room side wall. Relief air will be discharged through louvers or roof hoods.

All AHUs will have double-wall construction, access doors at each coil and filter section, and internal lights for ease of maintenance. Vibration isolation (internal and/or external) will be provided to minimize noise and vibration transmission to the occupied spaces below.

EXHAUST SYSTEMS

High-plume mixed-flow exhaust fan systems will be installed to provide exhaust for the required facility spaces. Each fan system will be sized to exhaust both fume/lab exhaust as well as general building exhaust (such as restrooms, custodial closets, etc.). The new fan systems will be sized for N+1 redundancy. Each fan will be variable speed and include sound attenuation, and each fan system will include a mixing box / bypass plenum.

All exhaust discharge from the building will be located as far as feasible from fresh air intakes and from other buildings to help prevent air recirculation into occupied spaces.

ATRIUM SMOKE EVACUATION SYSTEM

A smoke evacuation system will be provided to serve the 3-story atrium in the building addition. It will include multiple roof-mounted exhaust fans that will be located and sized based on future smoke modeling calculations. Makeup air will be provided through passive means, such as through operable doors and/or louvers.

HEAT RECOVERY SYSTEM

A heat recovery unit will be installed to transfer energy between the 100% OA AHUs and the exhaust fan systems. The heat recovery unit(s) will be located in the penthouse and will consist of a MERV 8 filter bank followed by a runaround coil. All internal components will be either stainless steel or coated steel to minimize corrosion due to the fume exhaust airstream. A base-mounted pump will be provided for each runaround loop, located in the penthouse, and will circulate a mixture of glycol and water between the exhaust runaround coils and the AHU runaround coils. A three-way valve will be provided for temperature control and frost control purposes.

AIR DISTRIBUTION SYSTEMS

A variable air volume (VAV) air distribution system will be utilized for all areas. With this system type, each non-laboratory temperature control zone will be served by a supply VAV box with an integral hot water reheat coil, while each laboratory temperature control zone will be served by a high-speed venturi air valve and hot water reheat coil. The VAV box/air valve will modulate its damper position to maintain the required airflow as system pressure fluctuates. A heating water 2-way control valve will modulate water flow to the reheat coil to maintain desired zone temperature conditions. Supply air ductwork will generally be galvanized steel construction.

The exhaust system will operate in a VAV mode similar to the supply air system. Each temperature control zone will be served by an exhaust VAV box or air valve. In non-laboratory zones, the airflow of the exhaust VAV box will "track" the airflow of the corresponding zone supply VAV box to guarantee proper space pressurization is maintained. In laboratory zones, a fume hood air valve will be used to provide proper fume hood face velocity and a general exhaust air valve will modulate to provide proper room pressurization and minimum ventilation rates. All exhaust air will be routed using common ductwork to the high-plume exhaust fans. Exhaust air ductwork will generally be galvanized steel construction; however, all ductwork downstream of fume hoods, canopy hoods, snorkel hoods, or other specialized equipment will be stainless steel construction.

The return air system for the recirculating AHUs will generally consist of transfer ducts and return air plenum. Return air airflow-measuring dampers will be used near the return air duct main to control the air volume for each floor.

Room occupancy sensors will be used to reduce the airflow to the spaces during unoccupied hours. In laboratory areas, the airflow will be reduced, but will still be sufficient to maintain minimum code-required ventilation rates.

STANDALONE HEATING/COOLING SYSTEMS

In order to minimize the size of the AHUs, standalone units will be provided to supply dedicated heating and cooling to specialized spaces. Electrical rooms, mechanical rooms, telecom closets, and other similar cooling-only zones will be served by chilled water fan coil units (FCUs) or refrigerant-based split systems. Dock areas will be served by heating water unit heaters (UHs). Stairs and vestibules will be served by 2-pipe or 4-pipe FCUs.

CHILLED WATER SYSTEM

New rooftop air-cooled chillers will be provided to serve the building addition. Additionally, the use of small heat recovery chillers will be investigated during the design phase to provide simultaneous heating and cooling during low-load conditions.

New chilled water pumps will be provided to circulate chilled water to all required coils. The pumps will be controlled via VFDs and will modulate pump speed to allow chilled water flow reduction during low load conditions.

All new coil loads will be provided with pressure-independent 2-way control valves.

STEAM AND CONDENSATE SYSTEM

New steam and condensate piping will be extended from the campus system to the building. A new steam pressure reducing station will be provided to create low pressure steam.

New steam-to-hot water heat exchangers will be provided to generate heating water. Steam will be extended to the 100% OA AHUs for humidification. A new condensate pump serving the building will be provided to return condensate to the campus system.

HEATING WATER SYSTEM

The new steam-to-hot water heat exchangers will generate heating water. New heating water pumps will be provided to circulate heating water to all required AHU, terminal unit, and perimeter heating loads. Pumps will be controlled via VFD to modulate pump speed for energy savings.

Panel radiators will be provided to serve perimeter zones with large expanses of glazing. All new loads will be provided with pressure-independent 2-way control valves.

BUILDING AUTOMATION SYSTEM (BAS)

The building addition will utilize direct digital controls (DDC). The BAS will have the capability to adjust setpoints and system operation to match changing facility functions. All controls items will be integrated into the existing University controls infrastructure.

WATER SYSTEMS

New parallel, main backflow preventers and water meter will be provided at the location of the building water entrance. Additional backflow preventers will be used to create a laboratory cold water system for use in the lab spaces. The additional backflow preventers are planned to be installed in the mechanical penthouse along with the water softener and water heaters described below.

Two new semi-instantaneous steam-fed water heaters will be installed in the mechanical penthouse (one domestic, one laboratory) to support their respective fixtures. Recirculating pumps and piping will be installed on each hot water system to ensure continuous hot water supply at each point of use.

A water softener will be provided to reduce the hardness of all water feeding the water heaters, pure water equipment, and certain laboratory equipment. Additionally, soft water will be piped as necessary to any required laboratory areas.

Temperature mixing valves will be provided to serve any emergency fixtures (eye washes or emergency showers) in compliance with ANSI standards.

PURE WATER SYSTEMS

If required for laboratory uses, high purity water will be generated by a single water purification skid. The equipment will include carbon filters, reverse osmosis (RO) equipment, deionization (DI) tanks, ultraviolet (UV) sterilizer, 0.2-micron filters, storage and recirculating pump(s) that will continuously circulate the pure water through a polypropylene pipe loop to use points and laboratory equipment throughout the addition. The water quality produced by this system will be equivalent to Type 2 (1 mega-ohm) grade meeting ASTM/ISO 3696 specifications. Point of use polishers will be used for Type 1 lab water needs.

DRAIN, WASTE, AND VENT

Sanitary waste and vent piping will be extended to all required fixtures throughout the facility. Laboratory waste piping will be limited to piping from a laboratory sink/drain to the nearest main riser and will be comprised of fuse-seal polypropylene pipe and fittings. A dedicated acid neutralization system is not anticipated as chemicals will be collected and disposed of in lieu of dumping them down the sinks.

STORM WATER SYSTEMS

Primary and overflow storm drainage piping will be extended to all roof drain areas. The primary system will be routed to the underground storm sewer system. The overflow system will be routed to downspout nozzles located on the exterior walls 18" above grade.

NATURAL GAS SYSTEM

Natural gas will be routed to the new laboratory areas. When serving laboratory areas, an emergency shutoff valve will be provided to stop the flow of natural gas in the event of an emergency. Delivery pressure for laboratory use points will be between 7-11" w.c. unless an elevated pressure is required.

SPECIALTY GASES

LABORATORY COMPRESSED AIR: A new air compressor will be installed in the penthouse to serve new laboratory equipment. The compressor will be a dual oil free scroll tank mount type and installed on top of a 4" high concrete equipment pad with vibration isolators. The system will include a refrigerated air dryer (37.4 deg F dewpoint) and inline filters to provide clean, dry air suitable for laboratory grade use. Piping and fittings will be high purity copper suitable for laboratory use. A master pressure reducing valve will be installed in the penthouse to regulate the system delivery pressure to 125 psig.

CYLINDER GASES: The need and quantity of cylinder gases will be determined during subsequent design phases. Where centralized and stored within a dedicated cylinder closet, gas manifolds with auto-changeover capabilities will be installed and high purity copper suitable for laboratory use will be routed to all use points and equipment.

LABORATORY VACUUM: A new centralized laboratory vacuum pump system will be installed in the penthouse. The pump will be a multi-plex unit with receiver installed on top of a 4" high concrete equipment pad with vibration isolators. The system will be size to maintain a vacuum of 19 inches of mercury at the farthest terminal at peak demand based on 0.5 scfm demand at each terminal. Piping/fittings will be high purity copper suitable for laboratory use.

FIRE PROTECTION

A new fire suppression system will be installed to provide full coverage to all required areas. Hazard classifications will be based on applicable NFPA 13 requirements for each space type.

New fire protection standpipes and hose connections will be installed in all egress stairs.

All work will comply with NFPA 13, NFPA 14, NFPA 24, and other local requirements.

Code-required fire dampers, smoke dampers, and fire/smoke dampers will be installed throughout the building as necessary.

ELECTRICAL NARRATIVE

ELECTRICAL DISTRIBUTION SYSTEM

The building addition will be served by a new 480Y/277V, 3-phase, 4-wire normal electrical service. The main service will be sized to accommodate Phase 2 of the project. A main switchboard will provide feeds to distribution panelboards, and large mechanical loads throughout the building. In general, new HVAC equipment and large equipment loads will be served at 480 volts, 3-phase. Lighting throughout the facility will be served at 277 volts, single phase. Laboratory, office, and computer equipment, as well as general-purpose receptacle circuits will be served at 120 volts, single phase. All other equipment and devices will be served by the appropriate distribution system voltage

Additional electrical distribution system details include the following:

- Distribution system switchboards and panelboards will make use of circuit breakers for overcurrent protection of feeders and branch circuits.
- Copper bussing will be provided for all electrical distribution system equipment.
- Digital customer metering equipment will be provided as determined by consultation with University facilities personnel. Digital metering devices will be connected to the building energy management control system to allow for remote monitoring.
- Separate panelboards will be used to support facility lighting and general-purpose electrical requirements.
- Surge Protection Devices (SPD) will be provided for all new Life Safety distribution equipment

STANDBY/EMERGENCY GENERATOR SYSTEM

A new pad mounted diesel driven generator and associated emergency/standby electrical distribution equipment will be provided for the addition. It will be sized to feed Phase 2 of the project. The system will be used to supply code required emergency and life safety loads. These loads will include but may not be limited to emergency egress and exit lighting, any essential HVAC loads, alarm and communication systems and fire alarm equipment. In addition to code required loads some capacity will be provided for standby loads in each lab as coordinated with the owner.

LIGHTING SYSTEMS

Lighting systems throughout the facility will be designed in accordance with University design guidelines, IES recommendations and applicable energy codes. Lighting power densities will be minimized by using highly efficient fixtures throughout the areas of renovation. Occupancy/vacancy sensors will be used throughout most spaces to provide automatic off of lighting loads during unoccupied times. In addition, where daylighting opportunities and requirements exist, the use of daylighting controlled lighting systems will be utilized. In general, lighting systems will be as follows:

- For laboratories/classrooms it is critical to provide appropriate illumination levels on bench tops, to minimize the impact of shadows created by equipment, casework and personnel.. In addition, it is imperative that labs be provided with lighting fixtures that can withstand environmental conditions in each space. In areas with ceilings, high efficient, recessed linear, LED fixtures will be installed over the edge of the bench tops. This type of lighting provides adequate levels of illumination on bench tops, helps to minimize issues associated with glare and shadowing, while still providing illumination of vertical surfaces.

- All fixtures in laboratories with no ceiling will be linear pendant, high efficient LED fixtures. A portion of the light distribution of these fixtures will be indirect in order to increase the quality of light by providing even, diffuse light levels.

- All fixtures in laboratory areas will be equipped with dimming to provide a variety of light levels. Normal power fixtures in laboratories will be enabled by occupancy/vacancy sensors, and controlled locally within each space. A portion of the lighting in all laboratories will be connected to the emergency generator system.

- In chemical storage areas or laboratories that make use of a significant amount of chemicals, the most prudent approach to lighting is 1'x 4' recessed lensed LED troffers. This type of illumination reduces shadowing and provides adequate illumination levels. Normal fixtures in these spaces will be enabled by occupancy/vacancy sensors, and controlled locally within each space. A portion of the lighting in all areas with high chemical usage will be connected to the emergency generator system.

- Lighting in corridors will be provided by recessed, high efficient, LED fixtures. A portion of these fixtures will be connected to the emergency generator system to provide Code required emergency egress lighting and night lighting. All normal lighting fixtures will be connected to a lighting control system so they are turned off when the building is normally unoccupied.

RECEPTACLE LAYOUTS

Receptacle layouts and circuiting to support computer equipment, classroom equipment, laboratory equipment, telecommunications equipment and general purpose needs will be provided in accordance with direction provided by building users and campus personnel.

Two channel surface metal raceway systems will be provided above benches in laboratories to support the distribution of power, telecommunications and instrumentation cabling to computer and laboratory equipment. Duplex receptacles will be installed in surface metal raceway systems at intervals dictated by building users. Receptacles in raceway systems will be connected to 20-amp branch circuits unless further direction has been provided by a specific user.

In equipment alcoves and shared equipment or instrumentation spaces wall mounted busway will be utilized. The busway will provide quick plug-and-play power re-configuration to accommodate equipment changes. Busway will be rated at 208Y/120V, 3 phase, 4-wire with amperage ratings that vary depending on length. Standard busway receptacle/circuit breaker combination units will be coordinated with existing equipment and Campus personnel.

All electrical devices in laboratories will be labeled with the panel source and circuit number. Dedicated receptacles and circuits will be provided as required to support specific equipment locations throughout the facility. All receptacle branch circuits will be provided with equipment ground conductors. All branch circuit wiring will be copper and will be installed in concealed raceway systems. Ground fault interrupting type receptacles will be provided in all Code required locations, and in all designated "wet" locations throughout the facility.

FIRST FLOOR

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

SECOND FLOOR

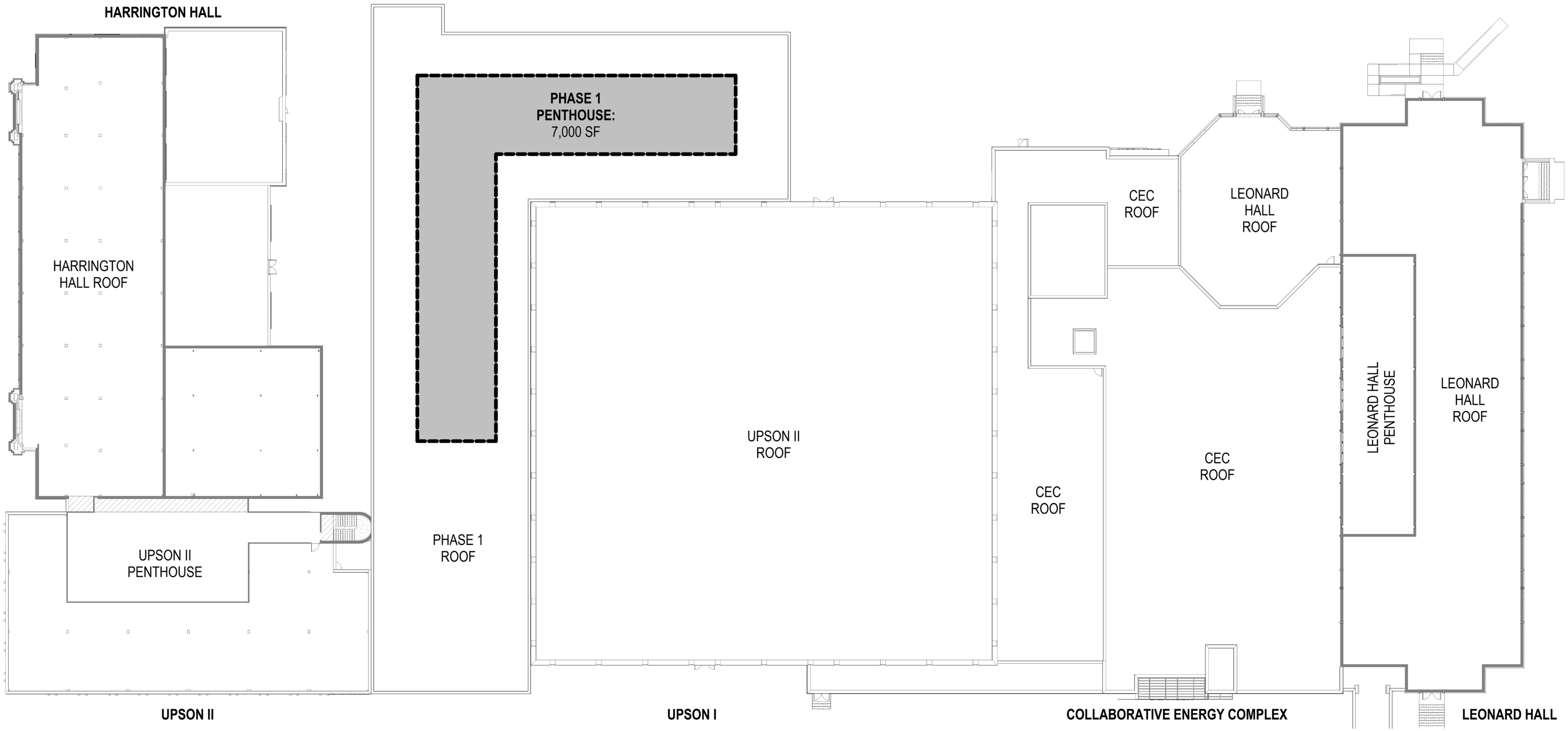
DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

THIRD FLOOR

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION



ROOF PLAN

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

PHASE 2

DEMOLITION AND INFILL

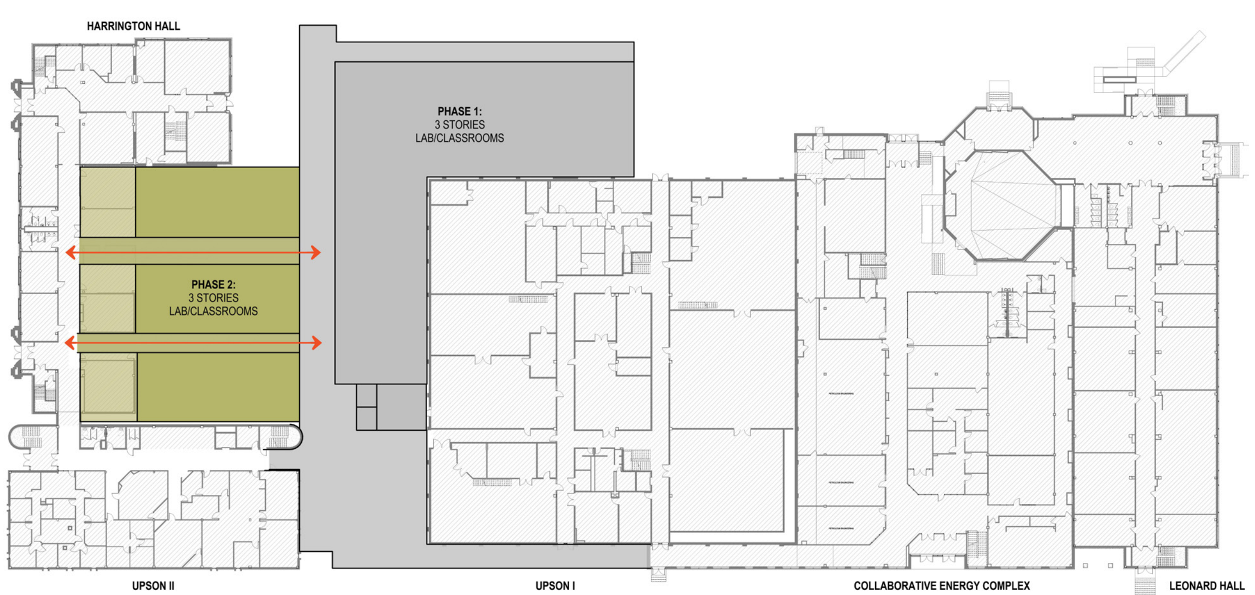
PHASE SUMMARY

Phase 2 of the master plan will demolish a significant portion of the east side of Harrington Hall and replace it with a new three-story addition aligning with the construction completed in Phase 1. The portion of the program accommodated in Phase 2 will include new teaching laboratories for Electrical Engineering, the Civil Engineering's MICA and Bridge Labs, Chemistry teaching labs for Chemical Engineering and several flexible, open research spaces to be shared among several departments.

The tables below the phase statistics and use distribution in NSF. The floor plan illustrates the location in the campus and the chart to the right indicates all programmatic spaces included in phase 2.

STATS	
PHASE NUMBER	2
NUMBER OF LEVELS	3
NET SQUARE FEET	25,205
GROSS SQUARE FEET	44,219
COST	$21,049,123
TYPE	DEMO + NEW

USE BREAKOUT (NSF)		
TEACHING LABORATORY	7,297	29%
RESEARCH LABORATORY	16,698	66%
LABORATORY SUPPORT	1,210	5%
LECTURE + CLASSROOM	0	0%
OFFICE + ADMINISTRATION	0	0%
OTHER	0	0%



SPACE IN PHASE 2

	QTY	NSF
PETROLEUM ENGINEERING		3,630
Industry Partner Computational Laboratory	1	1,452
New PE Research Laboratory	1	2,178
CIVIL ENGINEERING		9,112
Computational Laboratory	1	400
Environmental Engineering Lab 1	1	726
Environmental Engineering Lab 2	1	726
Industrial Research Laboratory	1	2,904
Bridge Lab	1	1,452
MICA Laboratory	1	2,904
CHEMICAL ENGINEERING		4,840
Wet Chemistry Teaching Laboratory	2	1,452
Chem E Research	1	2,178
Teaching Lab Prep	1	242
Glassware Prep / Chemical Storage	1	363
Chemical Storage	1	363
Chemical Storage	1	242
ELECTRICAL ENGINEERING & COMPUTER		4,719
SCIENCE	1	1,815
EE&CS Teaching Laboratory	1	1,089
EE&CS Circuits & Power Teaching Lab	1	363
EE&CS Research Laboratory	1	363
EE&CS Research Laboratory	1	1,089
Computational Research Laboratory		2,904
MECHANICAL ENGINEERING	1	1,089
ME Instructional Measurement Lab	1	1,815
ME Student Projects Laboratory		
TOTALS		25,205

MECHANICAL NARRATIVE

SITE EQUIPMENT AND UTILITIES

The Phase 1 building addition will provide utility connections for Phase 2. Where the partial demolition of Harrington Hall affects utilities, provisions will be made to keep the remaining portions of the building in service during Phase 2 construction.

AIR HANDLING SYSTEMS

The building addition will be served by two different types of air handling units (AHUs). In general, laboratory spaces will be served by 100% outside air (OA) AHUs, while non-laboratory spaces will be served by recirculating AHUs. Each AHU will operate in a variable air volume (VAV) mode to minimize energy use. To the extent possible, all AHUs will be located in the new penthouse. Additionally, the new AHUs will be sized for future extension to Harrington Hall in Phase 4.

