

July 2019



UNIVERSITY OF DELAWARE

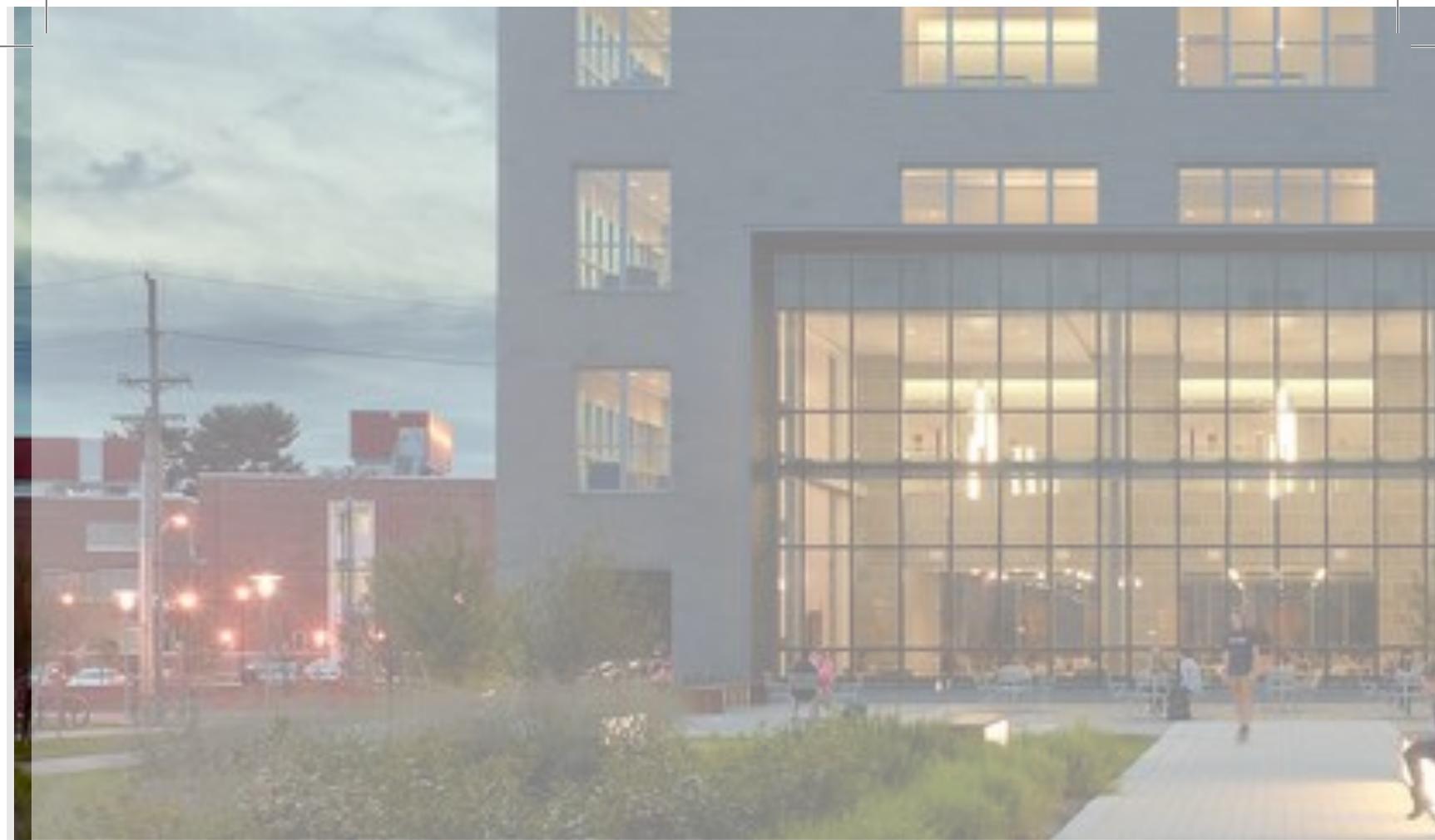
THE 21ST CENTURY CAMPUS

**CAMPUS MASTER PLAN
PHASE 3A SUMMARY**



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CAMPUS MASTER PLAN PROCESS

The University's Campus Master Plan effort began January 2018 with the goal of creating a ten year plan to inform integrated planning and decision making around space, growth, and strategic priorities. Using the president's Five Pillars as the foundational strategy, the planning team has organized the efforts into four phases: visioning, goals and objectives, alignment of strategic objectives with physical planning tactics, and documentation of the plan.