The components of each 100% AHU will be as follows (listed in direction of airflow):

COMPONENT	COMMENTS
Outside air dampers	*Low-leak dampers, airflow measurement*
Prefilter bank	*MERV 8, 2" plated filters*
Final filter bank	*MERV 14, 12" cartridge*
Heat recovery coil bank	*Runaround water coil, glycol for freeze protection*
Preheat coil bank	*Heating water coil*
Supply fan(s)	*Fan array with VFD*
Humidifier grid	*Steam dispersion grid*
Cooling coil bank	*Chilled water coil*
Sound attenuator	*36" sound attenuating section*
Discharge dampers	*Low-leak dampers*

The components of each recirculating AHU will be as follows (listed in direction of airflow):

COMPONENT	COMMENTS
Return fan(s)	*Fan array with VFD*
Return/relief mixing box	*Low-leak dampers*
Return/outside air mixing box	*Low-leak dampers, 100% economizer capabilities, airflow measurement on outside air*
Prefilter bank	*MERV 8, 2" plated filters*
Final filter bank	*MERV 14, 12" cartridge*
Preheat coil bank	*Heating water coil*
Supply fan(s)	*Fan array with VFD*
Cooling coil bank	*Chilled water coil*
Sound attenuator	*36" sound attenuating section*
Discharge dampers	*Low-leak dampers*

Outside air will be introduced to each of the AHUs via louvers in the mechanical room side wall. Relief air will be discharged through louvers or roof hoods.

All AHUs will have double-wall construction, access doors at each coil and filter section, and internal lights for ease of maintenance. Vibration isolation (internal and/or external) will be provided to minimize noise and vibration transmission to the occupied spaces below.

EXHAUST SYSTEMS

High-plume mixed-flow exhaust fan systems will be installed to provide exhaust for the required facility spaces. Each fan system will be sized to exhaust both fume/lab exhaust as well as general building exhaust (such as restrooms, custodial closets, etc.). The new fan systems will be sized for N+1 redundancy. Each fan will be variable speed and include sound attenuation, and each fan system will include a mixing box / bypass plenum. The new exhaust fan systems will be sized for future extension to Harrington Hall in Phase 4.

All exhaust discharge from the building will be located as far as feasible from fresh air intakes and from other buildings to help prevent air recirculation into occupied spaces.

HEAT RECOVERY SYSTEM

A heat recovery unit will be installed to transfer energy between the 100% OA AHUs and the exhaust fan systems. The heat recovery unit(s) will be located in the penthouse and will consist of a MERV 8 filter bank followed by a runaround coil. All internal components will be either stainless steel or coated steel to minimize corrosion due to the fume exhaust airstream. A base-mounted pump will be provided for each runaround loop, located in the penthouse, and will circulate a mixture of glycol and water between the exhaust runaround coils and the AHU runaround coils. A three-way valve will be provided for temperature control and frost control purposes.

AIR DISTRIBUTION SYSTEMS

A variable air volume (VAV) air distribution system will be utilized for all areas. With this system type, each non-laboratory temperature control zone will be served by a supply VAV box with an integral hot water reheat coil, while each laboratory temperature control zone will be served by a high-speed venturi air valve and hot water reheat coil. The VAV box/air valve will modulate its damper position to maintain the required airflow as system pressure fluctuates. A heating water 2-way control valve will modulate water flow to the reheat coil to maintain desired zone temperature conditions. Supply air ductwork will generally be galvanized steel construction.

The exhaust system will operate in a VAV mode similar to the supply air system. Each temperature control zone will be served by an exhaust VAV box or air valve. In non-laboratory zones, the airflow of the exhaust VAV box will "track" the airflow of the corresponding zone supply VAV box to guarantee proper space pressurization is maintained. In laboratory zones, a fume hood air valve will be used to provide proper fume hood face velocity and a general exhaust air valve will modulate to provide proper room pressurization and minimum ventilation rates. All exhaust air will be routed using common ductwork to the high-plume exhaust fans. Exhaust air ductwork will generally be galvanized steel construction; however, all ductwork downstream of fume hoods, canopy hoods, snorkel hoods, or other specialized equipment will be stainless steel construction.

The return air system for the recirculating AHUs will generally consist of transfer ducts and return air plenum. Return air airflow-measuring dampers will be used near the return air duct main to control the air volume for each floor.

Room occupancy sensors will be used to reduce the airflow to the spaces during unoccupied hours. In laboratory areas, the airflow will be reduced, but will still be sufficient to maintain minimum code-required ventilation rates.

STANDALONE HEATING/COOLING SYSTEMS

In order to minimize the size of the AHUs, standalone units will be provided to supply dedicated heating and cooling to specialized spaces. Electrical rooms, mechanical rooms, telecom closets, and other similar cooling-only zones will be served by chilled water fan coil units (FCUs) or refrigerant-based split systems. Dock areas will be served by heating water unit heaters (UHs). Stairs and vestibules will be served by 2-pipe or 4-pipe FCUs.

CHILLED WATER SYSTEM

New rooftop air-cooled chillers will be provided to serve the building addition. Additionally, the use of small heat recovery chillers will be investigated during the design phase to provide simultaneous heating and cooling during low-load conditions. The new chilled water systems will be sized for future extension to Harrington Hall in Phase 4.

New chilled water pumps will be provided to circulate chilled water to all required coils. The pumps will be controlled via VFDs and will modulate pump speed to allow chilled water flow reduction during low load conditions.

All new coil loads will be provided with pressure-independent 2-way control valves.

STEAM AND CONDENSATE SYSTEM

New low-pressure steam and condensate piping will be extended from the Phase 1 building addition to the Phase 2 building.

New steam-to-hot water heat exchangers will be provided to generate heating water. Steam will be extended to the 100% OA AHUs for humidification. A new condensate pump serving the building will be provided to return condensate to the campus system.

HEATING WATER SYSTEM

The new steam-to-hot water heat exchangers will generate heating water. New heating water pumps will be provided to circulate heating water to all required AHU, terminal unit, and perimeter heating loads. Pumps will be controlled via VFD to modulate pump speed for energy savings.

Panel radiators will be provided to serve perimeter zones with large expanses of glazing. All new loads will be provided with pressure-independent 2-way control valves.

BUILDING AUTOMATION SYSTEM (BAS)

The building addition will utilize direct digital controls (DDC). The BAS will have the capability to adjust setpoints and system operation to match changing facility functions. All controls items will be integrated into the existing University controls infrastructure.

WATER SYSTEMS

Domestic water will be extended from the Phase 1 building to the Phase 2 building. Backflow preventers will be used to create a laboratory cold water system for use in the lab spaces. The additional backflow preventers are planned to be installed in the mechanical penthouse along with the water softener and water heaters described below.

Two new semi-instantaneous steam-fed water heaters will be installed in the mechanical penthouse (one domestic, one laboratory) to support their respective fixtures. Recirculating pumps and piping will be installed on each hot water system to ensure continuous hot water supply at each point of use.

A water softener will be provided to reduce the hardness of all water feeding the water heaters, pure water equipment, and certain laboratory equipment. Additionally, soft water will be piped as necessary to any required laboratory areas.

Temperature mixing valves will be provided to serve any emergency fixtures (eye washes or emergency showers) in compliance with ANSI standards.

PURE WATER SYSTEMS

If required for laboratory uses, high purity water will be generated by a single water purification skid. The equipment will include carbon filters, reverse osmosis (RO) equipment, deionization (DI) tanks, ultraviolet (UV) sterilizer, 0.2-micron filters, storage and recirculating pump(s) that will continuously circulate the pure water through a polypropylene pipe loop to use points and laboratory equipment throughout the addition. The water quality produced by this system will be equivalent to Type 2 (1 mega-ohm) grade meeting ASTM/ISO 3696 specifications. Point of use polishers will be used for Type 1 lab water needs.

DRAIN, WASTE, AND VENT

Sanitary waste and vent piping will be extended to all required fixtures throughout the facility. Laboratory waste piping will be limited to piping from a laboratory sink/drain to the nearest main riser and will be comprised of fuse-seal polypropylene pipe and fittings. A dedicated acid neutralization system is not anticipated as chemicals will be collected and disposed of in lieu of dumping them down the sinks.

STORM WATER SYSTEMS

Primary and overflow storm drainage piping will be extended to all roof drain areas. The primary system will be routed to the underground storm sewer system. The overflow system will be routed to downspout nozzles located on the exterior walls 18" above grade.

NATURAL GAS SYSTEM

Natural gas will be routed to the new laboratory areas from the Phase 1 building. When serving laboratory areas, an emergency shutoff valve will be provided to stop the flow of natural gas in the event of an emergency. Delivery pressure for laboratory use points will be between 7-11" w.c. unless an elevated pressure is required.

SPECIALTY GASES

LABORATORY COMPRESSED AIR: A new air compressor will be installed in the penthouse to serve new laboratory equipment. The compressor will be a dual oil free scroll tank mount type and installed on top of a 4" high concrete equipment pad with vibration isolators. The system will include a refrigerated air dryer (37.4 deg F dewpoint) and inline filters to provide clean, dry air suitable for laboratory grade use. Piping and fittings will be high purity copper suitable for laboratory use. A master pressure reducing valve will be installed in the penthouse to regulate the system delivery pressure to 125 psig.

CYLINDER GASES: The need and quantity of cylinder gases will be determined during subsequent design phases. Where centralized and stored within a dedicated cylinder closet, gas manifolds with auto-changeover capabilities will be installed and high purity copper suitable for laboratory use will be routed to all use points and equipment.

LABORATORY VACUUM: A new centralized laboratory vacuum pump system will be installed in the penthouse. The pump will be a multi-plex unit with receiver installed on top of a 4" high concrete equipment pad with vibration isolators. The system will be size to maintain a vacuum of 19 inches of mercury at the farthest terminal at peak demand based on 0.5 scfm demand at each terminal. Piping/fittings will be high purity copper suitable for laboratory use.

FIRE PROTECTION

The Phase 1 fire suppression system will be extended to the Phase 2 building to provide full coverage to all required areas. Hazard classifications will be based on applicable NFPA 13 requirements for each space type.

New fire protection standpipes and hose connections will be installed in all egress stairs.

All work will comply with NFPA 13, NFPA 14, NFPA 24, and other local requirements.

Code-required fire dampers, smoke dampers, and fire/smoke dampers will be installed throughout the building as necessary.

ELECTRICAL NARRATIVE

ELECTRICAL DISTRIBUTION SYSTEM

The Phase 1 addition's new 480Y/277V, 3-phase, 4-wire normal electrical service and standby/generator system will be extended to serve the Phase 2 project. Lighting throughout Phase 2 will be served at 277 volts, single phase. Laboratory, office, and computer equipment, as well as general-purpose receptacle circuits will be served at 120 volts, single phase. All other equipment and devices will be served by the appropriate distribution system voltage

Additional electrical distribution system details include the following:

- Distribution system switchboards and panelboards will make use of circuit breakers for overcurrent protection of feeders and branch circuits.
- Copper bussing will be provided for all electrical distribution system equipment.
- Digital customer metering equipment will be provided as determined by consultation with University facilities personnel. Digital metering devices will be connected to the building energy management control system to allow for remote monitoring.
- Separate panelboards will be used to support facility lighting and general-purpose electrical requirements.
- Surge Protection Devices (SPD) will be provided for all new Life Safety distribution equipment

LIGHTING SYSTEMS

Lighting systems throughout the Phase 2 will be designed in accordance with University design guidelines, IES recommendations and applicable energy codes. Lighting power densities will be minimized by using highly efficient fixtures throughout the areas of renovation. Occupancy/vacancy sensors will be used throughout most spaces to provide automatic off of lighting loads during unoccupied times. In addition, where daylighting opportunities and requirements exist, the use of daylighting controlled lighting systems will be utilized. In general, lighting systems will be as follows:

- For laboratories/classrooms it is critical to provide appropriate illumination levels on bench tops, to minimize the impact of shadows created by equipment, casework and personnel.. In addition, it is imperative that labs be provided with lighting fixtures that can withstand environmental conditions in each space. In areas with ceilings, high efficient, recessed linear, LED fixtures will be installed over the edge of the bench tops. This type of lighting provides adequate levels of illumination on bench tops, helps to minimize issues associated with glare and shadowing, while still providing illumination of vertical surfaces.

- All fixtures in laboratories with no ceiling will be linear pendant, high efficient LED fixtures. A portion of the light distribution of these fixtures will be indirect in order to increase the quality of light by providing even, diffuse light levels.

- All fixtures in laboratory areas will be equipped with dimming to provide a variety of light levels. Normal power fixtures in laboratories will be enabled by occupancy/vacancy sensors, and controlled locally within each space. A portion of the lighting in all laboratories will be connected to the emergency generator system.

- In chemical storage areas or laboratories that make use of a significant amount of chemicals, the most prudent approach to lighting is 1'x 4' recessed lensed LED troffers. This type of illumination reduces shadowing and provides adequate illumination levels. Normal fixtures in these spaces will be enabled by occupancy/vacancy sensors, and controlled locally within each space. A portion of the lighting in all areas with high chemical usage will be connected to the emergency generator system.

- Lighting in corridors will be provided by recessed, high efficient, LED fixtures. A portion of these fixtures will be connected to the emergency generator system to provide Code required emergency egress lighting and night lighting. All normal lighting fixtures will be connected to a lighting control system so they are turned off when the building is normally unoccupied.

RECEPTACLE LAYOUTS

Receptacle layouts and circuiting to support computer equipment, classroom equipment, laboratory equipment, telecommunications equipment and general purpose needs will be provided in accordance with direction provided by building users and campus personnel.

Two channel surface metal raceway systems will be provided above benches in laboratories to support the distribution of power, telecommunications and instrumentation cabling to computer and laboratory equipment. Duplex receptacles will be installed in surface metal raceway systems at intervals dictated by building users. Receptacles in raceway systems will be connected to 20-amp branch circuits unless further direction has been provided by a specific user.

In equipment alcoves and shared equipment or instrumentation spaces wall mounted busway will be utilized. The busway will provide quick plug-and-play power re-configuration to accommodate equipment changes. Busway will be rated at 208Y/120V, 3 phase, 4-wire with amperage ratings that vary depending on length. Standard busway receptacle/circuit breaker combination units will be coordinated with existing equipment and Campus personnel.

All electrical devices in laboratories will be labeled with the panel source and circuit number. Dedicated receptacles and circuits will be provided as required to support specific equipment locations throughout the facility. All receptacle branch circuits will be provided with equipment ground conductors. All branch circuit wiring will be copper and will be installed in concealed raceway systems. Ground fault interrupting type receptacles will be provided in all Code required locations, and in all designated “wet” locations throughout the facility.

FIRST FLOOR

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

SECOND FLOOR

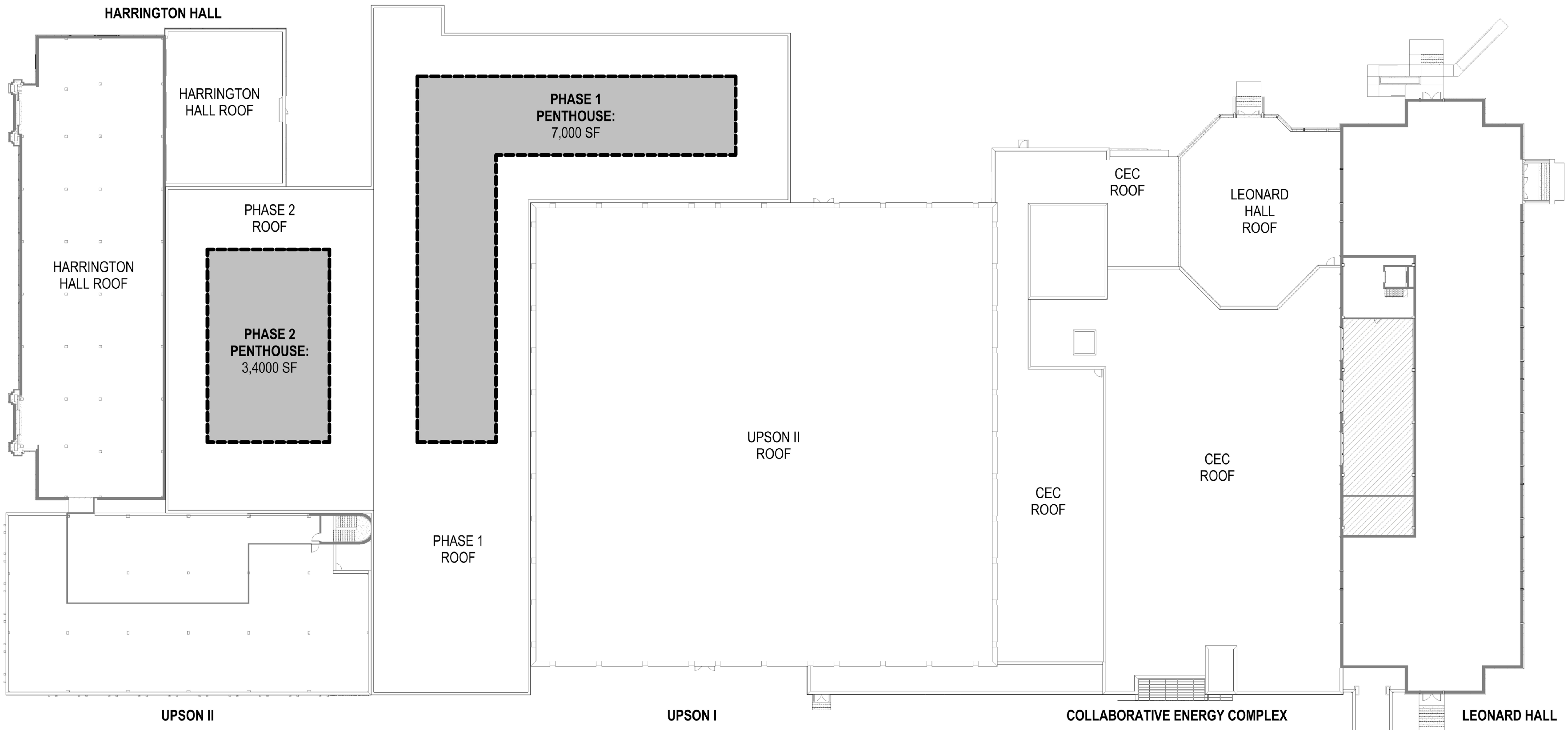
DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

THIRD FLOOR

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION



ROOF PLAN

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

PHASE 3

RENOVATE UPSON II

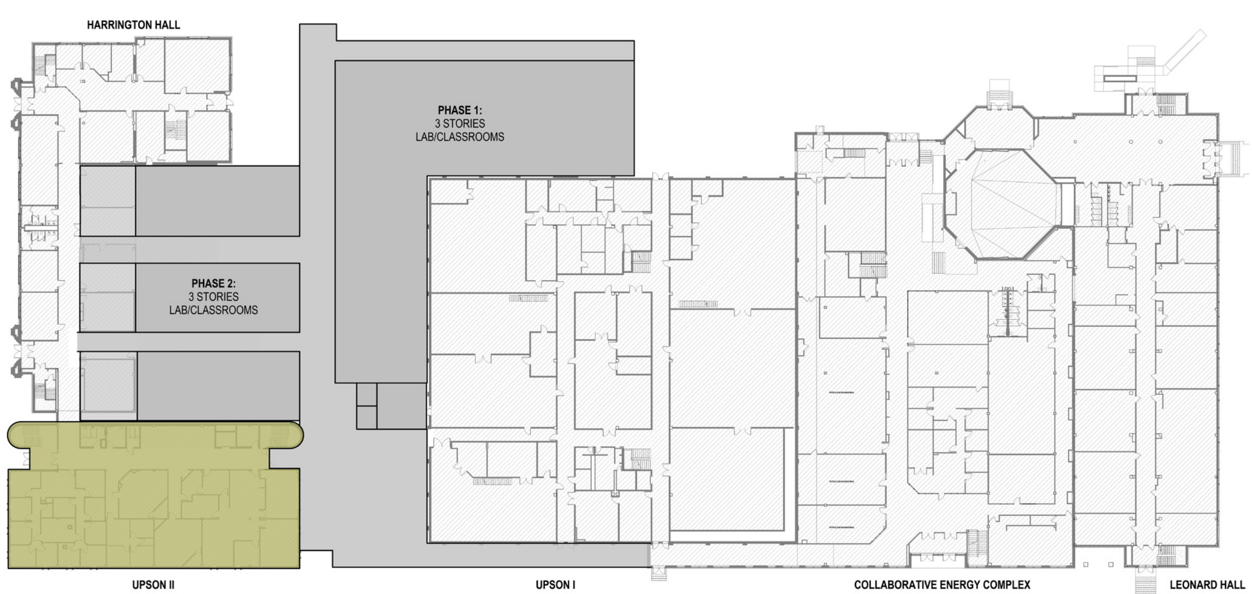
PHASE SUMMARY

Phase 3 will renovate Upson II to consolidate the bulk of the faculty and departmental offices for Electrical Engineering and Computer Science, Mechanical Engineering, Chemical Engineering and Civil Engineering as well as the Dean's Office and most administrative functions of the college. It is assumed that office space can be accommodated elsewhere on campus during this phase of construction as all lab and instruction functions would have already been vacated as part of Phases 1 and 2. This phase ideally would also include a major exterior renovation of Upson II to bring it more in context with the adjacent building in this region of the campus.

The tables below the phase statistics and use distribution in NSF. The floor plan illustrates the location in the campus and the chart to the right indicates all programmatic spaces included in phase 3.

STATS	
PHASE NUMBER	3
NUMBER OF LEVELS	4
NET SQUARE FEET	23,877
GROSS SQUARE FEET	41,889
COST	$8,355,132
TYPE	RENOVATION

USE BREAKOUT (NSF)		
TEACHING LABORATORY	0	0%
RESEARCH LABORATORY	0	0%
LABORATORY SUPPORT	0	0%
LECTURE + CLASSROOM	0	0%
OFFICE + ADMINISTRATION	23,877	100%
OTHER	0	0%



SPACE IN PHASE 3

	QTY	NSF
CIVIL ENGINEERING		3,312
Department Chair Civil E	1	170
Faculty Office	12	1440
CE Reception Area	1	203
Conference Room	1	183
Mail Room	1	36
Grad Students / PhD Offices	16	1280
CHEMICAL ENGINEERING		6,766
Department Chair Chem E	1	170
Faculty Office	11	1320
Department Office	1	499
Conference Room	1	144
Mail Room	1	101
Grad Students / PhD Offices	48	3840
Break Room	1	161
Student Lounge	1	531

	QTY	NSF
ELECTRICAL ENGINEERING/COMPUTER SCIENCE		8,035
Department Chair Office	1	170
Faculty Office	30	3600
EE&CS Reception Area	1	270
Conference Space	1	183
Copy Room	1	120
GTA Office	1	319
Grad Students / PhD Offices	40	3200
Storage	1	173
MECHANICAL ENGINEERING		5,764
ME Department Chair	1	170
Faculty Offices	20	2400
Lab Manager's Office	1	120
ME Department Office	1	258
ME Conference Room	1	256
Grad Students / PhD Offices	32	2560
TOTALS		23,877

MECHANICAL NARRATIVE

SITE EQUIPMENT AND UTILITIES

The existing steam, steam condensate, water, sanitary sewer, storm sewer, and natural gas piping services will be re-used during the renovation. All primary equipment will be replaced during the renovation.

AIR HANDLING SYSTEMS

The existing AHUs in Upson II will be replaced with new recirculating AHUs. Each AHU will operate in a variable air volume (VAV) mode to minimize energy use. To the extent possible, all AHUs will be located in the existing penthouse.

The components of each recirculating AHU will be as follows (listed in direction of airflow):

COMPONENT	COMMENTS
Return fan(s)	*Fan array with VFD*
Return/relief mixing box	*Low-leak dampers*
Return/outside air mixing box	*Low-leak dampers, 100% economizer capabilities, airflow measurement on outside air*
Prefilter bank	*MERV 8, 2" plated filters*
Final filter bank	*MERV 14, 12" cartridge*
Preheat coil bank	*Heating water coil*
Supply fan(s)	*Fan array with VFD*
Cooling coil bank	*Chilled water coil*
Sound attenuator	*36" sound attenuating section*
Discharge dampers	*Low-leak dampers*

Outside air will be introduced to each of the AHUs via louvers in the mechanical room side wall. Relief air will be discharged through louvers or roof hoods.

All AHUs will have double-wall construction, access doors at each coil and filter section, and internal lights for ease of maintenance. Vibration isolation (internal and/or external) will be provided to minimize noise and vibration transmission to the occupied spaces below.

EXHAUST SYSTEMS

Roof-mounted centrifugal exhaust fan systems will be installed to provide exhaust for the required facility spaces. Each fan will be variable speed via VFD.

All exhaust discharge from the building will be located as far as feasible from fresh air intakes and from other buildings to help prevent air recirculation into occupied spaces.

AIR DISTRIBUTION SYSTEMS

A variable air volume (VAV) air distribution system will be utilized for all areas. With this system type, each non-laboratory temperature control zone will be served by a supply VAV box with an integral hot water reheat coil. The VAV box will modulate its damper position to maintain the required airflow as system pressure fluctuates. A heating water 2-way control valve will modulate water flow to the reheat coil to maintain desired zone temperature conditions. Supply air ductwork will generally be galvanized steel construction.

The exhaust system will operate in a VAV mode similar to the supply air system. Each temperature control zone will be served by an exhaust VAV box. The airflow of the exhaust VAV box will "track" the airflow of the corresponding zone supply VAV box to guarantee proper space pressurization is maintained. Exhaust air ductwork will generally be galvanized steel construction.

The return air system for the recirculating AHUs will generally consist of transfer ducts and return air plenum. Return air airflow-measuring dampers will be used near the return air duct main to control the air volume for each floor.

Room occupancy sensors will be used to reduce the airflow to the spaces during unoccupied hours.

STANDALONE HEATING/COOLING SYSTEMS

In order to minimize the size of the AHUs, standalone units will be provided to supply dedicated heating and cooling to specialized spaces. Electrical rooms, mechanical rooms, telecom closets, and other similar cooling-only zones will be served by chilled water fan coil units (FCUs) or refrigerant-based split systems. Dock areas will be served by heating water unit heaters (UHs). Stairs and vestibules will be served by 2-pipe or 4-pipe FCUs.

CHILLED WATER SYSTEM

The existing rooftop air-cooled chillers, pumps, and accessories will be re-used to serve the renovated building. Piping will be modified as necessary to accommodate new AHUs and other coils.

All new coil loads will be provided with pressure-independent 2-way control valves.

STEAM AND CONDENSATE SYSTEM

The existing low-pressure steam and condensate piping will be re-used. Building equipment will be upgraded, however.

New steam-to-hot water heat exchangers will be provided to generate heating water. A new condensate pump serving the building will be provided to return condensate to the campus system.

HEATING WATER SYSTEM

The new steam-to-hot water heat exchangers will generate heating water. New heating water pumps will be provided to circulate heating water to all required AHU, terminal unit, and perimeter heating loads. Pumps will be controlled via VFD to modulate pump speed for energy savings.

Panel radiators will be provided to serve perimeter zones with large expanses of glazing. All new loads will be provided with pressure-independent 2-way control valves.

BUILDING AUTOMATION SYSTEM (BAS)

The building addition will utilize direct digital controls (DDC). The BAS will have the capability to adjust setpoints and system operation to match changing facility functions. All controls items will be integrated into the existing University controls infrastructure.

WATER SYSTEMS

The existing water service to the building will be re-used. Backflow preventers and other primary equipment will be replaced. Additionally, existing piping will be replaced to the extent possible during renovation.

A new semi-instantaneous steam-fed water heaters will be installed in the mechanical room to serve the domestic hot water system. Recirculating pumps and piping will be installed to ensure continuous hot water supply at each point of use.

A new water softener will be provided to reduce the hardness of all water feeding the water heaters and other required equipment.

Temperature mixing valves will be provided to serve any emergency fixtures (eye washes or emergency showers) in compliance with ANSI standards.

DRAIN, WASTE, AND VENT

The existing sanitary waste piping to the building will be re-used. Existing waste and vent piping will be replaced to the extent possible during renovation.

STORM WATER SYSTEMS

The existing storm water piping to the building will be re-used. Existing primary and overflow storm piping will be replaced to the extent possible during renovation.

NATURAL GAS SYSTEM

The existing natural gas piping to the building will be re-used. Piping will be replaced to the extent possible during renovation.

FIRE PROTECTION

A new fire service will be installed to provide full coverage to all areas. Hazard classifications will be based on applicable NFPA 13 requirements for each space type.

New fire protection standpipes and hose connections will be installed in all egress stairs.

All work will comply with NFPA 13, NFPA 14, NFPA 24, and other local requirements.

Code-required fire dampers, smoke dampers, and fire/smoke dampers will be installed throughout the building as necessary.

ELECTRICAL NARRATIVE

ELECTRICAL DISTRIBUTION SYSTEM

When possible, existing panelboard will be replaced, however, it is anticipated that new distribution panels and branch panels will be required to support the areas of renovation. Lighting throughout the building will be replaced, and served at 277 volts, single phase. Laboratory, office, and computer equipment, as well as general-purpose receptacle circuits will be served at 120 volts, single phase. All other equipment and devices will be served by the appropriate distribution system voltage

Additional electrical distribution system details include the following:

- Distribution system switchboards and panelboards will make use of circuit breakers for overcurrent protection of feeders and branch circuits.
- Copper bussing will be provided for all electrical distribution system equipment.
- Digital customer metering equipment will be provided as determined by consultation with University facilities personnel. Digital metering devices will be connected to the building energy management control system to allow for remote monitoring.
- Separate panelboards will be used to support facility lighting and general-purpose electrical requirements.
- Surge Protection Devices (SPD) will be provided for all new Life Safety distribution equipment

LIGHTING SYSTEMS

Lighting systems throughout the building will be replaced, and designed in accordance with University design guidelines, IES recommendations and applicable energy codes. Lighting power densities will be minimized by using highly efficient fixtures throughout the areas of renovation. Occupancy/vacancy sensors will be used throughout most spaces to provide automatic off of lighting loads during unoccupied times. In addition, where daylighting opportunities and requirements exist, the use of daylighting controlled lighting systems will be utilized. In general, lighting systems will be as follows:

- For classrooms it is critical to provide appropriate illumination levels on bench tops, to minimize the impact of shadows created by equipment, casework and personnel.. In addition, it is imperative that labs be provided with lighting fixtures that can withstand environmental conditions in each space. In areas with ceilings, high efficient, recessed linear, LED fixtures will be installed over the edge of the bench tops. This type of lighting provides adequate levels of illumination on bench tops, helps to minimize issues associated with glare and shadowing, while still providing illumination of vertical surfaces.

- All fixtures in office areas will be equipped with dimming to provide a variety of light levels. Normal power fixtures in laboratories will be enabled by occupancy/vacancy sensors, and controlled locally within each space.

- Lighting in corridors will be provided by recessed, high efficient, LED fixtures. A portion of these fixtures will be connected to the emergency generator system to provide Code required emergency egress lighting and night lighting. All normal lighting fixtures will be connected to a lighting control system so they are turned off when the building is normally unoccupied.

RECEPTACLE LAYOUTS

Receptacle layouts and circuiting to support computer equipment, classroom equipment, office equipment, telecommunications equipment and general purpose needs will be provided in accordance with direction provided by building users and campus personnel.

PHASE 4

RENOVATIONS

PHASE SUMMARY

Phase 4 will ultimately be broken up into smaller areas of work over several years to renovate targeted portions of the remainder of Harrington and Leonard Halls. It is anticipated that the work on Harrington Hall would include upgrades to mechanical and electrical systems as well as new lighting and a general refresh. It is not anticipated that major realignment of walls or spaces would be needed. The work in Leonard Hall will be more invasive and involve a multi-phase approach to renovating the individual floors to realign the main north/south corridors in the building. This realignment will provide the opportunity to enlarge research and instructional spaces on the west side of the corridor while creating right sized spaces for faculty offices and support spaces on the east. The Leonard Hall renovations will also include the addition of a high-density storage area in the basement to create a more compact system for storing the large volume of geological and paleontology specimens for the Geology and Geological Engineering department.

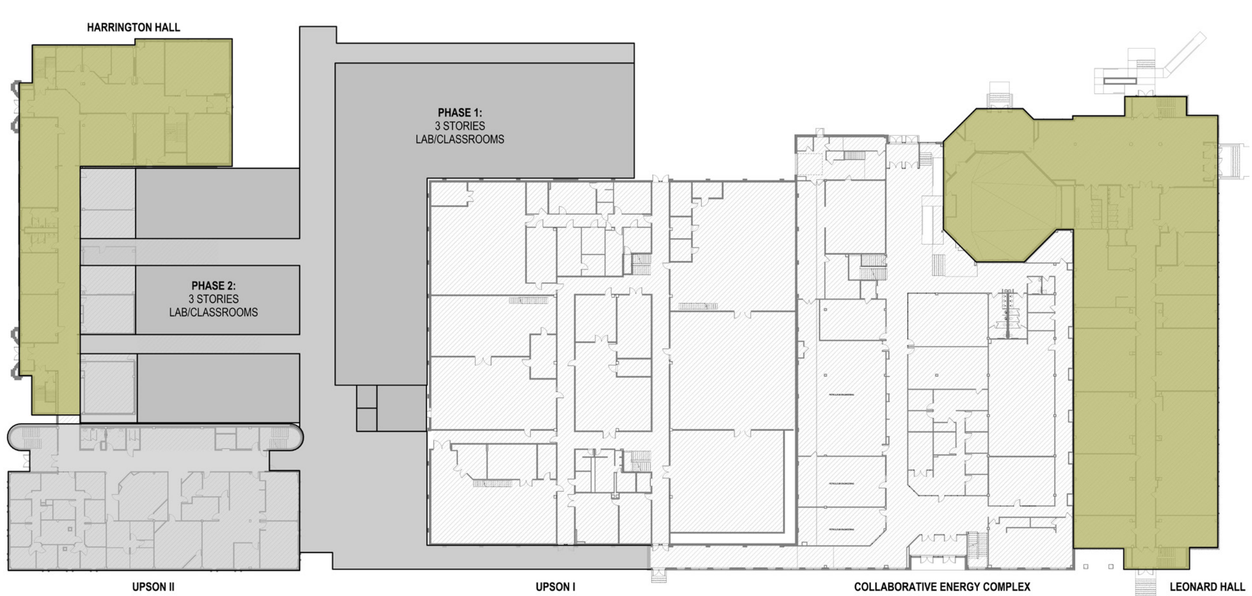
The tables below the phase statistics and use distribution in NSF. The floor plan illustrates the location in the campus and the chart to the right indicates all programmatic spaces included in phase 4.

STATS

PHASE NUMBER	4
NUMBER OF LEVELS	3
NET SQUARE FEET	112,573
GROSS SQUARE FEET	197,496
COST	$42,409,474
TYPE	RENOVATION

USE BREAKOUT (NSF)

TEACHING LABORATORY	20,173	18%
RESEARCH LABORATORY	26,809	24%
LABORATORY SUPPORT	13,671	12%
LECTURE + CLASSROOM	13,461	12%
OFFICE + ADMINISTRATION	23,609	21%
OTHER	14,850	13%



SPACE IN PHASE 4

	QTY	NSF
PETROLEUM ENGINEERING		7,410
Department Chair Office	1	170
Faculty Office	10	1200
Visiting Faculty Office	2	240
Staff / Administrative Offices	10	1,000
PhD Open Office	60	4,800
GEOLOGY AND GEOLOGICAL ENGINEERING		28,559
Instruct / Res. Lab - Environmental Eng.	1	304
Instruct / Res. Lab - Geomorphology	1	1,289
Instruct / Res. Lab - Geo Engineering	1	274
Instruct / Res. Lab - Hydrology	1	274
Geology Computer Laboratory	1	849
Mineralogy Teaching Laboratory	1	921
Instruct / Res. Lab - Microscopy	1	875
Sedimentology Instructional Laboratory	1	1,452
Computer Teaching Laboratory	1	281
Research Lab - Geo Eng.	1	608
Geochemistry Research Laboratory	1	809
Mineralogy Research Laboratory	1	595
Paleontolgy Research & Teaching Laboratory	1	1,123
Geo Research Laboratory	1	280
Geo EARL Laboratory (Chem)	1	459
Geo EARL Laboratory	1	243
Geo EARL Laboratory (office)	1	178
Research Laboratory	1	230
Geo Research Laboratory	1	248
Geology 101 Prep Lab	1	363
Field Equipment Storage	1	611
Storage / Shop	1	216
Rock Prep	1	258
Rock Prep Storage	1	37
Hydrology Equipment	1	142
Rock Saw Room	1	301
Geology Sample Recovery	1	300
Geology Field Gear & Collections	1	617
Prep Lab?	1	151
Prep Lab?	1	118
Dark Room	1	113
High Density Specimen Storage	1	1,320
Instructional Recording Studio	1	212
Department Chair Office	1	170

	QTY	NSF
Faculty Office	10	1,200
Visiting Faculty Office	1	120
Staff / Administrative Offices	1	564
Staff / Administrative Offices	1	286
Staff / Administrative Offices	1	143
Conference Room	1	446
Lab Director Office	1	120
Faculty Lounge	1	269
FD Holland Jr. Library - Dir. Office	1	174
Grad Students / PhD Offices	36	2,880
Emeritus Faculty	1	120
Student Study Area	1	554
Storage / Library	1	233
Geo Break Area	1	274
FD Holland Jr. Geo Library	1	1,793
FD Holland Jr. Library - Workroom	1	199
FD Holland Jr. Geo Library - Mezzanine - 1	1	1,297
FD Holland Jr. Geo Library - Mezzanine - 2	1	315
FD Holland Jr. Geo Library - Map Room - 1	1	848
FD Holland Jr. Geo Library - Map Room - 2	1	503
CIVIL ENGINEERING		10,116
Concrete and Asphalt Laboratory	1	3,130
Steel and Concrete Laboratory	1	3,342
Basement Storage	1	370
Basement Storage	1	370
Basement Pump Room	1	380
Equipment Storage	1	141
Surveying Equipment	1	155
Asphalt Binding Room	1	261
Water Sampling Equipment	1	41
Curing Room	1	103
Equipment Room	1	101
Storage Room	1	156
Storage Room	1	101
Mezzanine	1	689
Lab Storage	1	90
Lab Storage	1	104
Prep Lab	1	77
CE Commons / Student Groups	1	505
CHEMICAL ENGINEERING		2,241
Computational Laboratory	1	800

Pilot Scale Systems Research	1	383
Hoffman Energetics Laboratory	1	107
Electrolysis Laboratory	1	120
Storage	1	42
Storage	1	236
Storage	1	238
Unused	1	140
Unused	1	175
ELECTRICAL ENGINEERING & COMPUTER SCIENCE		4,312
EE&CS Embedded Systems Teaching Lab	1	572
EE&CS Research Laboratory	1	461
Power and Energy Research Laboratory	1	734
EE&CS Research Laboratory	1	333
EE&CS Research Laboratory	1	391
EE&CS Research Laboratory	1	726
EE&CS Research Laboratory	1	153
EE&CS Research Laboratory	1	177
EE & CS Computer Laboratory	1	442
Senior Design Lab	1	323
INSTITUTE FOR ENGINEERING STUDIES		3,489
IES High Bay Equip. Test Laboratory (Mezz)	1	1,089
IES Instructor's Office	1	120
IES Grant Writer's Office	1	120
IES Staff Office	18	2,160
MECHANICAL ENGINEERING		21,065
ME Computational Laboratory	1	510
ME Instructional Machine Shop exg	1	1,568
ME Recording Room	1	102
ME Research Laboratory (hi-temp/manuf)	1	1,310
ME Faculty Research Laboratory	1	2,015
ME Freshman Projects	1	726
Laser Laboratory	1	660
ME Undergraduate Robotics Lab	1	366
ME Faculty Research Laboratory	1	260
ME Formula Car Cage	1	1,110
ME Student Projects Research Laboratory	1	1,741
ME Faculty Research Laboratory	1	360
ME Machine Shop exg	1	1,911
Machine Vision Laboratory	1	357
Machine Vision Laboratory	1	105
Mechanical Testing Laboratory	1	667
ME Faculty Research Laboratory	1	368
Senior Design Lab	1	323
ME Faculty Research Laboratory	1	220
ME Faculty Research Laboratory	1	381
Chemical Storage	1	108
Electrical Equipment	1	135
Machining Shop	1	135
Storage	1	370
Storage	1	370
ME 3D Printing	1	207
ME High Bay Support	1	246
Welding Shop	1	1,980
Welding Supply	1	126
ME Foundry	1	332
Storage	1	139
Storage	1	181
ME Foundry Support	1	71
Storage	1	187
Secure Storage	1	150
ME Wood Shop	1	479
ME Vibration Equipment Cage	1	395
ME 3D Printing	1	394
COLLEGE OF ENGINEERING		21,994
Mezzanine Teaching Laboratory?	1	1,153
Core Imaging Laboratory	1	1,029
Undergraduate Computer Laboratory	1	760
Mezzanine Research Laboratory	1	726
CEM Computer Laboratory	1	839
CEM Computer Lab Support	1	104
Imaging Prep Laboratory	1	197
Executive Training Room	1	617
Multi-Purpose Classroom	1	732
Multi-Purpose Classroom	1	737
General Classroom (COE)	1	303
COE Admin. - Reception	1	722
COE Admin. - Deans Office	1	401
COE Admin. - Assistants Office	1	110
COE Admin - Business Officer Office	1	143
COE- Admin Office	1	177
COE Dean's Conference Room	1	358
COE Admin - Support Specialist Office	1	558
COE Admin Office	1	102
COE Admin Office	1	102
COE Admin - Online Program Coor. Office	1	111
COE Admin - Online Program Support Office	1	103
COE Admin Office	1	103
COE Admin - Copy Room	1	251
COE Admin Office	1	113
COE Admin Office	1	114
COE Admin Grant Manager's Office	1	164
COE Admin. Grant Manager's Office	1	107
COE Admin. - Undergrad Program Coor. Office	1	119
COE Admin. - Grad Program Coor. Office	1	109
COE Admin. - Linux Administrators Office	1	152
COE Admin. -IT Coor. Office	1	98
Office - IT?	1	107
Office - IT?	1	109
COE Storage	1	109
COE Copy Room	1	143
Conference Room	1	405
AE2S Board Room	1	810
AE2S BR Storage	1	54
AE2S BR Coats	1	51
Reception Area (ME; EE&CS)	1	203
Jodsaas Center Lobby	1	878
Jodsaas Center Admin Office	1	136
Jodsaas Center Admin Office	1	167
Jodsaas Center Admin Office	1	181
Jodsaas Center Admin Office	1	250
Jodsaas Center Conference Room	1	754
Student Organization Office / Storage	1	242
Solberg Student Success Center	1	209
Kitchenette	1	62
Lounge - Kitchenette	1	230
Faculty Lounge	1	390
Student Lounge	1	264
1st Floor Lobby / Museum (Leonard Hall)	1	2,577
Storage	1	42
Vending	1	134
Storage	1	236
Closet	1	35
Instructional Services Office?	1	191
COE Hall of Fame	1	393
Open Lounge	1	350
Student Study Space	1	695
Unknown	1	173
REGISTRAR		13,387
Shared Teching Laboratory / Classroom	1	847
Shared Teching Laboratory / Classroom	1	561
Shared Teching Laboratory / Classroom	1	1,069
Lecture Hall	1	2,500
Classroom	1	608
Classroom	1	1,681
Classroom	1	646
Classroom	1	918
Classroom (Interactive)	1	925
Classroom	1	949
Classroom (Interactive)	1	1,026
Classroom	1	462
Classroom	1	1,145
Projection Booth	1	50
TOTALS		**112,573**

MECHANICAL NARRATIVE

SITE EQUIPMENT AND UTILITIES

The existing steam, steam condensate, water, sanitary sewer, storm sewer, and natural gas piping services will be re-used during the renovation. All primary equipment will be replaced during the renovation.

AIR HANDLING SYSTEMS

The Harrington Hall renovation will be served by two different types of air handling units (AHUs) located in the Phase 2 penthouse. The existing AHU in Upson II will be removed. In general, laboratory spaces will be served by 100% outside air (OA) AHUs, while non-laboratory spaces will be served by recirculating AHUs. Each AHU will operate in a variable air volume (VAV) mode to minimize energy use.

The components of each 100% AHU will be as follows (listed in direction of airflow):

COMPONENT	COMMENTS
Outside air dampers	*Low-leak dampers, airflow measurement*
Prefilter bank	*MERV 8, 2" plated filters*
Final filter bank	*MERV 14, 12" cartridge*
Heat recovery coil bank	*Runaround water coil, glycol for freeze protection*
Preheat coil bank	*Heating water coil*
Supply fan(s)	*Fan array with VFD*
Humidifier grid	*Steam dispersion grid*
Cooling coil bank	*Chilled water coil*
Sound attenuator	*36" sound attenuating section*
Discharge dampers	*Low-leak dampers*

The components of each recirculating AHU will be as follows (listed in direction of airflow):

COMPONENT	COMMENTS
Return fan(s)	*Fan array with VFD*
Return/relief mixing box	*Low-leak dampers*
Return/outside air mixing box	*Low-leak dampers, 100% economizer capabilities, airflow measurement on outside air*
Prefilter bank	*MERV 8, 2" plated filters*
Final filter bank	*MERV 14, 12" cartridge*
Preheat coil bank	*Heating water coil*
Supply fan(s)	*Fan array with VFD*
Cooling coil bank	*Chilled water coil*
Sound attenuator	*36" sound attenuating section*
Discharge dampers	*Low-leak dampers*

Outside air will be introduced to each of the AHUs via louvers in the mechanical room side wall. Relief air will be discharged through louvers or roof hoods.

All AHUs will have double-wall construction, access doors at each coil and filter section, and internal lights for ease of maintenance. Vibration isolation (internal and/or external) will be provided to minimize noise and vibration transmission to the occupied spaces below.

EXHAUST SYSTEMS

The Harrington Hall renovation will be served by the high-plume mixed-flow exhaust fan systems installed on the Phase 2 roof.

All exhaust discharge from the building will be located as far as feasible from fresh air intakes and from other buildings to help prevent air recirculation into occupied spaces.