The University's Five Pillars

- Enhancing the success of our students
- Building an environment of inclusive excellence
- Investing in our intellectual and physical capital
- Strengthening interdisciplinary and global programs
- Fostering a spirit of innovation and entrepreneurship

During Phase 1, the planning team held visioning sessions and interviews, and round table discussions between January – April 2018 with over 45 campus leaders to develop an understanding of priorities and aspirations.

In Phase 2, from September 2018 – January 2019, nearly 60 participants divided into three thematic committees provided additional perspectives to establish the plan's goals and objectives. The groups were organized around three key themes:

Amplified Campus – a mixed use campus focused on elevating the campus experience

Connected Campus – a campus where short distances and increased mobility connect our culture and campus life

Translational Campus – increasing campus-wide opportunities to expand research and industry partnerships and have greater global impact

Phase 3 includes alignment strategies where the information gathered in the first two phases informed decisions around physical planning. The spring of 2019 focused on executing physical planning tactics (real estate strategies, renovations/renewal/new construction, open space, and infrastructure) Led by the Executive Committee and Advisory Committee, six Technical Working Groups with more than 170 participants were established to inform the master planning process. The information in the Phase 3A summary represents the findings and recommendations from the working groups. The campus plan establishes a road map to advance future decisions through an integrated planning approach.



Why does UD need a Campus Master Plan?

- Emphasize the importance of “One Campus”
- Maintain the unique environment of a small and big campus feel
- Leverage the opportunities at STAR and the South campus

A process driven Campus Master Plan

- Identify what does UD want to be in the future?
- What kind of campus master plan is right for UD?
- Plan a clear process
- Gather input from a variety of stakeholders
- Establish goals and objectives for the master plan
- Align strategic objectives with physical planning tactics
- Key Finding: a need for the campus master plan to inform integrated planning, governance, and decision making around space, growth, and priorities

How does the University prioritize investments within a blueprint for the future?

- Campus Wide Strategies and Policies
- Precinct Planning
- Design Guidelines

Phase 1 - Vision

- Listening
- Context for change
- Prioritization
- Align near term priorities and longer term opportunities

Phase 2 - Goals & Objectives

- Amplified Campus
- Connected Campus
- Translational Campus

Phase 3 - Alignment Strategies

- **Academics & Library**
- **Research & Laboratories**
- **Physical Campus Planning**
- **Campus Experience**
- **Administration & Finance**
- **Community & External Relations**

Phase 4 - Campus Master Plan

PLANNING CONSIDERATIONS

Goals and Key Outcomes

The University of Delaware Campus Master Plan assembles a diverse collection of places and needs into one common vision to guide future decisions around existing and new buildings, landscape, mobility and infrastructure.

The goals of the Campus Master Plan include:

- Establishing planning principles and design guidelines for the overall campus and specific campus districts
- Generate strategies for building re-use, renovation, new development, open space, circulation, and infrastructure improvements
- Create a collaborative, consensus driven process

The primary goal for the Phase 3 of the Campus Master Plan is to interpret and translate the key themes and concepts developed during Phase 2 into a comprehensive strategy and physical plan for the campus. This includes outlining the campus needs around academic and research space, as well as program considerations for an enhanced campus experience. The phase established a comprehensive vision for the campus while also considering the unique qualities of campus districts.

A diverse collection of University representatives were engaged to help form the strategies and development the alignment priorities. Along with these stakeholders, the work established the creation of policies, guidelines and implementation strategies.

Phase 3 Campus Master Plan Working Groups

University stakeholders were divided around six different topics to focus the conversations with key University representatives informing the plan. In addition to the working groups, the strategies were also informed by conversations with students, faculty, an advisory committee, and executive leadership committee.

Each Working Group considered the plan from the vantage point of its focus area. The groups included:

1. Academics & Library
2. Research & Laboratories
3. Physical Campus Planning
4. Campus Experience
5. Administration & Finance
6. Community & External Relations

1. Academics & Library Working Group

The Academic Working Group provided information related to the current campus teaching and learning spaces (including the Library) and the challenges associated with delivering high-quality academic experiences for undergraduate students, graduate students, and faculty. The working group also defined the types and characteristics of academic and learning spaces that will be necessary to meet the strategic directives for the University. The groups also helped determine the physical and technological requirements necessary to adapt to evolving pedagogies and encourage interdisciplinary collaboration. This group developed an estimate of the physical space program necessary to meet near and long term needs associated with academic learning spaces.