AIR DISTRIBUTION SYSTEMS

The existing duct systems will be replaced during the renovation. A variable air volume (VAV) air distribution system will be utilized for all areas. With this system type, each non-laboratory temperature control zone will be served by a supply VAV box with an integral hot water reheat coil, while each laboratory temperature control zone will be served by a high-speed venturi air valve and hot water reheat coil. The VAV box/air valve will modulate its damper position to maintain the required airflow as system pressure fluctuates. A heating water 2-way control valve will modulate water flow to the reheat coil to maintain desired zone temperature conditions. Supply air ductwork will generally be galvanized steel construction.

The exhaust system will operate in a VAV mode similar to the supply air system. Each temperature control zone will be served by an exhaust VAV box or air valve. In non-laboratory zones, the airflow of the exhaust VAV box will "track" the airflow of the corresponding zone supply VAV box to guarantee proper space pressurization is maintained. In laboratory zones, a fume hood air valve will be used to provide proper fume hood face velocity and a general exhaust air valve will modulate to provide proper room pressurization and minimum ventilation rates. All exhaust air will be routed using common ductwork to the high-plume exhaust fans. Exhaust air ductwork will generally be galvanized steel construction; however, all ductwork downstream of fume hoods, canopy hoods, snorkel hoods, or other specialized equipment will be stainless steel construction.

The return air system for the recirculating AHUs will generally consist of transfer ducts and return air plenum. Return air airflow-measuring dampers will be used near the return air duct main to control the air volume for each floor.

Room occupancy sensors will be used to reduce the airflow to the spaces during unoccupied hours. In laboratory areas, the airflow will be reduced, but will still be sufficient to maintain minimum code-required ventilation rates.

STANDALONE HEATING/COOLING SYSTEMS

In order to minimize the size of the AHUs, standalone units will be provided to supply dedicated heating and cooling to specialized spaces. Electrical rooms, mechanical rooms, telecom closets, and other similar cooling-only zones will be served by chilled water fan coil units (FCUs) or refrigerant-based split systems. Dock areas will be served by heating water unit heaters (UHs). Stairs and vestibules will be served by 2-pipe or 4-pipe FCUs.

CHILLED WATER SYSTEM

The Phase 2 chillers, pumps, and accessories will be re-used to serve the renovated building. Piping will be modified as necessary to accommodate new AHUs and other coils.

All new coil loads will be provided with pressure-independent 2-way control valves.

STEAM AND CONDENSATE SYSTEM

The existing low-pressure steam and condensate piping will be re-used. Building equipment will be upgraded, however.

New steam-to-hot water heat exchangers will be provided to generate heating water. A new condensate pump serving the building will be provided to return condensate to the campus system.

HEATING WATER SYSTEM

The new steam-to-hot water heat exchangers will generate heating water. New heating water pumps will be provided to circulate heating water to all required AHU, terminal unit, and perimeter heating loads. Pumps will be controlled via VFD to modulate pump speed for energy savings.

Panel radiators will be provided to serve perimeter zones with large expanses of glazing. All new loads will be provided with pressure-independent 2-way control valves.

BUILDING AUTOMATION SYSTEM (BAS)

The building addition will utilize direct digital controls (DDC). The BAS will have the capability to adjust setpoints and system operation to match changing facility functions. All controls items will be integrated into the existing University controls infrastructure.

WATER SYSTEMS

The existing water service to the building will be re-used. Backflow preventers and other primary equipment will

be replaced. Additional backflow preventers will be used to create a laboratory cold water system for use in the lab spaces. Additionally, existing piping will be replaced to the extent possible during renovation.

Two new semi-instantaneous steam-fed water heaters will be installed in the mechanical penthouse (one domestic, one laboratory) to support their respective fixtures. Recirculating pumps and piping will be installed on each hot water system to ensure continuous hot water supply at each point of use.

A water softener will be provided to reduce the hardness of all water feeding the water heaters, pure water equipment, and certain laboratory equipment. Additionally, soft water will be piped as necessary to any required laboratory areas.

Temperature mixing valves will be provided to serve any emergency fixtures (eye washes or emergency showers) in compliance with ANSI standards.

PURE WATER SYSTEMS

If required for laboratory uses, high purity water will be generated by a single water purification skid. The equipment will include carbon filters, reverse osmosis (RO) equipment, deionization (DI) tanks, ultraviolet (UV) sterilizer, 0.2-micron filters, storage and recirculating pump(s) that will continuously circulate the pure water through a polypropylene pipe loop to use points and laboratory equipment throughout the addition. The water quality produced by this system will be equivalent to Type 2 (1 mega-ohm) grade meeting ASTM/ISO 3696 specifications. Point of use polishers will be used for Type 1 lab water needs.

DRAIN, WASTE, AND VENT

The existing sanitary waste piping to the building will be re-used. Existing waste and vent piping will be replaced to the extent possible during renovation. Laboratory waste piping will be limited to piping from a laboratory sink/drain to the nearest main riser and will be comprised of fuse-seal polypropylene pipe and fittings. A dedicated acid neutralization system is not anticipated as chemicals will be collected and disposed of in lieu of dumping them down the sinks.

STORM WATER SYSTEMS

The existing storm water piping to the building will be re-used. Existing primary and overflow storm piping will be replaced to the extent possible during renovation.

NATURAL GAS SYSTEM

The existing natural gas piping to the building will be re-used. Piping will be replaced to the extent possible during renovation.

SPECIALTY GASES

LABORATORY COMPRESSED AIR: A new air compressor will be installed in the penthouse to serve new laboratory equipment. The compressor will be a dual oil free scroll tank mount type and installed on top of a 4" high concrete equipment pad with vibration isolators. The system will include a refrigerated air dryer (37.4 deg F dewpoint) and inline filters to provide clean, dry air suitable for laboratory grade use. Piping and fittings will be high purity copper suitable for laboratory use. A master pressure reducing valve will be installed in the penthouse to regulate the system delivery pressure to 125 psig.

CYLINDER GASES: The need and quantity of cylinder gases will be determined during subsequent design phases. Where centralized and stored within a dedicated cylinder closet, gas manifolds with auto-changeover capabilities will be installed and high purity copper suitable for laboratory use will be routed to all use points and equipment.

LABORATORY VACUUM: A new centralized laboratory vacuum pump system will be installed in the penthouse. The pump will be a multi-plex unit with receiver installed on top of a 4" high concrete equipment pad with vibration isolators. The system will be size to maintain a vacuum of 19 inches of mercury at the farthest terminal at peak demand based on 0.5 scfm demand at each terminal. Piping/fittings will be high purity copper suitable for laboratory use.

FIRE PROTECTION

A new fire service will be installed to provide full coverage to all areas. Hazard classifications will be based on applicable NFPA 13 requirements for each space type.

New fire protection standpipes and hose connections will be installed in all egress stairs.

All work will comply with NFPA 13, NFPA 14, NFPA 24, and other local requirements.

Code-required fire dampers, smoke dampers, and fire/smoke dampers will be installed throughout the building as necessary.

ELECTRICAL NARRATIVE

ELECTRICAL DISTRIBUTION SYSTEM

The main electrical services for Harrington and Leonard Halls will remain, with modifications only taking place to remedy code issues and replace equipment that is no longer functional. New panels will be required to support some areas of renovation, however, when possible existing branch panelboards will be repurposed.

LIGHTING SYSTEMS

Lighting systems throughout both buildings will be replaced. The new lighting systems will be designed in accordance with University design guidelines, IES recommendations and applicable energy codes. Lighting power densities will be minimized by using highly efficient fixtures throughout the areas of renovation. Occupancy/vacancy sensors will be used throughout most spaces to provide automatic off of lighting loads during unoccupied times. In addition, where daylighting opportunities and requirements exist, the use of daylighting controlled lighting systems will be utilized. In general, lighting systems will be as follows:

- For laboratories/classrooms it is critical to provide appropriate illumination levels on bench tops, to minimize the impact of shadows created by equipment, casework and personnel.. In addition, it is imperative that labs be provided with lighting fixtures that can withstand environmental conditions in each space. In areas with ceilings, high efficient, recessed linear, LED fixtures will be installed over the edge of the bench tops. This type of lighting provides adequate levels of illumination on bench tops, helps to minimize issues associated with glare and shadowing, while still providing illumination of vertical surfaces.
- All fixtures in laboratories with no ceiling will be linear pendant, high efficient LED fixtures. A portion of the light distribution of these fixtures will be indirect in order to increase the quality of light by providing even, diffuse light levels.
- All fixtures in laboratory areas will be equipped with dimming to provide a variety of light levels. Normal power fixtures in laboratories will be enabled by occupancy/vacancy sensors, and controlled locally within each space. A portion of the lighting in all laboratories will be connected to the emergency generator system.
- In chemical storage areas or laboratories that make use of a significant amount of chemicals, the most prudent approach to lighting is 1'x 4' recessed lensed LED troffers. This type of illumination reduces shadowing and provides adequate illumination levels. Normal fixtures in these spaces will be enabled by occupancy/vacancy sensors, and controlled locally within each space. A portion of the lighting in all areas with high chemical usage will be connected to the emergency generator system.
- Lighting in corridors will be provided by recessed, high efficient, LED fixtures. A portion of these fixtures will be connected to the emergency generator system to provide Code required emergency egress lighting and night lighting. All normal lighting fixtures will be connected to a lighting control system so they are turned off when the building is normally unoccupied.

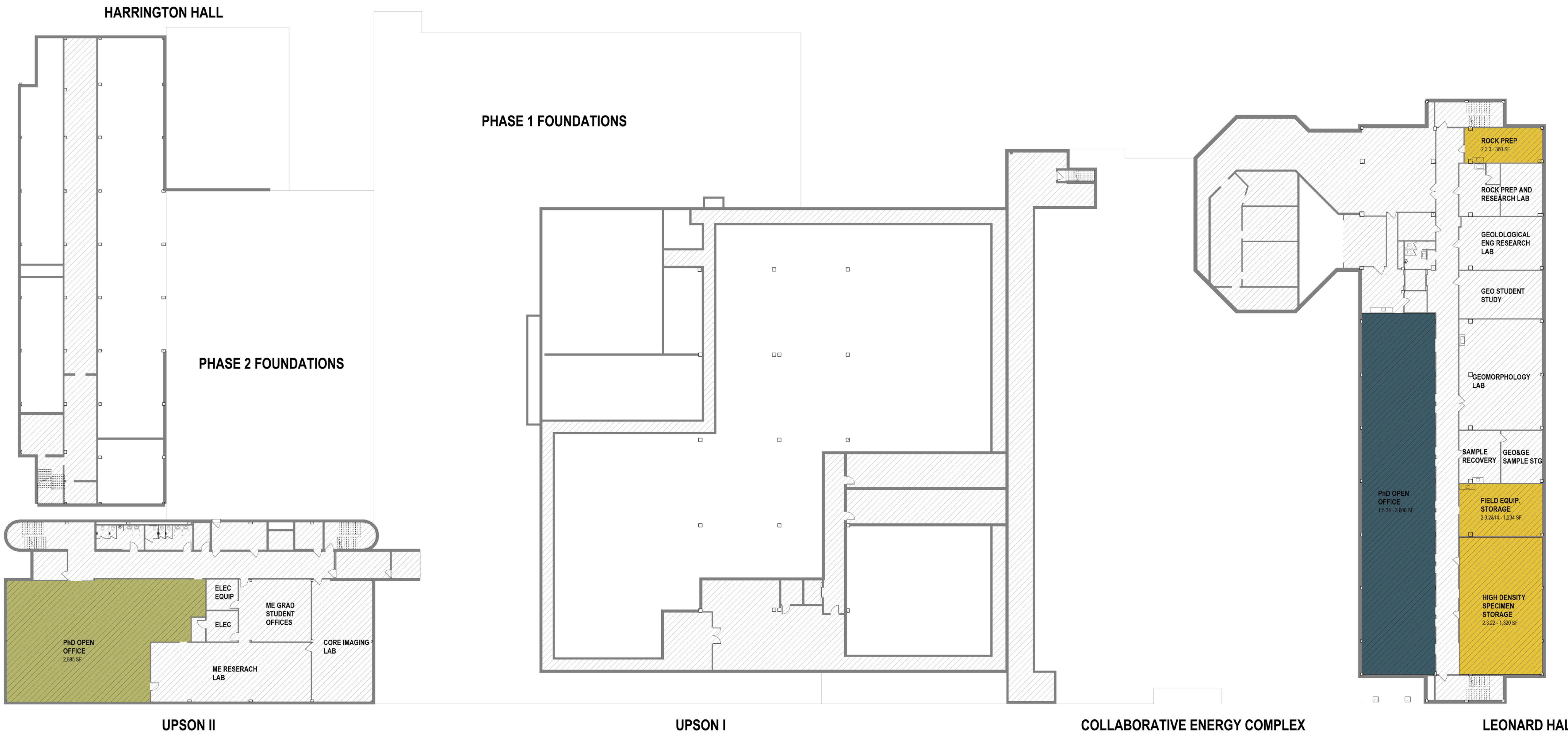
RECEPTACLE LAYOUTS

In areas of renovation, receptacle layouts and circuiting to support computer equipment, classroom equipment, laboratory equipment, telecommunications equipment and general purpose needs will be provided in accordance with direction provided by building users and campus personnel.

Two channel surface metal raceway systems will be provided above benches in laboratories to support the distribution of power, telecommunications and instrumentation cabling to computer and laboratory equipment. Duplex receptacles will be installed in surface metal raceway systems at intervals dictated by building users. Receptacles in raceway systems will be connected to 20-amp branch circuits unless further direction has been provided by a specific user.

In equipment alcoves and shared equipment or instrumentation spaces wall mounted busway will be utilized. The busway will provide quick plug-and-play power re-configuration to accommodate equipment changes. Busway will be rated at 208Y/120V, 3 phase, 4-wire with amperage ratings that vary depending on length. Standard busway receptacle/circuit breaker combination units will be coordinated with existing equipment and Campus personnel.

All electrical devices in laboratories will be labeled with the panel source and circuit number. Dedicated receptacles and circuits will be provided as required to support specific equipment locations throughout the facility. All receptacle branch circuits will be provided with equipment ground conductors. All branch circuit wiring will be copper and will be installed in concealed raceway systems. Ground fault interrupting type receptacles will be provided in all Code required locations, and in all designated “wet” locations throughout the facility.



LOWER LEVEL

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

FIRST FLOOR

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
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- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
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- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

SECOND FLOOR

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

THIRD FLOOR

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

OPINIONS OF PROBABLE COST

TOTALS

The preliminary costs shown below are for construction and demolition, only in 2021 dollars. No additional funds for escalation, soft costs, fees, design, furnishings or additional site costs have been included.

Net Square Feet	190,941
Gross Square Feet	334,984
Totals Construction Cost	**$95,886,491**

BREAKDOWN PER DEPARTMENT

The preliminary costs shown below are for construction and demolition, only in 2021 dollars. No additional funds for escalation, soft costs, fees, design, furnishings or additional site costs have been included.

DEPARTMENT	PHASE 1			PHASE 2		
	NSF	GSF	COST	NSF	GSF	COST
Petroleum Engineering	2,178	3,821	$2,006,053	3,630	6,368	$3,025,000
Geology & Geological Engineering	0	0	$0	0	0	$0
Civil Engineering	0	0	$0	9,112	15,986	$7,505,614
Chemical Engineering	7,864	13,796	$6,585,482	4,840	8,491	$4,404,825
Electrical Engineering & Computer Science	2,387	4,188	$1,943,333	4,719	8,279	$3,693,684
Institute for Energy Studies	0	0	$4,852,719	0	0	$0
Mechanical Engineering	5,703	10,005	$0	2,904	5,095	$2,420,000
College of Engineering	1,452	2,547	$1,273,684	0	0	$0
Registrar	0	0	$0	0	0	$0
Biomedical Engineering	9,702	17,021	$7,411,491	0	0	$0
Totals	**29,286**	**51,379**	**$24,072,763**	**25,205**	**44,219**	**$21,049,123**

DEPARTMENT	PHASE 3			PHASE 4		
	NSF	GSF	COST	NSF	GSF	COST
Petroleum Engineering	0	0	$0	7,410	13,000	$2,644,737
Geology & Geological Engineering	0	0	$0	28,559	50,104	$10,839,254
Civil Engineering	3,312	5,811	$1,162,105	10,116	17,747	$2,946,096
Chemical Engineering	6,766	11,870	$2,374,035	2,241	3,932	$810,746
Electrical Engineering & Computer Science	8,035	14,096	$2,796,535	4,312	7,565	$1,134,737
Institute for Energy Studies	0	0	$0	3,489	6,121	$1,463,026
Mechanical Engineering	5,764	10,112	$2,022,456	21,065	36,956	$8,166,491
College of Engineering	0	0	$0	21,994	38,586	$8,315,088
Registrar	0	0	$0	13,387	23,486	$6,089,298
Biomedical Engineering	0	0	$0	0	0	$0
Totals	**23,877**	**41,889**	**$8,355,132**	**112,573**	**197,496**	**$42,409,474**

ALTERNATE OPTION

HYSLOP STARCHER SITE

North Dakota State University has been working on a campus masterplan that includes an analysis for the establishment of a STEM building to serve the campus. While several sites have been evaluated, the committee for the College of Engineering masterplan asked the design team to provide a brief overview of the possibilities surrounding using a building site directly to the east of Leonard Hall to accommodate the additional programmatic space needed by the College of Engineering. According to the work on the STEM study completed at the time of this study, the STEM building would occupy the north end of the site and the new development for the college of engineering would occupy the south on a parcel that measures approximately 210 feet north to south and 340 feet east to west. The eastern site is currently occupied by the Hyslop Athletic center and Starcher Hall. Starcher Hall would be demolished and removed in it's entirely and most of Hyslop would be demolished except for the northern most wing of the building.

The committee asked the design team to investigate the eastern site to see how it might accommodate a new engineering building to provide the growth space identified in the program plus all space in Harrington and Upson II (slated for demolition). The eastern site would then need to provide net square footage to replace or provide new, the following major areas identified in the masterplan:

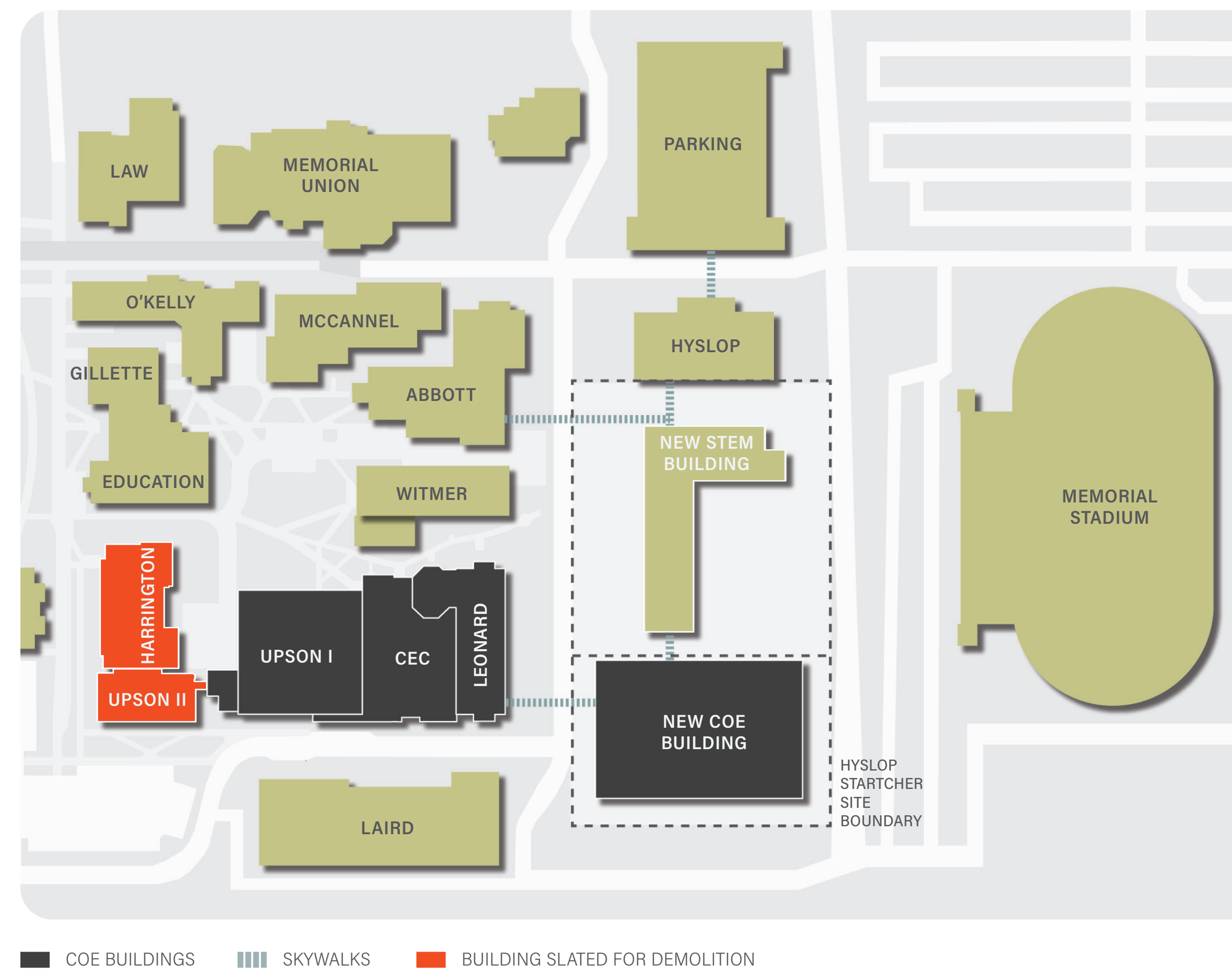
1. All new space currently planned for the Phase 1 addition to the west and north of Upson I. (29,286 net square feet)
2. All new space currently planned for the Phase 2 demolition and addition to the east side of Harrington Hall. (25,205 net square feet).
3. All existing space remaining in Harrington Hall after the implementation of Phase 2. (20,844 net square feet.)
4. All existing space in Upson II planned for renovation in Phase 3. (25,196 net square feet).

The total net square footage needed in this scenario is 100,531 net square feet. Assuming a similar net to gross ratio of 57%, a new multi-story engineering addition would need to be built to provide approximately 176,000 gross square feet. Assuming set backs of roughly 40 feet on the eastern site, it is assumed that a maximum footprint of approximately 51,000 gross square feet could be achieved yielding either a three or four-story development plus a penthouse. In addition, the development would also likely include a skywalk from Leonard Hall to the new addition and the demolition of the existing Harrington and Upson II structures. It is assumed that demolition of Hyslop and Starcher would be included in the development of the eastern site in preparation for the construction of the new STEM Building to the north of the proposed engineering annex.