2. Research & Laboratories Working Group

The Research and Laboratories Working Group developed an understanding of the relationships between campus research and laboratory facilities and the challenges associated with delivering a high quality research experience for undergraduate students, graduate students and faculty. This working group also defined the types and characteristics of research and laboratory facilities necessary to meet the goals of the University and assist in the development of the physical space program necessary to meet the needs. This group also developed test alternative planning scenarios to expand, contract, renovate, update or adaptively re-purpose research facilities in context with highest and best use parameters.

3. Physical Campus Planning Working Group

The Physical Campus Working Group focused on the existing physical challenges, needs and priorities of the University as it seeks to implement and advance the strategic goals. The group provided information and guidance towards the development of planning strategies. The group was divided into four focus topics to guide direction around mobility, building facilities, open space, and infrastructure. The focus groups also met together to discuss areas of conflict, synergies and alignment.

- **Transportation and Mobility**
Explored strategies for all mobility types, including vehicular, transit, parking, biking, and pedestrian movement. The group explored opportunities to improve campus mobility and better align and integrate the different systems together.
- **Infrastructure**
Outlined the status of existing infrastructural and operational systems on campus. The group developed priorities of near and long-term campus infrastructure initiatives associated with the master plan. The group also explored sustainable approaches at a variety of scales and timetables to provide greater performance and return on the campus systems.
- **Facilities**
Outlined existing building facilities requiring attention due to deferred maintenance and renovation needs. The group also explored opportunities for adapting new uses within existing structures and explored sites in the campus core for infill and new construction. Developed an evaluation matrix when exploring the potential of existing campus facilities to meet the near and long term needs of the University.
- **Open Space**
Developed strategies and policies for the network of natural and landscaped spaces, streets, and other open space components of the campus. Provided analysis and framework for the extent, character, structure and programming of each space. Develop landscape policies and guidelines, planting and material, and environmental best practices.

4. Campus Experience Working Group

The Campus Experience Working Group considered the social, extracurricular, and recreational aspects of student life on campus. They helped determine the needs associated with student success at UD—such as study spaces, technology, student support, maker’s space, wellness, and engagement. This group played a critical role in defining the characteristics that comprise the unique cultural identity of the University of Delaware, as well as the programs and initiatives that support the desired cultural outcomes inherent in the implantation and advancement of the University’s shared aspirations.

5. Administration & Finance Working Group

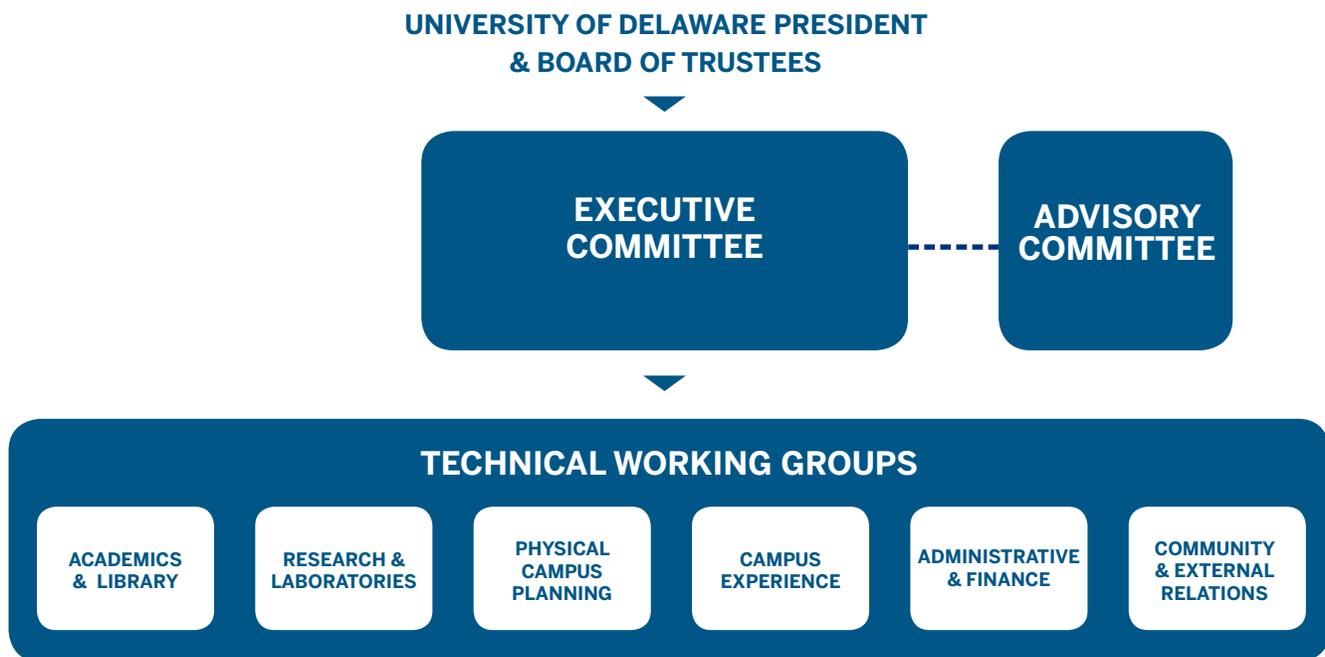
The Administration & Finance Working Group concentrated on implementation and management strategies related to the Campus Master Plan. Evaluated the impact of current, near and long term facilities with considerations of the capital, deferred maintenance, and other university budgets. The group explored various policy strategies that could be adjusted as the plan is implemented, as well as the best approach for project delivery and execution.

6. Community & External Relations Working Group

The Community & External Relations Working Group focused on the relationship between the University and the surrounding community including the City of Newark and the town residents. The group explored goals around current and future initiatives for the recruitment of diverse populations, engagement of the university community, and management of external relationships. Explored the potential to create or leverage existing relationships with our neighbors, the City of Newark, and the region as it relates to the implementation of the physical master plan.

ENGAGEMENT

The development of Phase 3: Alignment and Strategies has involved many representatives of the University of Delaware, a dedicated team of consultants, executive leadership, and an advisory group. The planning study was developed working together with these groups and advisors, students, and faculty who were integral to the process. We would like to thank them for their contributions to the work.



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ENGAGEMENT

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GUIDING PRINCIPLES

The planning study outlines strategies to create dynamic places for teaching, research, and learning centers, residential life communities, open space, recreation, and support services. It considers how the systems around mobility, infrastructure and sustainability link all of these programs together.

The vision is rooted in the need to think boldly, comprehensively, and strategically. It considers how to strengthen existing resources and transform under-utilized spaces by establishing into unique destinations on campus. The plan strives to align the bold vision outlined in the initial phases into implementation strategies guiding future decisions.

Organizing Ideas

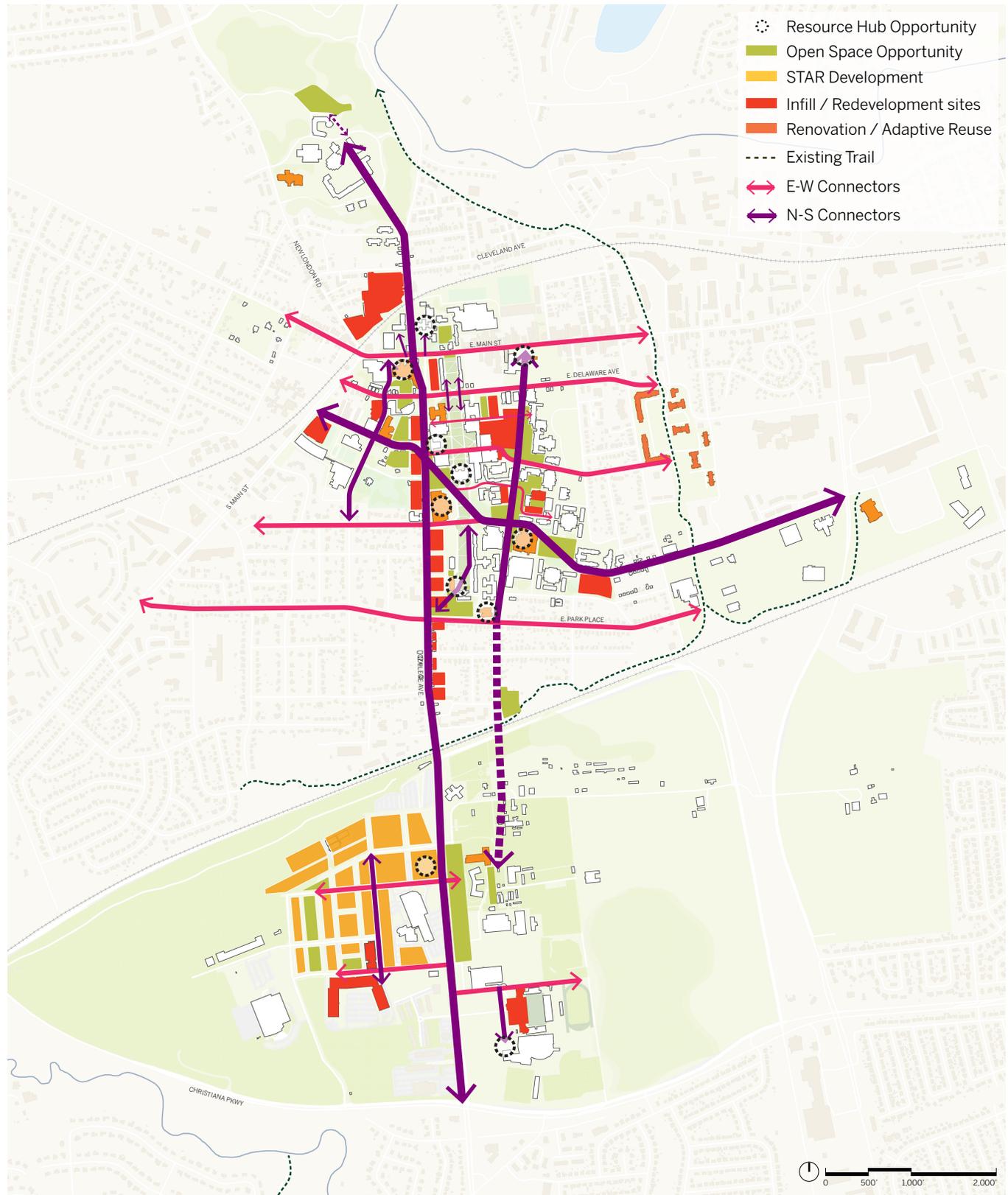
The planning study is informed by a series of organizing ideas rooted in the character and qualities of the existing campus, redevelopment potential of underutilized areas, and relationships to the larger campus community. These campus-wide considerations are intended to inform opportunities around future growth, open space improvements and development potential while responding to and enhancing the University's strategic goals.