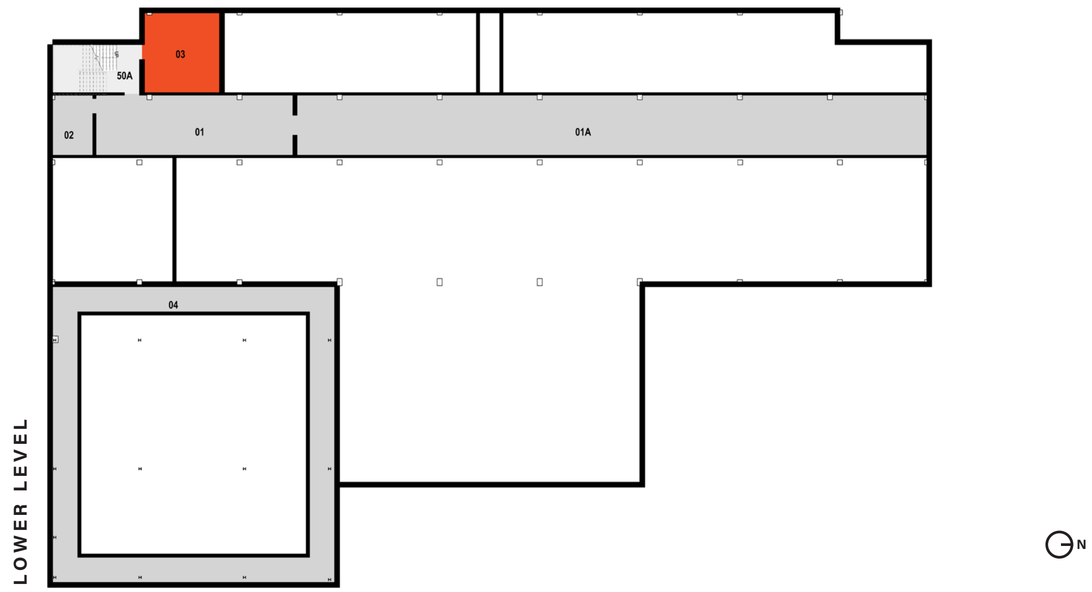
The preliminary costs shown below are for construction and demolition, only in 2021 dollars. No additional funds for escalation, soft costs, fees, design, furnishings or additional site costs have been included.

The preliminary costs shown below are for construction and demolition, only in 2021 dollars. No additional funds for escalation, soft costs, fees, design, furnishings or additional site costs have been included.

HYSLOP STARCHER SITE	COST
Construction of new Engineering Annex ($475 per GSF)	$83,600,000
Construction of skywalk (144 linear feet at $10,000 per LF)	$1,440,000
Demolition of Harrington and Upson II (at $6 per exg. GSF)	$650,000
Totals	**$85,690,000**



APPENDIX F

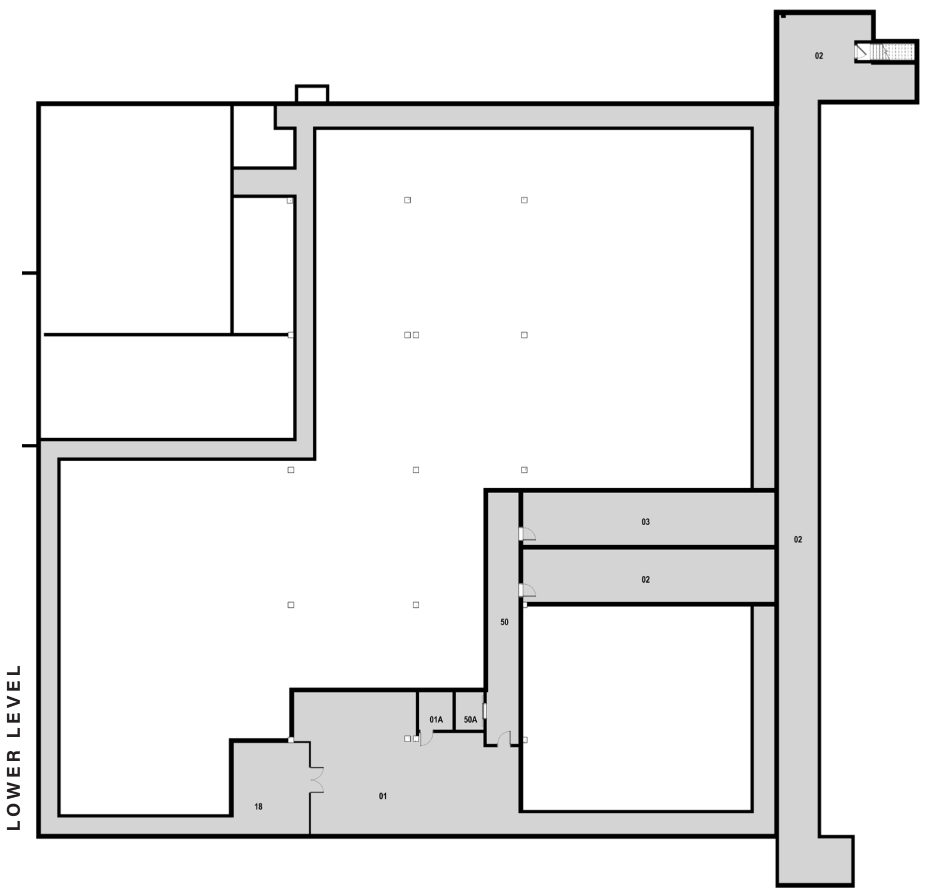


HARRINGTON HALL

DEPARTMENT BREAKOUT LEGEND

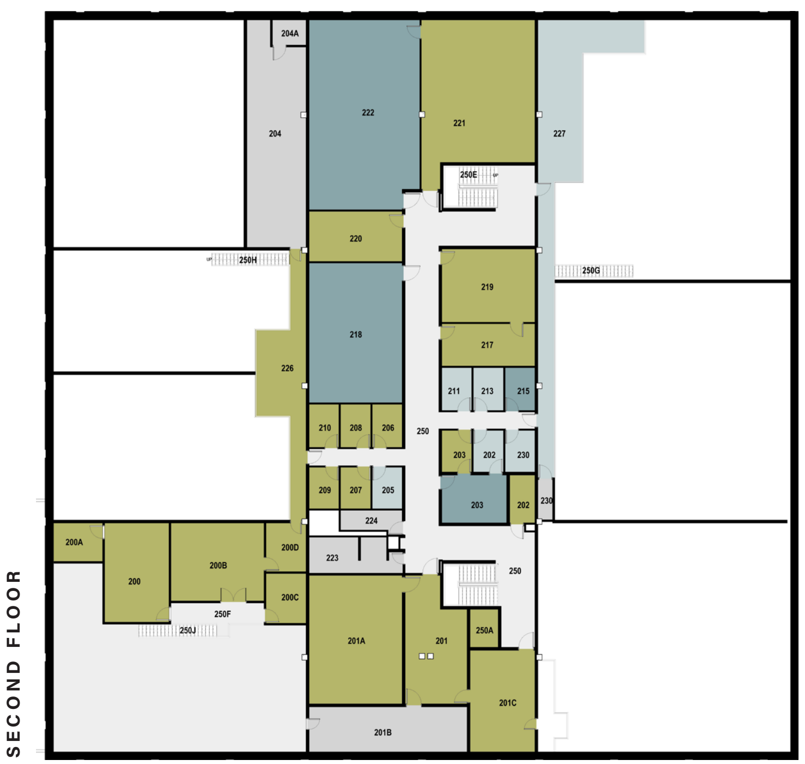
- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

LOWER LEVEL



FIRST FLOOR

SECOND FLOOR



UPSON I

DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
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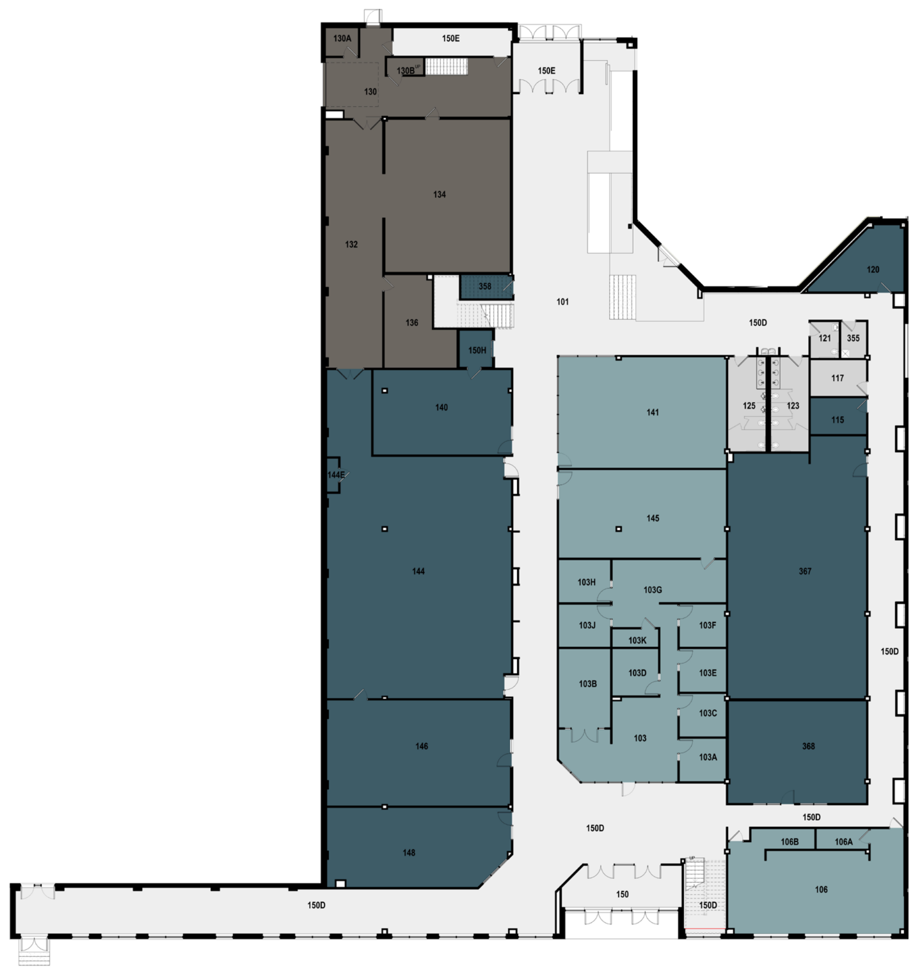
- BUILDING SUPPORT
- CIRCULATION

UPSON II

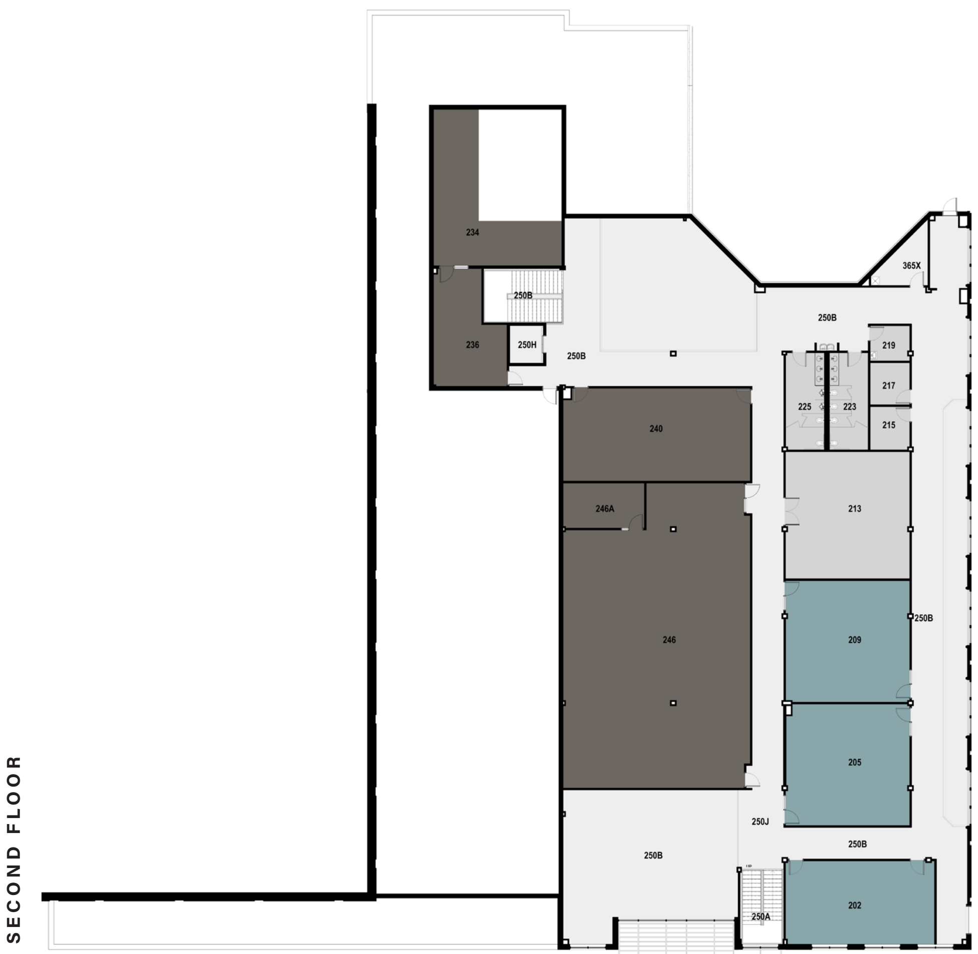
DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

FIRST FLOOR



SECOND FLOOR



COLLABORATIVE ENERGY COMPLEX

DEPARTMENT BREAKOUT LEGEND

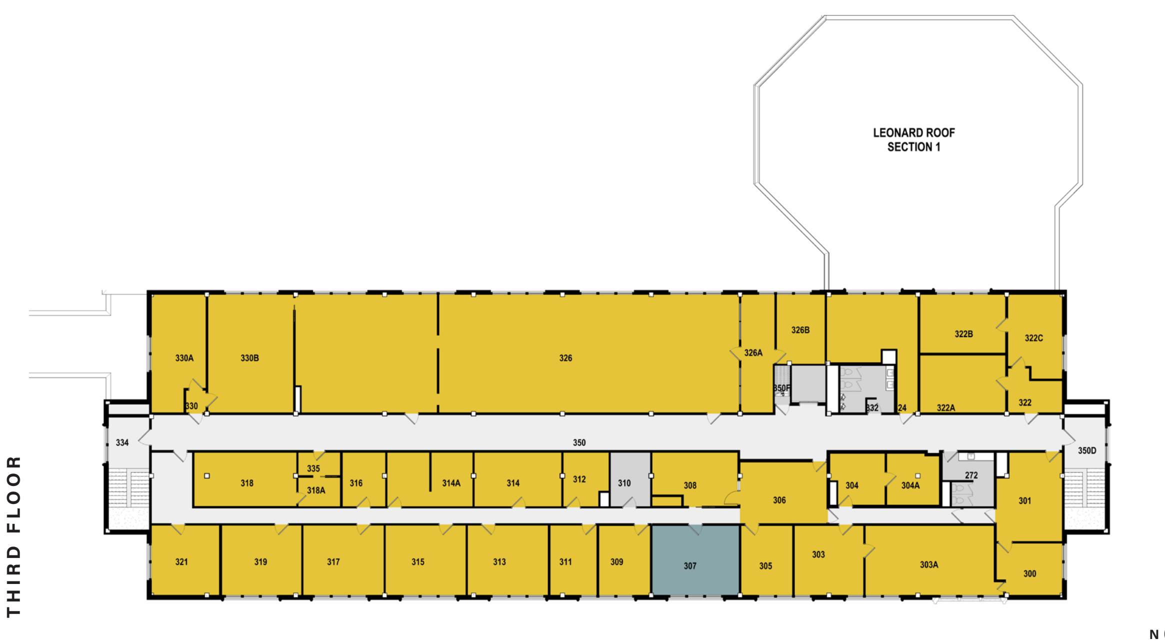
- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

LOWER LEVEL

FIRST FLOOR

SECOND FLOOR

THIRD FLOOR



LEONARD HALL

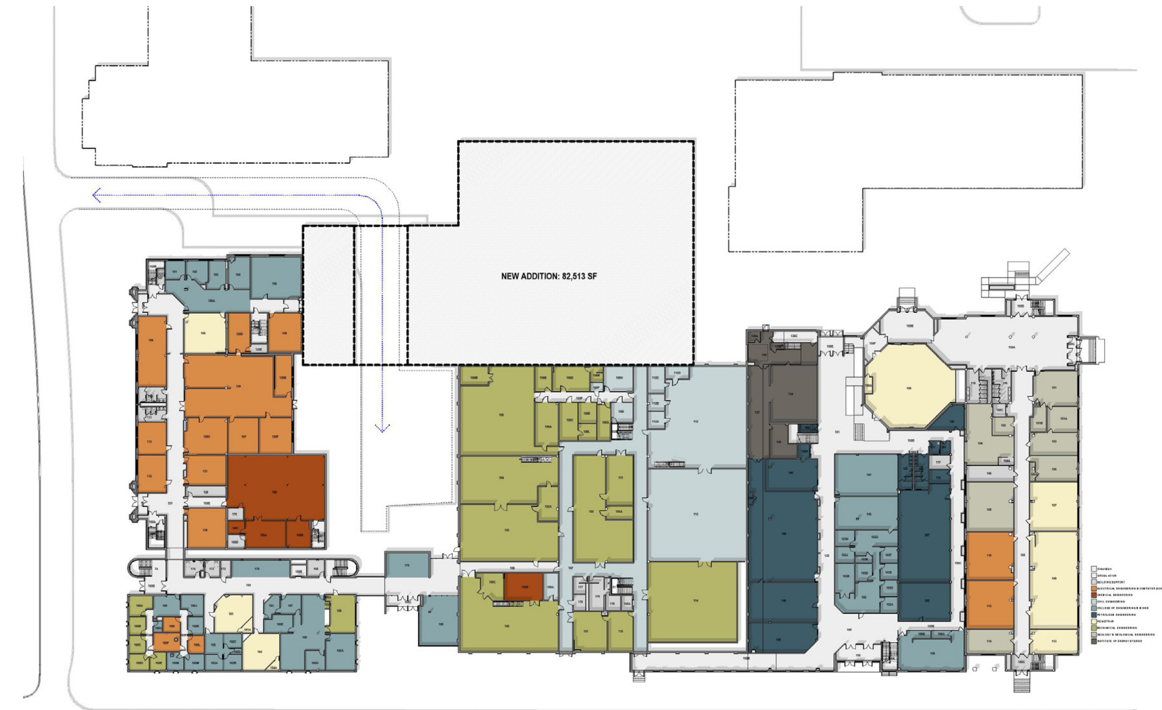
DEPARTMENT BREAKOUT LEGEND

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING + COMPUTER SCIENCE
- GEOLOGY + GEOLOGICAL ENGINEERING
- MECHANICAL ENGINEERING
- CIVIL ENGINEERING
- COLLEGE OF ENGINEERING + MINES
- PETROLEUM ENGINEERING
- REGISTRAR
- BIOMEDICAL ENGINEERING
- INSTITUTE OF ENERGY STUDIES
- BUILDING SUPPORT
- CIRCULATION

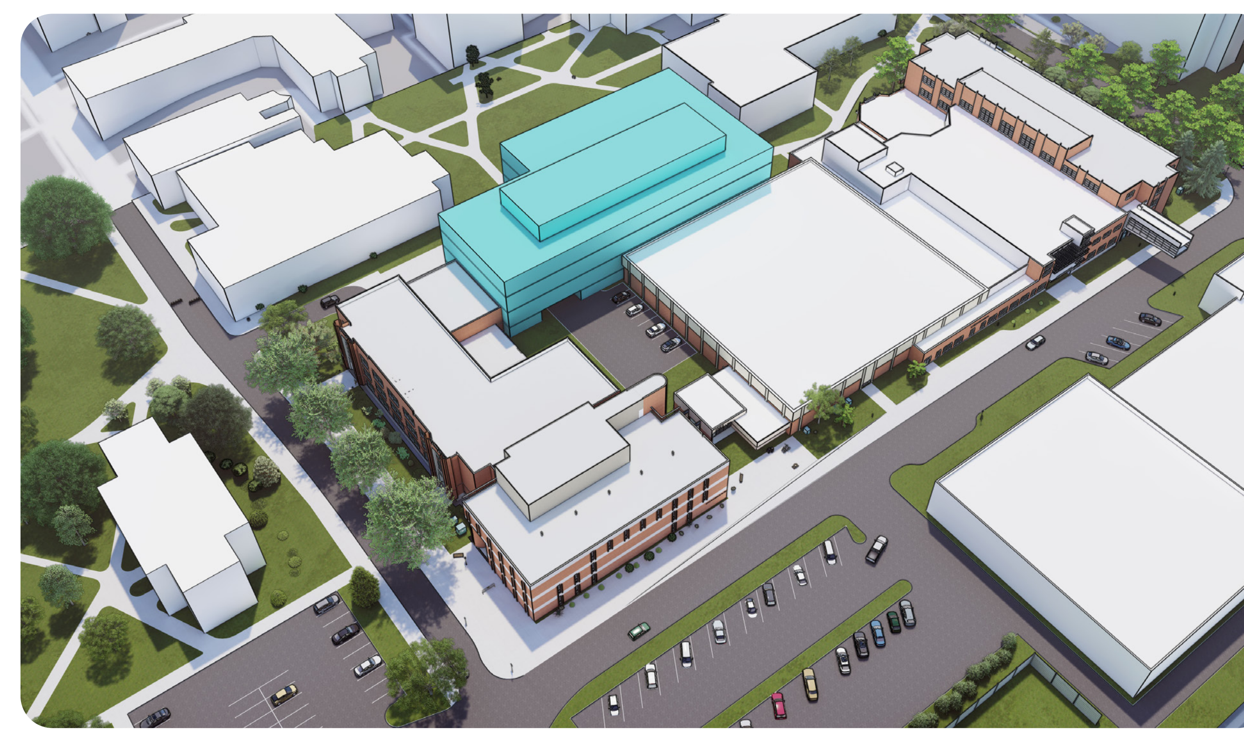
DESIGN ITERATION SERIES 01

82,000 SF ADDITION - PLAN
Without Underpass

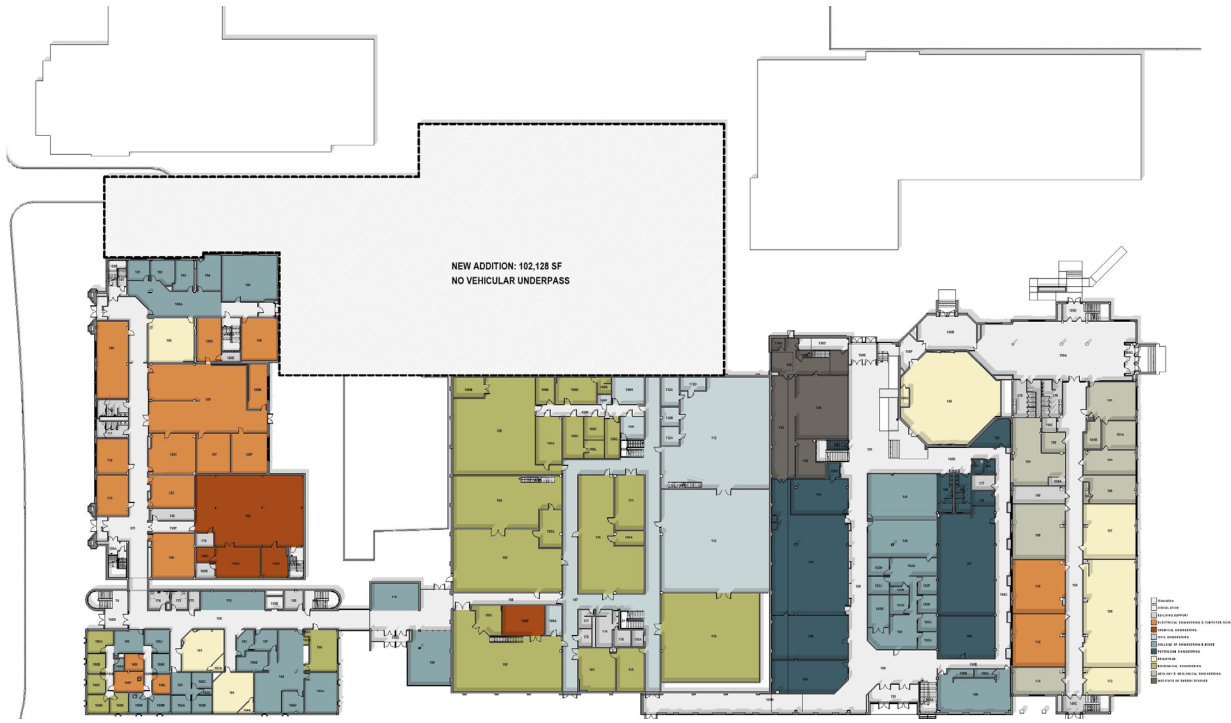
82,000 SF ADDITION - MASSING
Without Underpass