- Strengthen north-south corridors
- Enhance east-west connectivity and introduce “new diagonal”
- Link Green, Laird and South campus together
- Enhance existing mixed-use campus district
- Re-purpose spaces as networked resource hubs
- Develop swing building(s) for office and research labs
- Integrate space for student activities
- Identify partnership opportunities

Guiding Principles

- Emphasize “One Campus”
- Continue to strengthen and enhance to Campus Core
- Emphasize the first year student experience around the Green
- Create a pedestrian-focused, walkable and bikeable campus
- Prioritize underutilized campus buildings to accommodate new uses and future academic needs
- Better integrate STAR as integral part of overall campus experience
- Recognize the potential for a new gateway along South College Avenue
- Further align transit alternatives with optimal user experience
- Recognize Main Street with the potential to provide space for future needs in a mixed-use environment

Campus Planning Framework





PLANNING FOR THE FUTURE

A blue-tinted photograph of a modern building with a walkway and people. The building has a grid of windows and a light-colored facade. In the foreground, a paved walkway with a grid pattern leads towards the building. Several people are visible: one person is sitting on a wooden bench on the left, looking at a phone; another person is walking away in the middle ground; and a third person is walking towards the camera on the right. The overall scene is a modern, open-plan environment.

PLANNING FOR THE FUTURE

Through the coordination with the Working Groups, as well as alignment from previous planning studies, several renovation, reuse, infill and new development projects were identified. Conditioned project prioritization by the University is needed to identify near and longer term implementation timeframes.

Renovation / Adaptive Reuse Opportunities

The working groups identified the following potential renovation / reuse projects of existing buildings not currently meeting the needs of today's programming. Some of these buildings have prior renovation studies completed that can be referenced for additional details.