82,000 SF ADDITION - PLAN
With Underpass



82,000 SF ADDITION - MASSING
Without Underpass

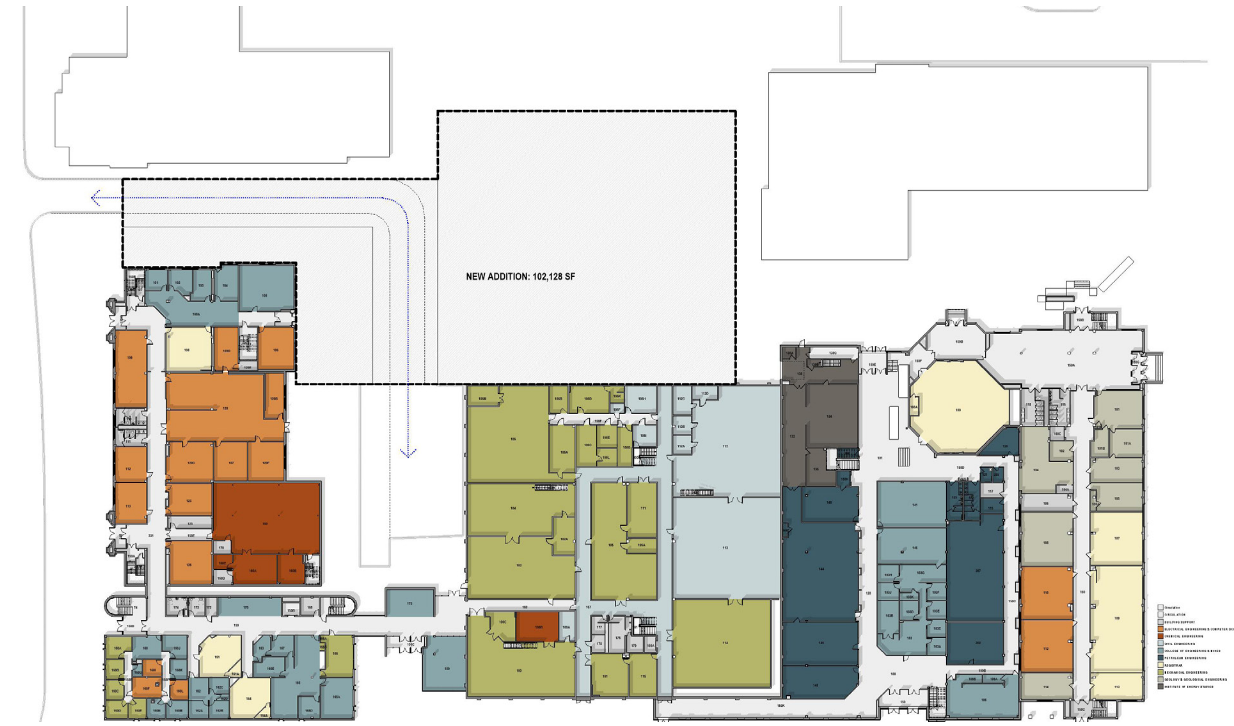


102,000 SF ADDITION - PLAN

Without Underpass

102,000 SF ADDITION - MASSING

Without Underpass



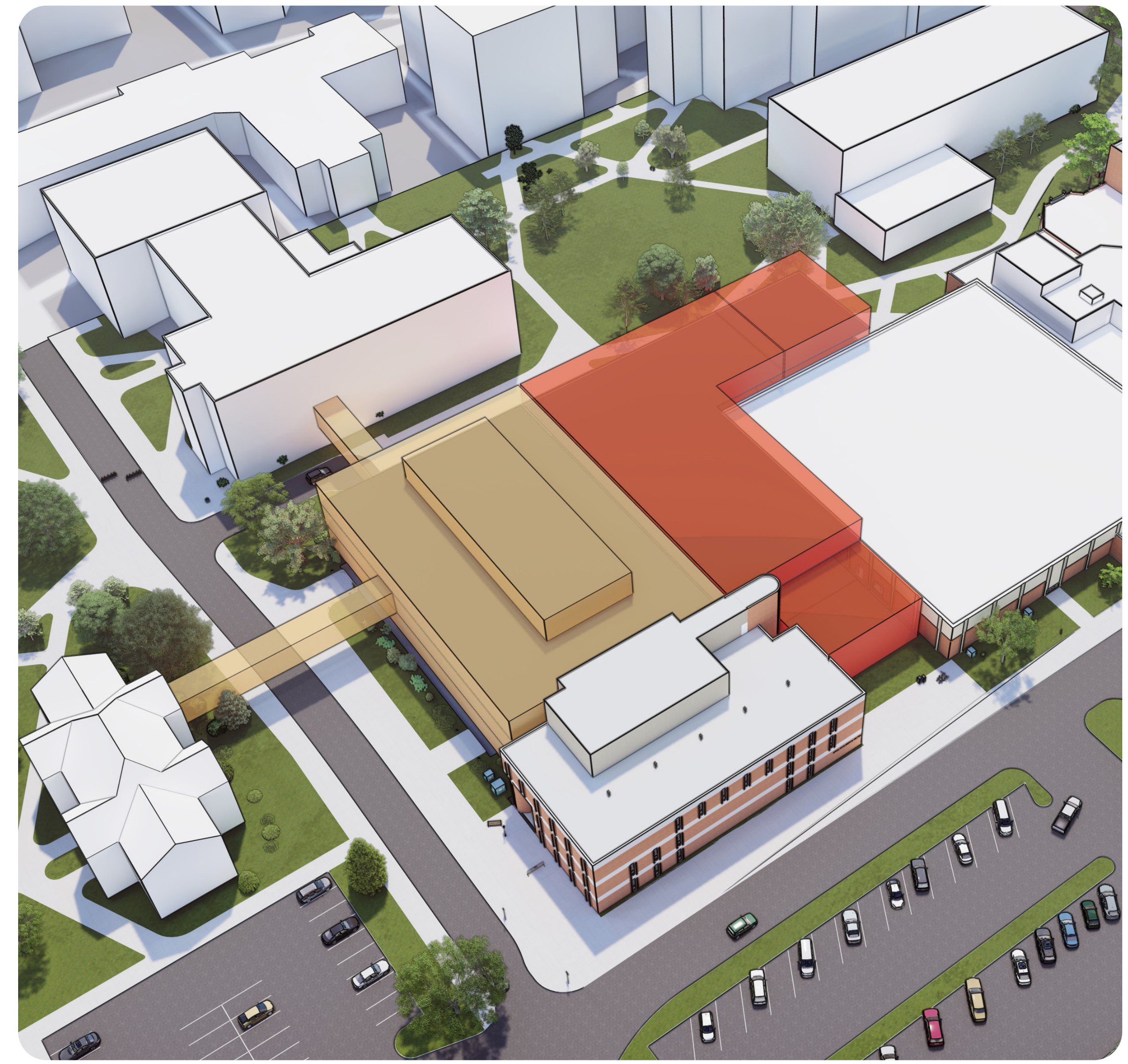
102,000 SF ADDITION - PLAN

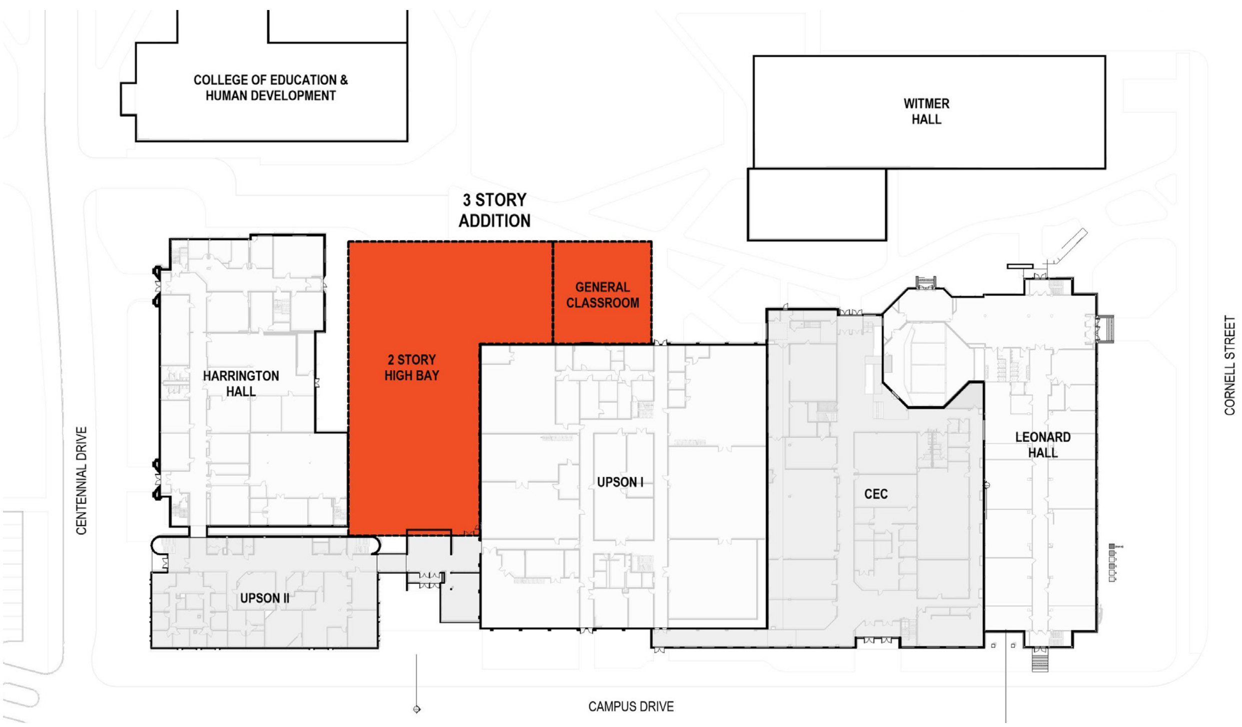
With Underpass

102,000 SF ADDITION - MASSING

Without Underpass

DESIGN ITERATION SERIES 02



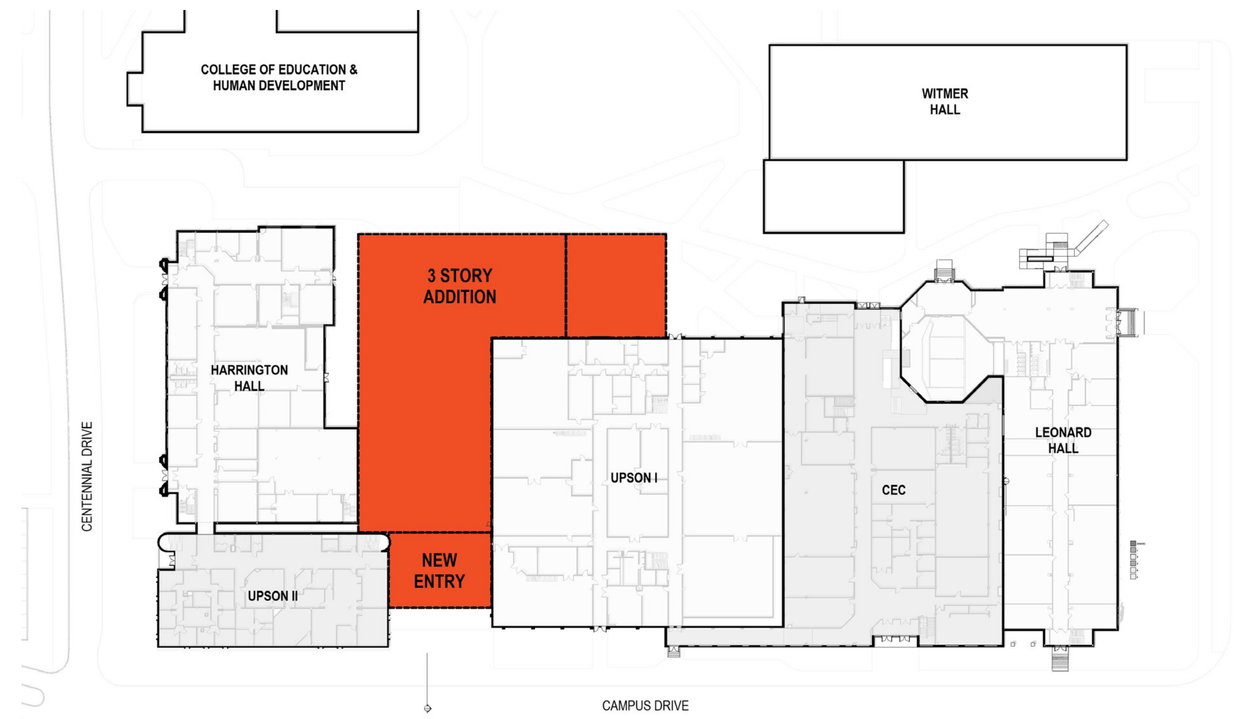


PHASE 1 - PLAN

2 Story High Bay + 1 Story Classrooms/Laboratories Addition

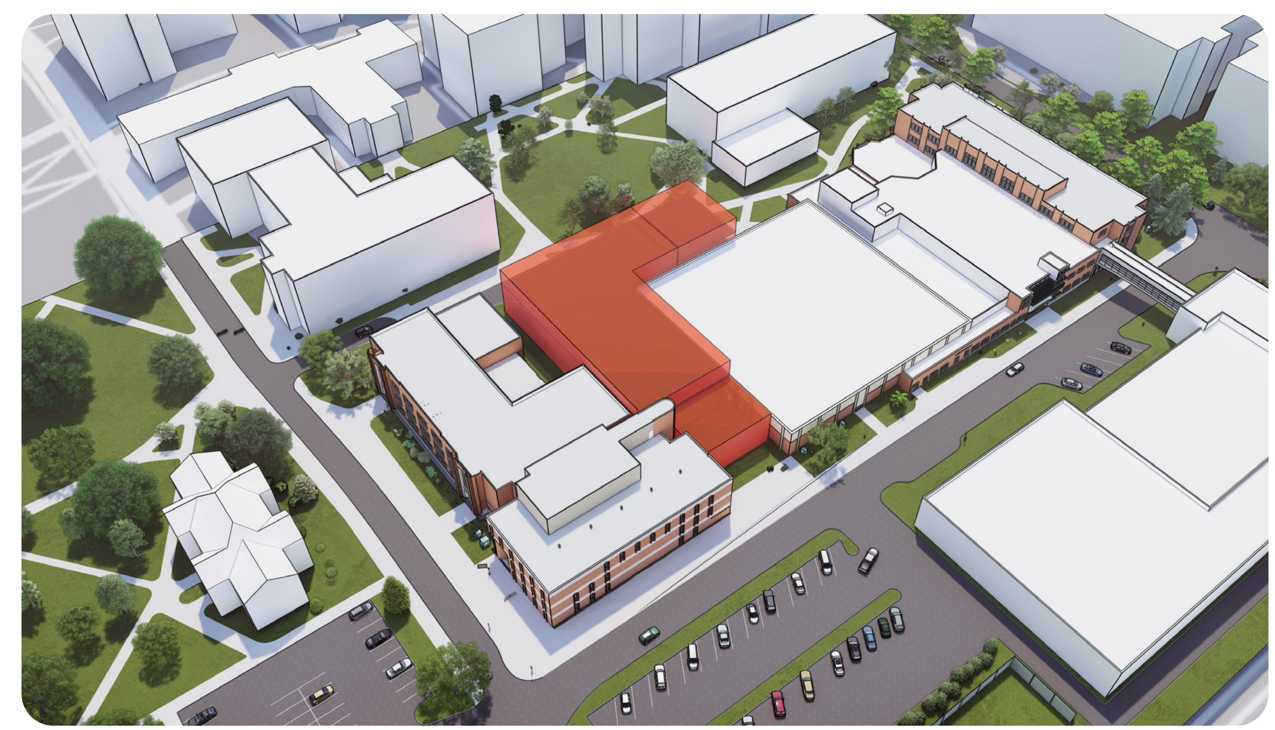
PHASE 1 - MASSING

Southwest View



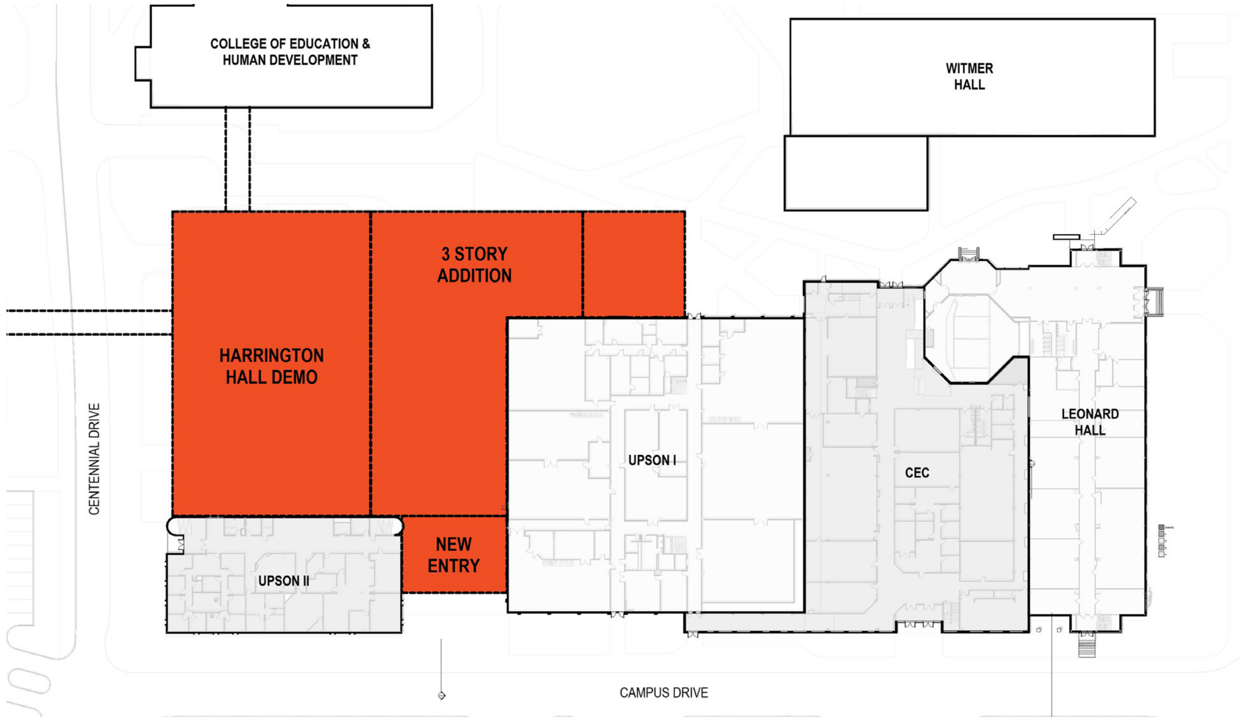
PHASE 2 - PLAN

New Entry Link



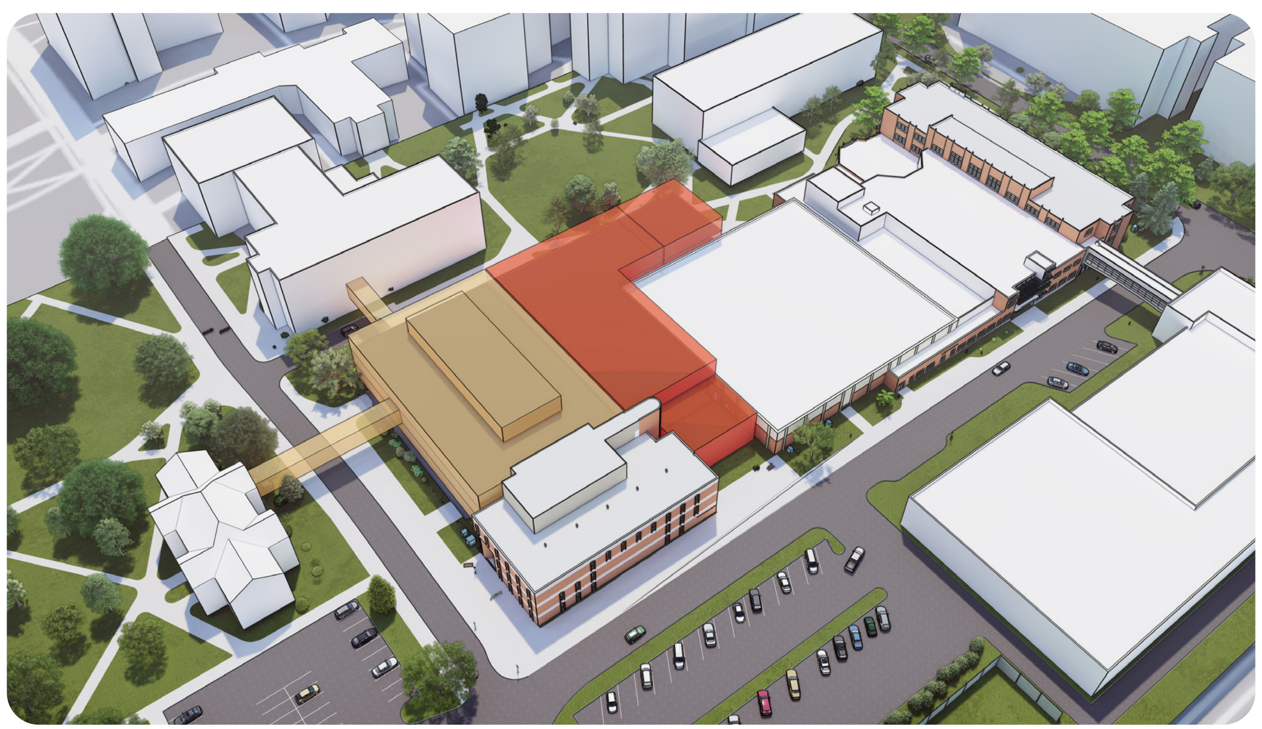
PHASE 2 - MASSING

Southwest View



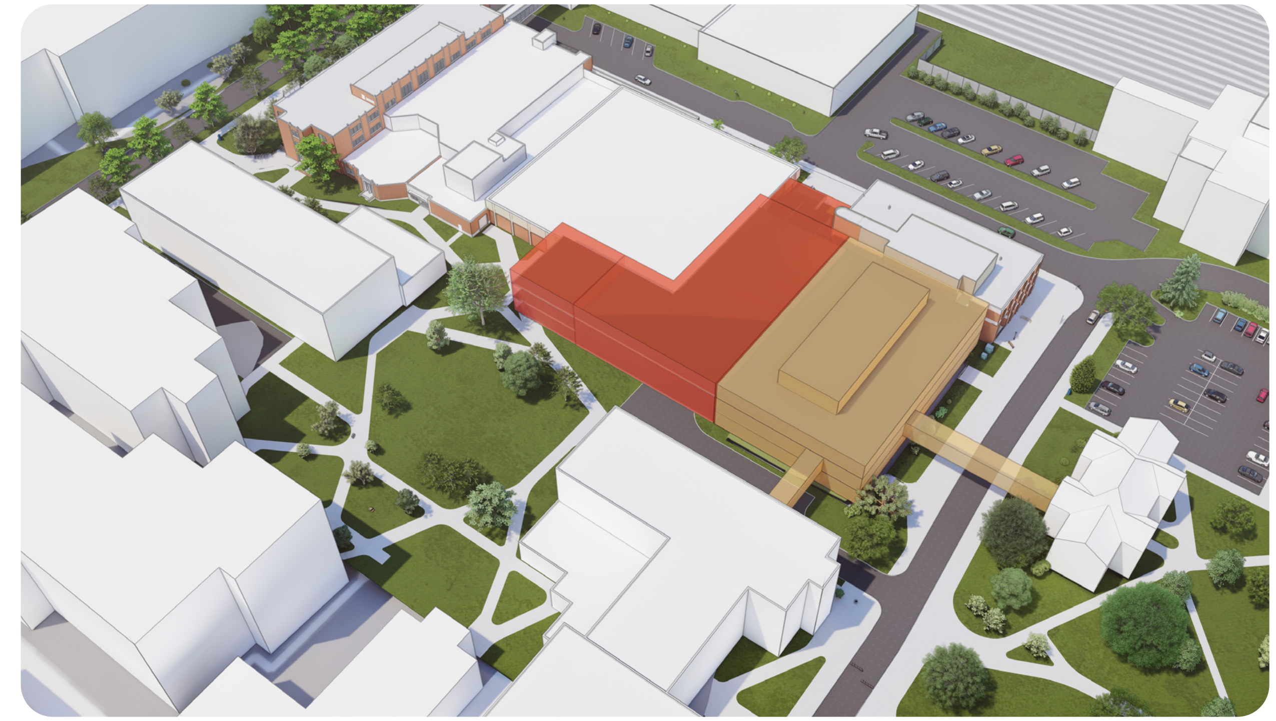
PHASE 3 - PLAN

Demo Harrington Hall + Skywalk Connections



PHASE 3 - MASSING

Southwest View



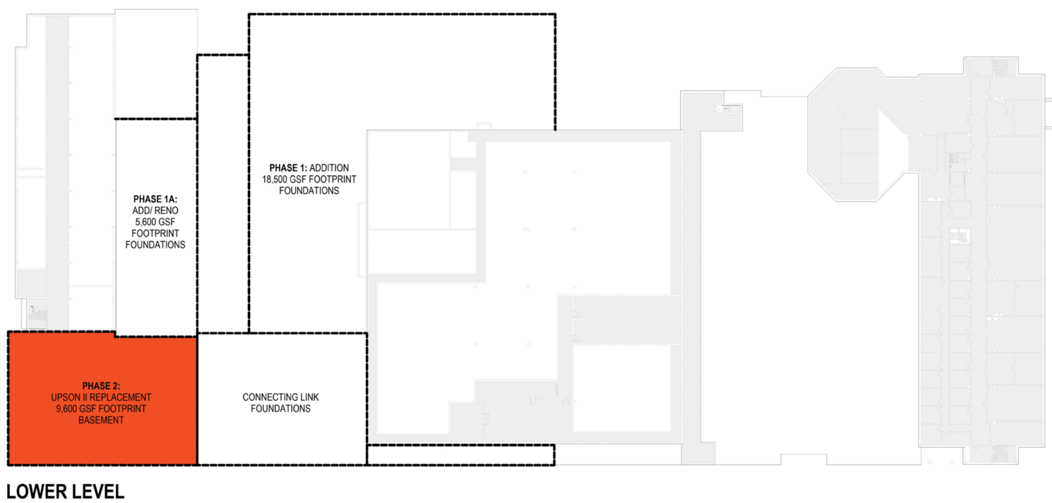
PHASE 3 - MASSING

Northwest View

102,000 SF ADDITION - MASSING

Southwest View

DESIGN ITERATION SERIES 03



PHASE 3 - PLAN

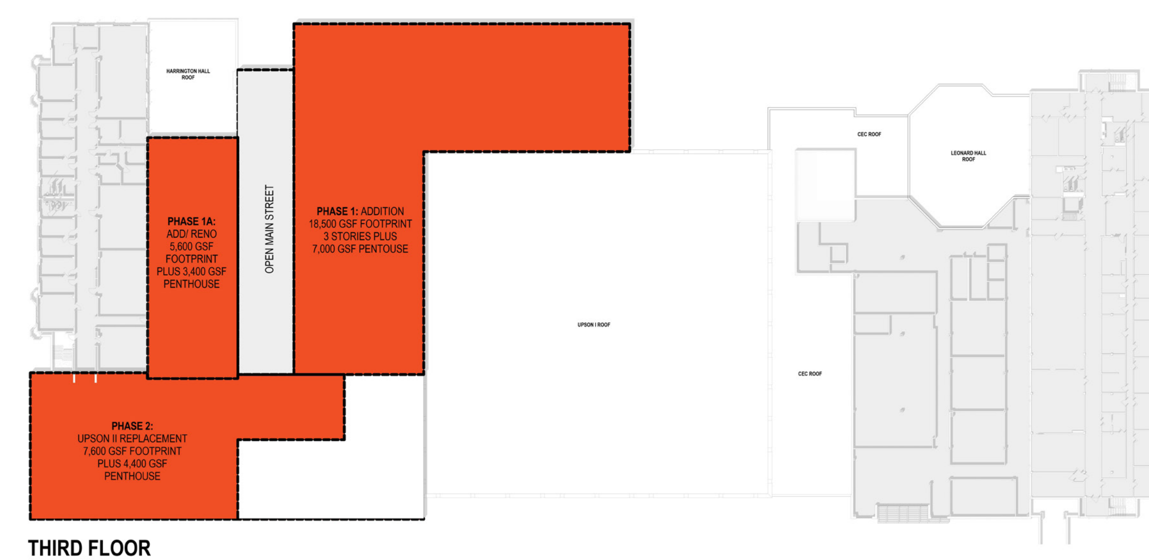
Demo Harrington Hall + Skywalk Connections

PHASE 3 - MASSING

Southwest View

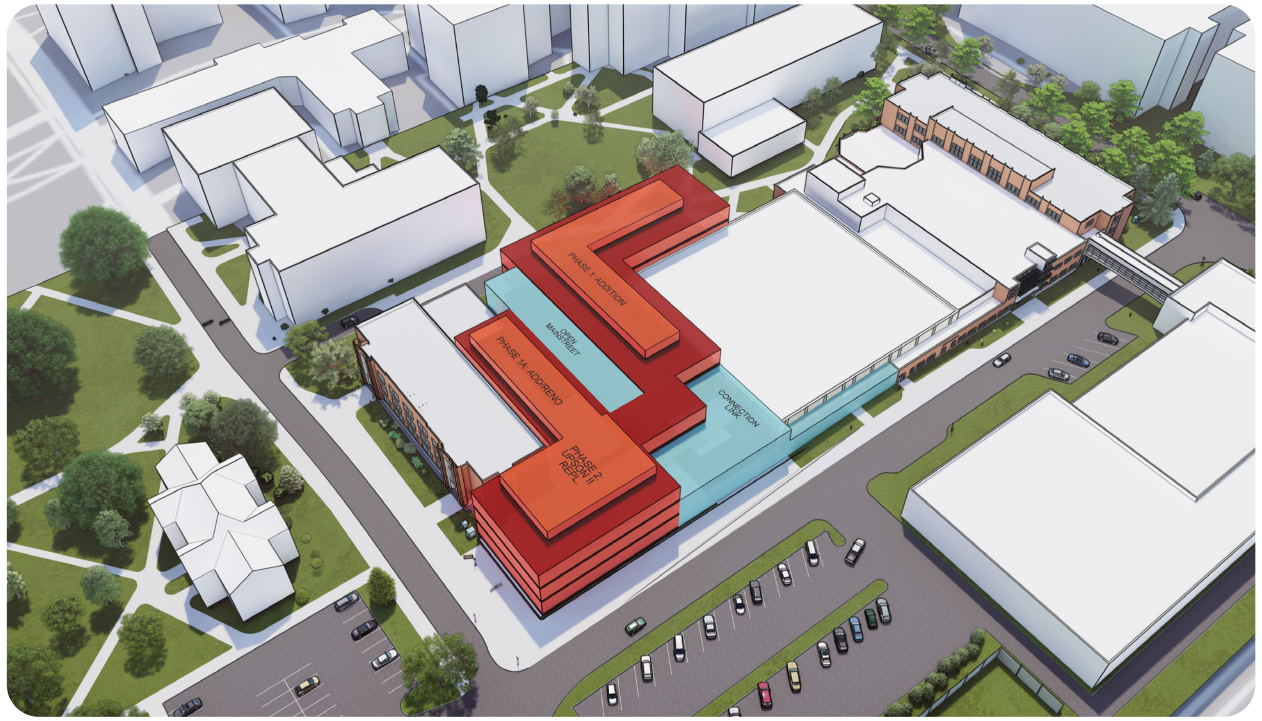
PHASE 3 - MASSING

Northwest View

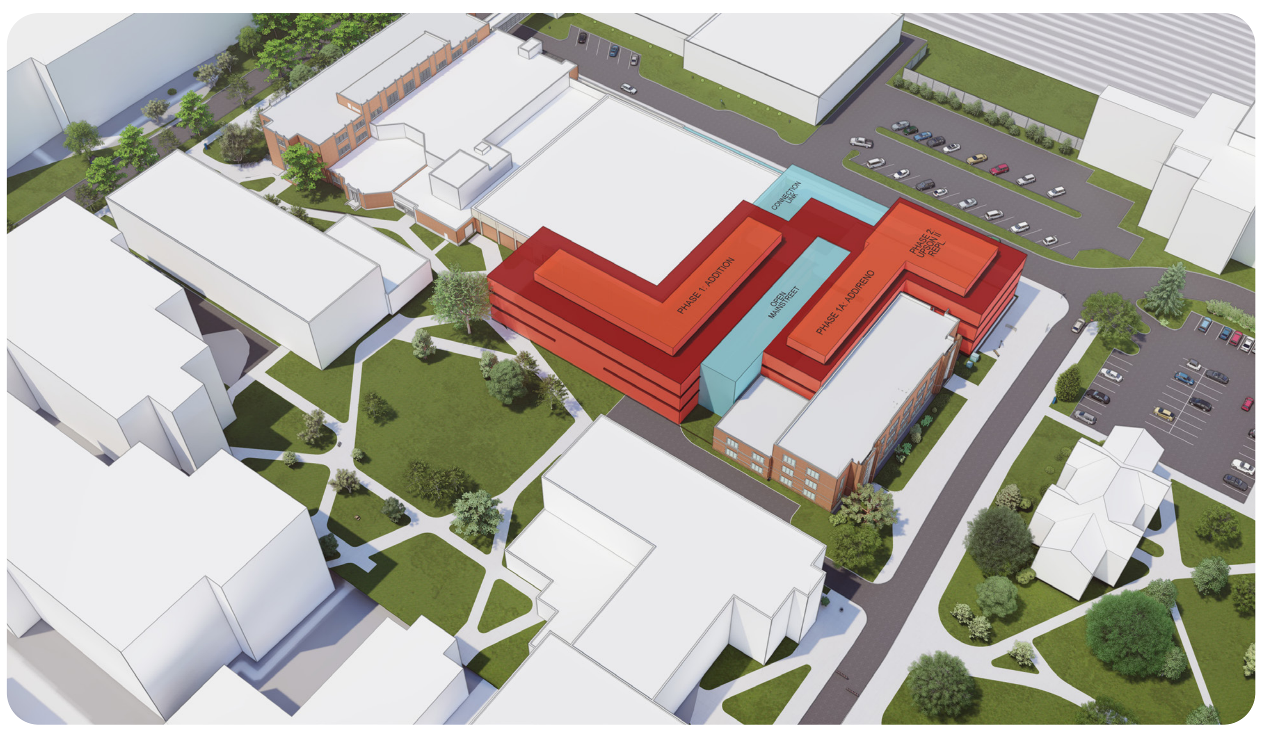


102,000 SF ADDITION - MASSING

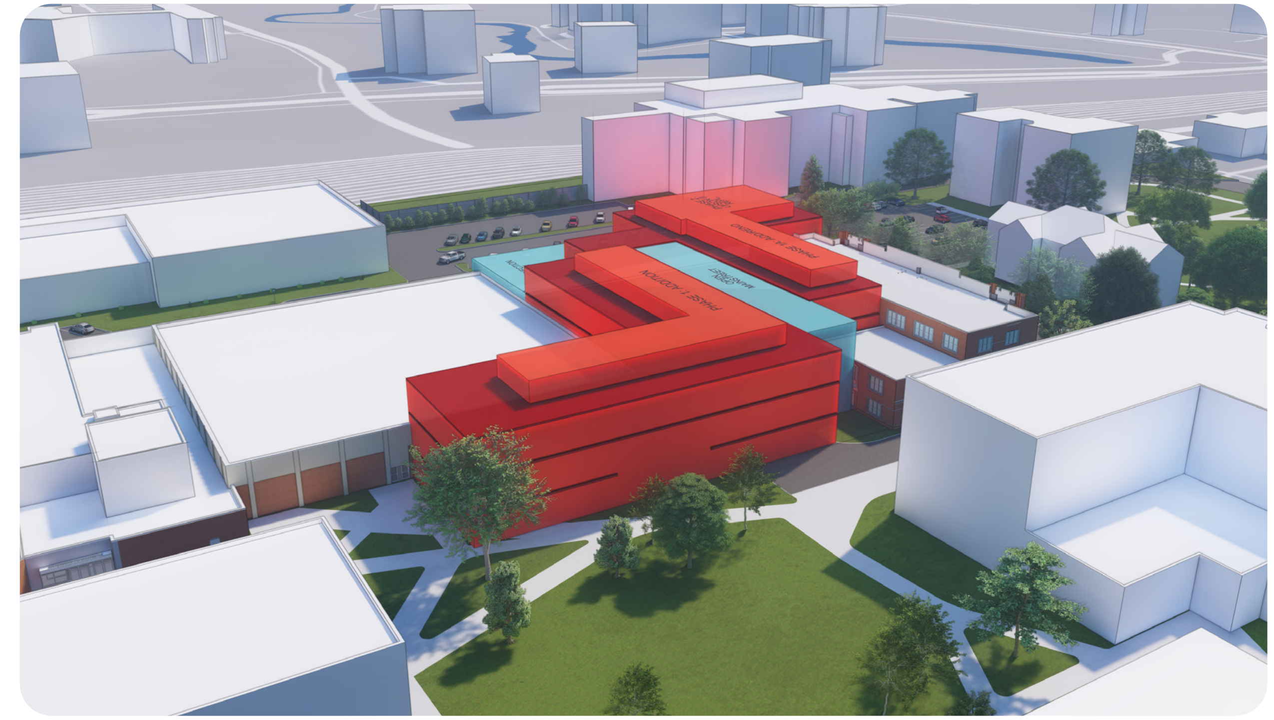
Southwest View



PHASE 3 - PLAN
Demo Harrington Hall + Skywalk Connections

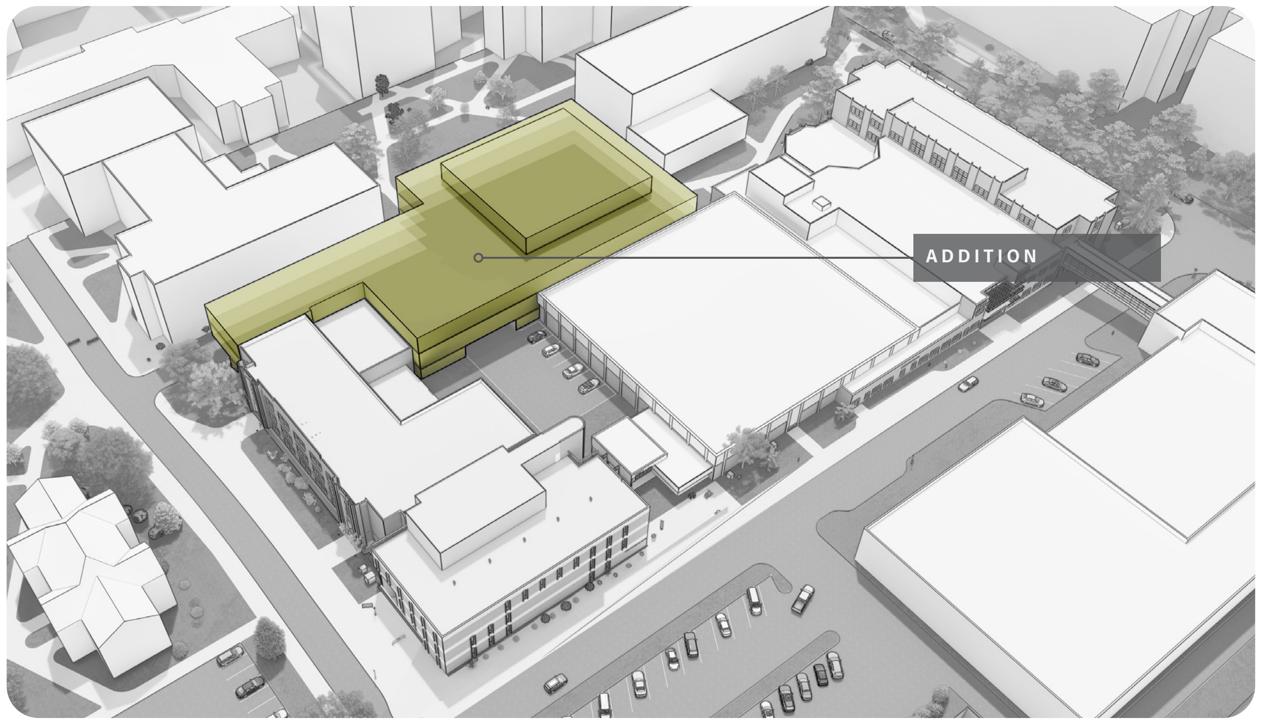


PHASE 3 - MASSING
Southwest View

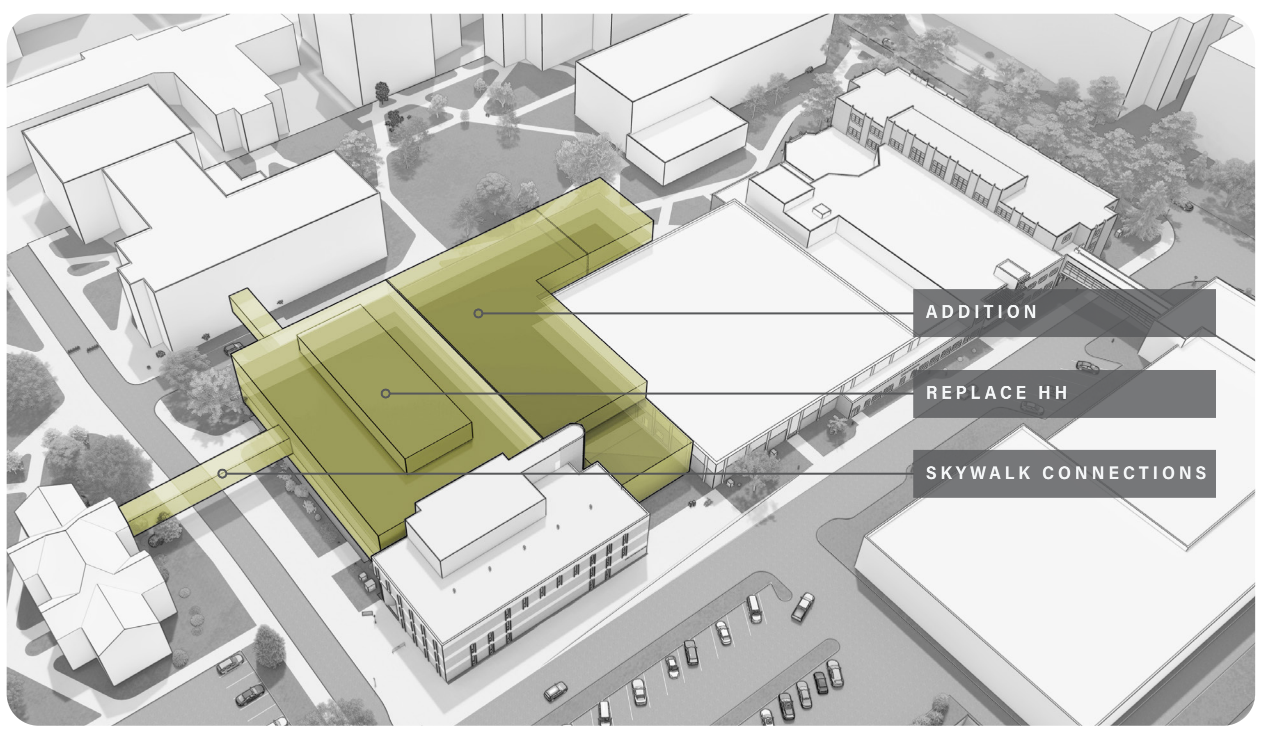


PHASE 3 - MASSING
Northwest View

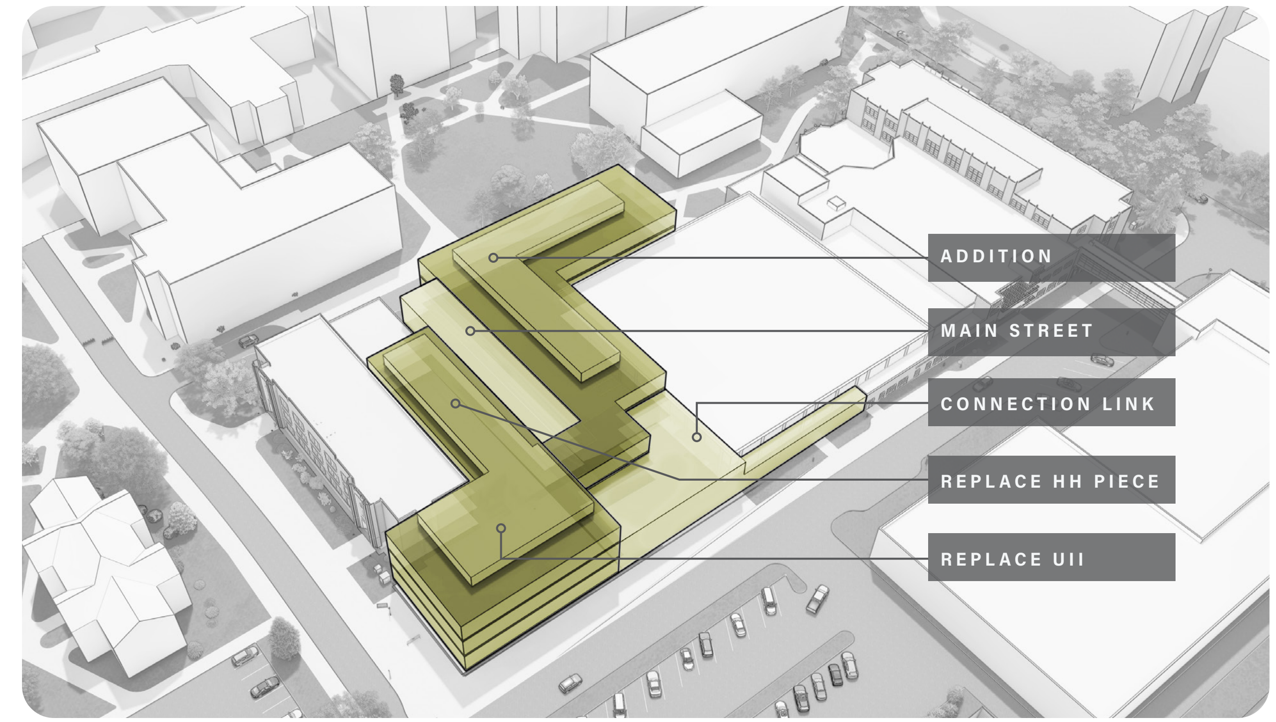
102,000 SF ADDITION - MASSING
Southwest View