- Trabant Student Center
- Perkins Student Center
- Purnell Hall
- Sharp Lab
- Warner Hall
- Morris Library
- Hartshorn Hall
- WorriLOW Hall
- Academy Building (reuse potential)
- Delaware Biotechnology Institute (backfill)
- University Courtyard Apartments (acquisition)
- Courtyard by Marriott (reuse)

Infill / Redevelopment Opportunities

Through discussions with the working groups and studies developed by the planning team, multiple infill and potential redevelopment sites were identified. Many of these sites are currently underutilized with surface parking, outdated facilities, or areas where additional density could be achieved.

- Building "X" (existing McKinly building)
- Whitney Athletic Center expansion
- Conover Apartment site redevelopment
- Future Interdisciplinary Social Science Center
- Lerner College renovation / expansion
- West of College Avenue sites (existing wood frames)
- South Green / South College Avenue sites
- Engineering and Sciences precinct infill / redevelopment
- Alison Hall parking lot site
- Penny Hall infill / redevelopment
- East Campus / Wyoming Street infill
- College Avenue / Main Street infill site
- North Surface Parking Lot

STAR Campus Development Opportunities

The STAR Campus provides great new development potential for the University and future partnership buildings. The University previously completed a STAR campus plan which can be referenced for additional development details.

- Biopharmaceuticals Building / NIIMBL (under construction)
- Newark Train Station (under construction)
- Hotel and conference center
- FinTech building
- Other future partnership buildings
- Housing
- Food / beverage / retail and amenity uses
- Community gathering space
- Mobility hub

Projected Population Increases

The University provided projected growth targets for faculty members, undergraduate students, and graduate students. The faculty increases include a focus on new cluster hires. In addition to the net new increase in faculty, there is also a significant number of retiring faculty expected in the coming years. Supporting UD staff numbers will also be impacted by these increases.



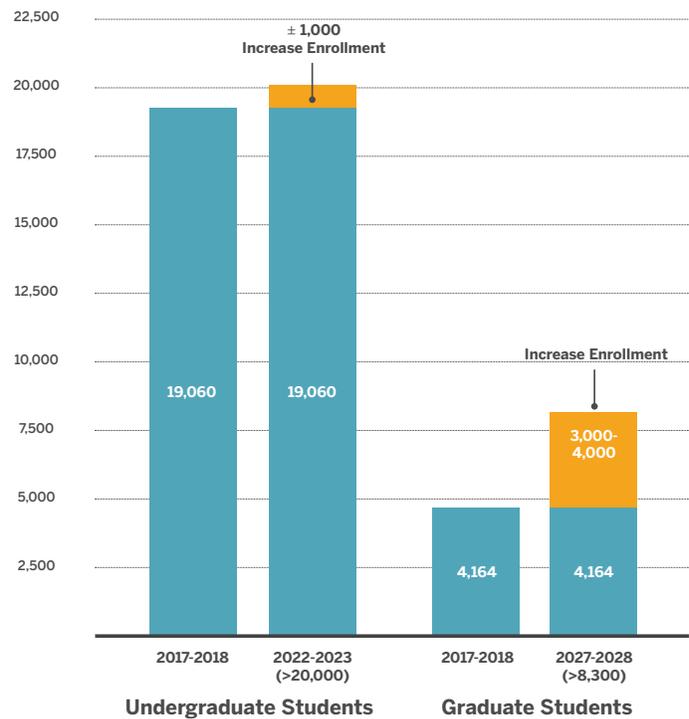
Projected Faculty Growth

- Planning projections for 250 net new faculty hires is considering a 10-year time frame.
- 99 of net FTE hires has already been hired, 151 FTE is planned to be hired
- Many senior faculty members are expected to retire in the next few years which will also have impacts on the hiring targets.

New hire ratios are assumed:

- 2/3 new hires: experimental researchers
- 1/3 new hires: quantitative researchers
- Advance programmatic synergies (cluster hires, thematic research)
- Align department assignments with strategic hiring around clusters

The student growth is primarily targeted in the graduate population, but some additional undergraduate students are also projected. With the increase in student numbers comes an increasingly more diverse and international student population.