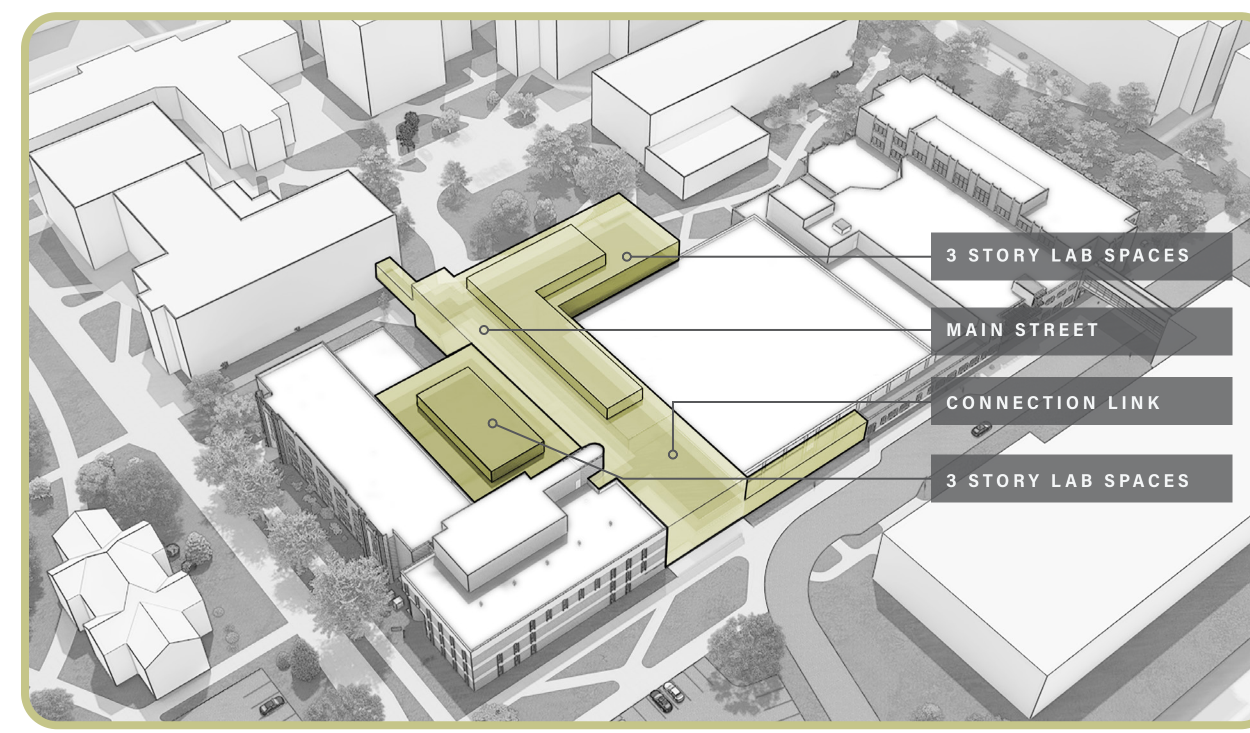
MASSING SERIES 1



MASSING SERIES 2



MASSING SERIES 3

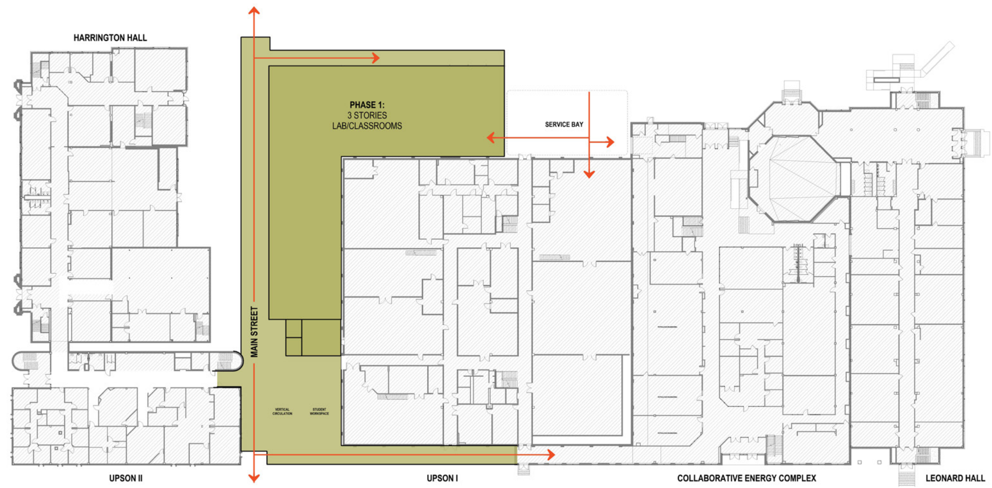


MASSING SERIES 4: MASSING TO MOVE FORWARD

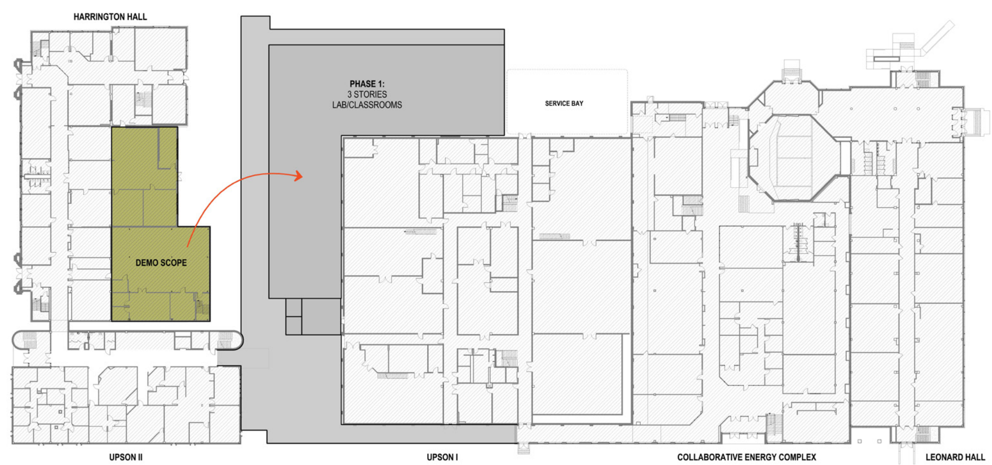
FINAL ROOM LIST

FINAL ROOM LIST

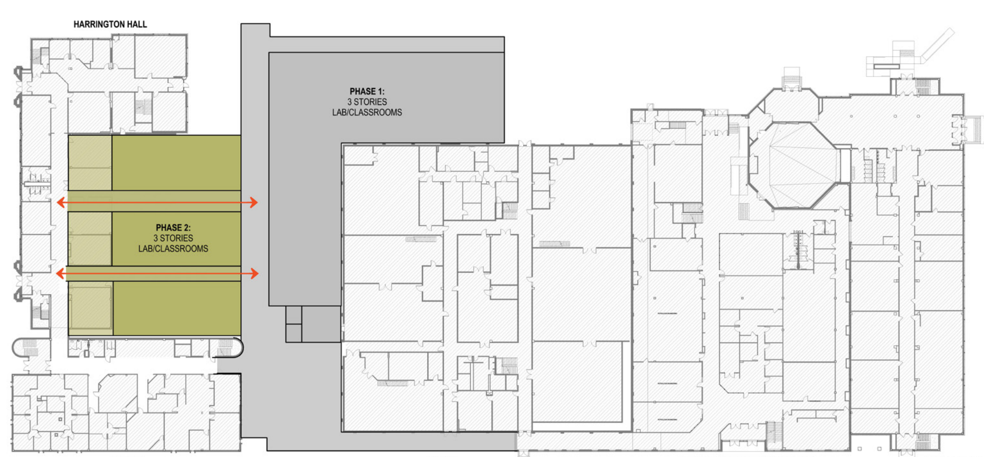
PHASE 1
Addition between Harrington Hall and Upson I



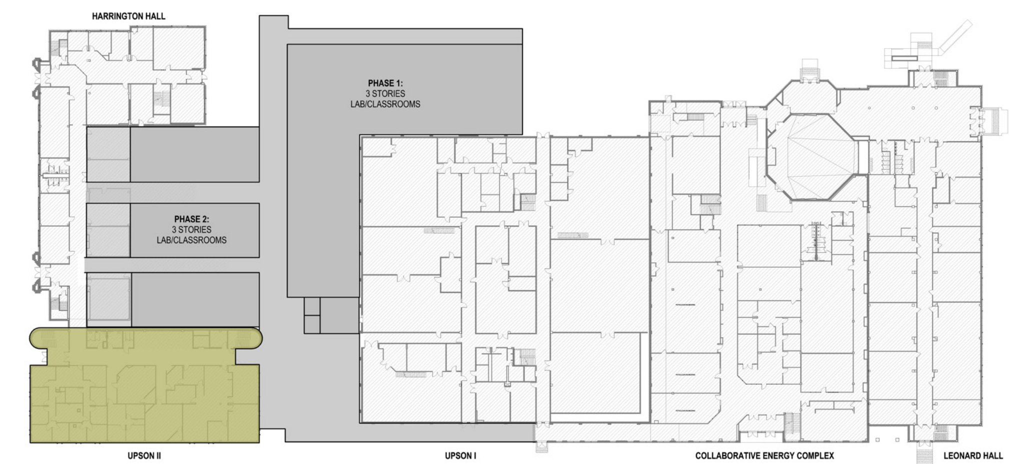
PHASE 2 DEMO
Addition between Harrington Hall and Upson I



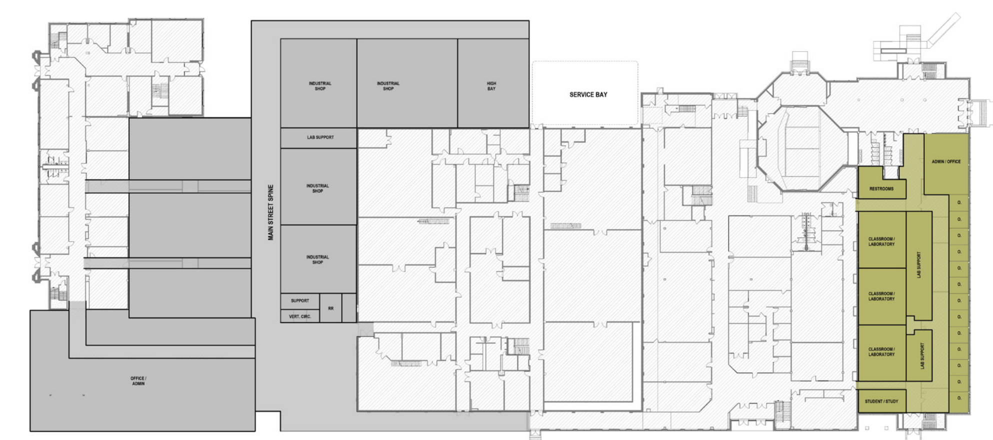
PHASE 3
Addition between Harrington Hall and Upson I



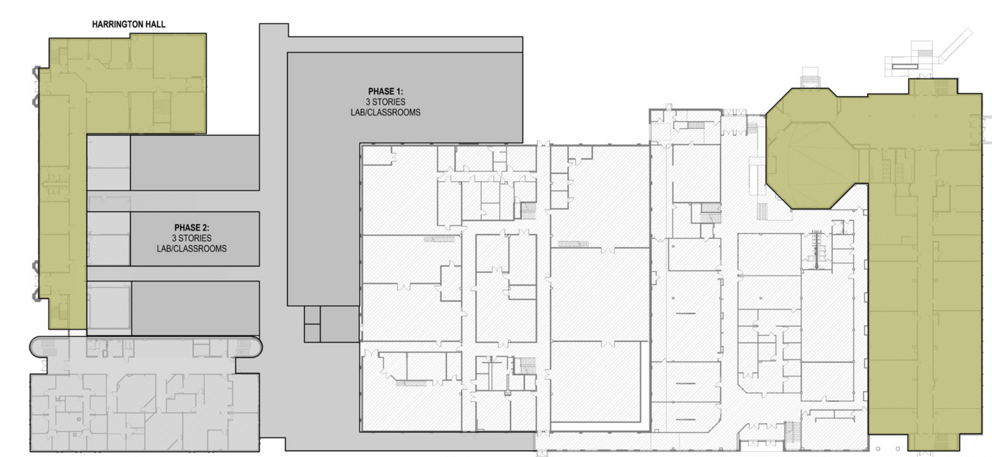
PHASE 3
Addition between Harrington Hall and Upson I



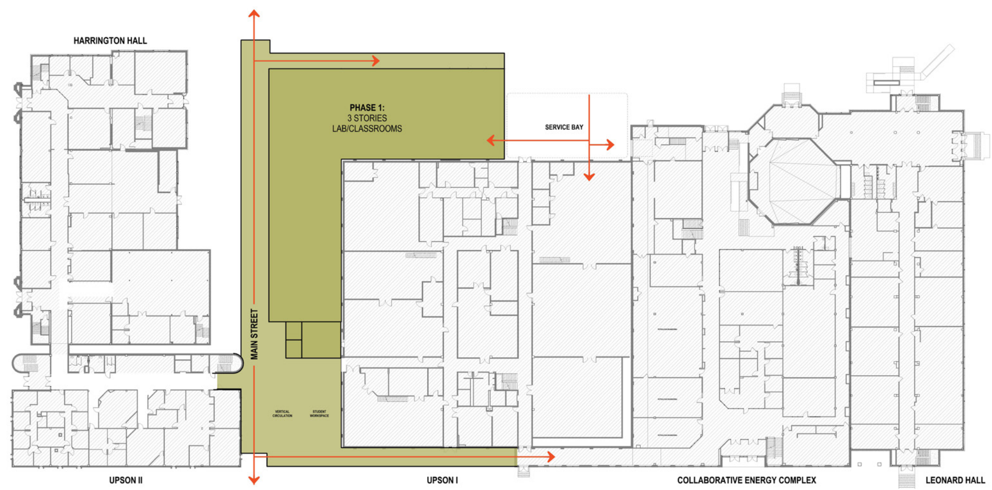
PHASE 4A
Addition between Harrington Hall and Upson I



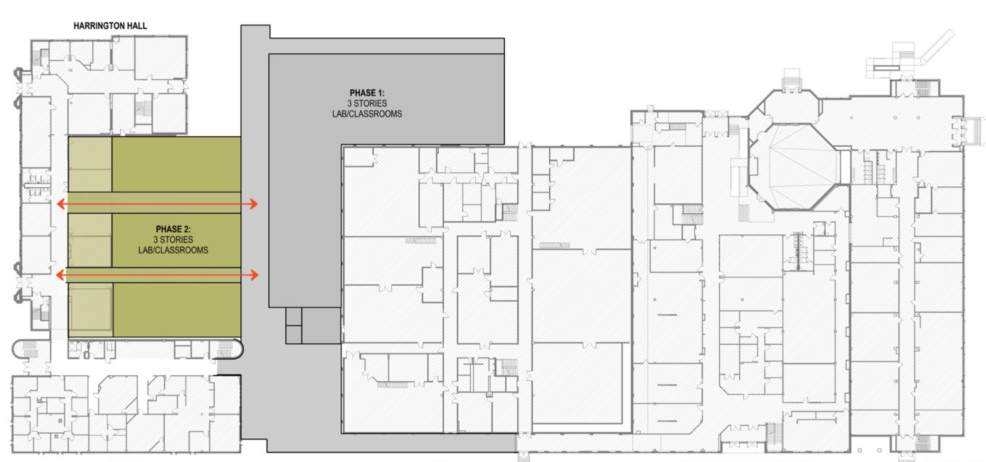
PHASE 4B
Addition between Harrington Hall and Upson I



PHASE 1
Addition between Harrington Hall and Upson I

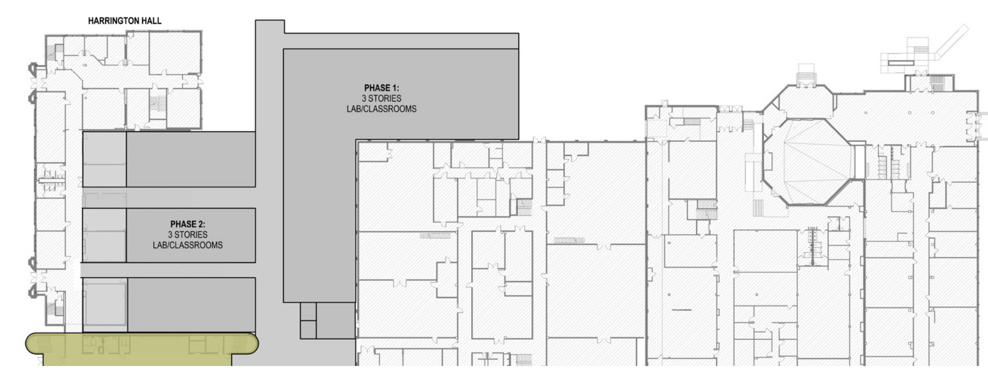


PHASE 3
Addition between Harrington Hall and Upson I

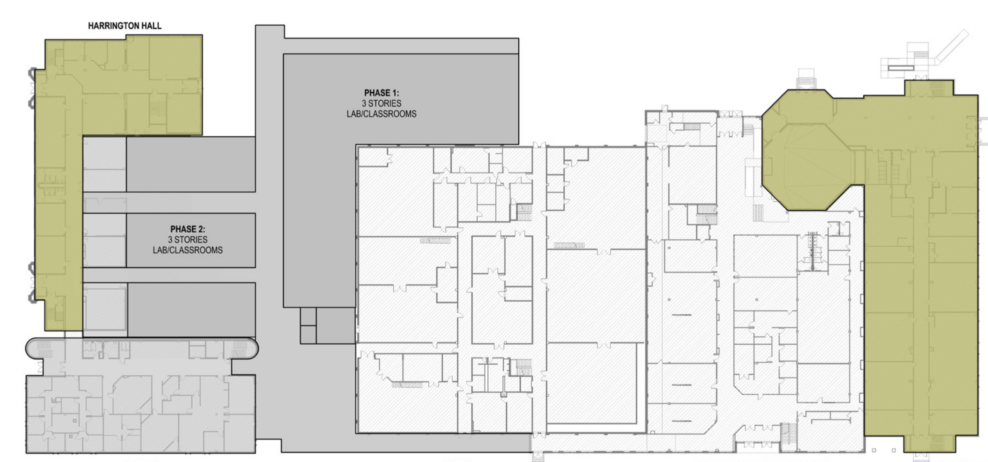


DEPARTMENT	PHASE 1			PHASE 2		
	NSF	GSF	COST	NSF	GSF	COST
Petroleum Engineering	2,178	3,821	$2,006,053	3,630	6,368	$3,025,000
Geology & Geological Engineering	0	0	$0	0	0	$0
Civil Engineering	0	0	$0	9,112	15,986	$7,505,614
Chemical Engineering	7,864	13,796	$6,585,482	4,840	8,491	$4,404,825
Electrical Engineering & Computer Science	2,387	4,188	$1,943,333	4,719	8,279	$3,693,684
Institute for Energy Studies	0	0	$4,852,719	0	0	$0
Mechanical Engineering	5,703	10,005	$0	2,904	5,095	$2,420,000
College of Engineering	1,452	2,547	$1,273,684	0	0	$0
Registrar	0	0	$0	0	0	$0
Biomedical Engineering	9,702	17,021	$7,411,491	0	0	$0
Totals	**29,286**	**51,379**	**$24,072,763**	**25,205**	**44,219**	**$21,049,123**

PHASE 3
Addition between Harrington Hall and Upson I

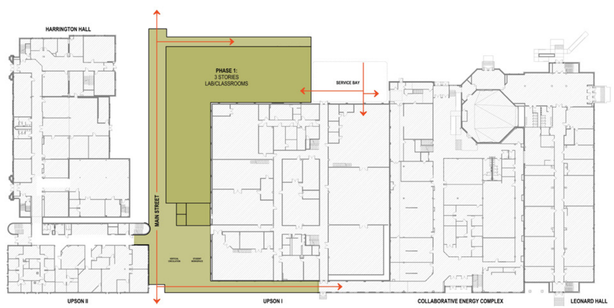


PHASE 4B
Addition between Harrington Hall and Upson I



	PHASE ONE	SUMMARY
NSF	29,286	New addition of laboratory spaces and entryway with commons.
GSF	51,379	
COST	$24,072,763	

	PHASE TWO	SUMMARY
NSF	29,286	New addition of laboratory spaces and entryway with commons.
GSF	51,379	
COST	$24,072,763	



DEPARTMENT	PHASE 1			PHASE 2		
	NSF	GSF	COST	NSF	GSF	COST
Petroleum Engineering	2,178	3,821	$2,006,053	3,630	6,368	$3,025,000
Geology & Geological Engineering	0	0	$0	0	0	$0
Civil Engineering	0	0	$0	9,112	15,986	$7,505,614
Chemical Engineering	7,864	13,796	$6,585,482	4,840	8,491	$4,404,825
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Institute for Energy Studies	0	0	$4,852,719	0	0	$0
Mechanical Engineering	5,703	10,005	$0	2,904	5,095	$2,420,000
College of Engineering	1,452	2,547	$1,273,684	0	0	$0
Registrar	0	0	$0	0	0	$0
Biomedical Engineering	9,702	17,021	$7,411,491	0	0	$0
Totals	**29,286**	**51,379**	**$24,072,763**	**25,205**	**44,219**	**$21,049,123**