Projected Student Growth

Planning Projections:

- +1,000 undergraduate student increase
- +3,000-4,000 graduate student increase

ACADEMIC SPACE

KEY FINDINGS

With leadership from the Academic Working Group, the following space considerations around teaching and learning spaces were outlined. The space understanding builds from the University's 2013 Space Utilization Study.

Classrooms

As per the instructional space update, the University likely has sufficient square footage to accommodate current and projected classroom needs. However, much of this existing space is not currently configured to support active learning and other changing pedagogies.

- The University should form a standing classroom committee that can monitor and prioritize classroom renovations.
- Ascertain which current classrooms are good conversion candidates for active learning.
- Absent specific pedagogical guidance, consider room sizes of 40 and 120 seats for active learning, with 30-35 assignable square feet per station.
- Technology investments should focus on infrastructure, allowing users to “plug-n-play” with their own devices.
- For the classroom committee to be effective, it will need to be a stated priority of senior University leadership, and it will need to have a dedicated annual budget.

Teaching Laboratories

The instructional space update found that the University likely has sufficient teaching laboratories to accommodate current and project needs. However, the fit is tight, particularly for chemistry and physics.

- Recommend, for planning purposes, the University consider some additive need for teaching laboratories on a small scale.
- A reasonable allotment for this purpose would be to consider six laboratories of 1,500 square feet with a 15% service component and a 60% grossing factor for a total of approximately 18,000 gross square feet.
(Note that these calculations do not include the College of Engineering which has undertaken its own study.)

To ensure efficiency and planning alignment, all other space needs calculations have been rolled into the Research Working Group and is outlined on the following pages. The Academics and Library Working Group focused instead on policy-oriented issues, and recommends an emphasis on creating collaborative work environments.

Office and Research Space

- Establish a standard for smaller private offices, ± 100 assignable square feet, with more collaboration space.
- Given the significant potential growth in graduate students, the university should not provide private offices for graduate students; nor should it provide private offices for most administrative staff.
- The University should actively incentive faculty to explore innovative work environments.

Library and Collaboration Space

Prioritize reinvestment in Morris Library as a university hub, potentially co-locating student support services here (such as the math center, which needs a new permanent home, the writing center, tutoring, etc.).

- As part of this reinvestment, consider installing a remote retrieval system to maximize opportunities for social and collaboration space within the building proper.
- The University should continue to investigate opportunities to create collaboration spaces within the Library and other existing buildings.
- Potentially consider repositioning Memorial Hall as a student space (which would require replacing its classrooms).

RENOVATION AND DEMOLITION PRIORITIES

With respect to STEM buildings, based on available condition and suitability data, the university should prioritize reinvestment in Spencer Lab, Colburn Lab, and DuPont Hall as lab buildings.

Drake Hall should down-cycle and be re-purposed as a general academic building. Evans Hall is another renovation priority. Sharp Lab is potentially a renovation/replacement candidate, but this will depend on the execution and final program of Building X.

In addition to these buildings, university staff identified several other priority candidates:

- Penny Hall, McDowell Hall, and Willard Hall Education Building do not have a good fit-to-function. Willard and McDowell are potential demolition candidates.
- Ewing Hall and Wolf Hall are strong renovation candidates
- Purnell Hall should be considered for demolition and the College of Business' accreditation concerns addressed
- Other potential demolition candidates include: Pearson Hall, Graham Hall, Kirkbride Hall, and the Amy Dupont Building

RECOMMENDATIONS

In general, the University should reserve new construction for wet science and active learning (if no suitable conversion candidates are available).

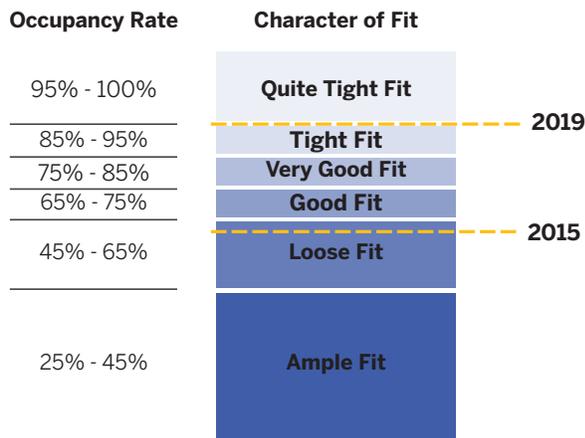
- This should be paired with a strategy to re-purpose old space for office uses.
- Where possible, this may be best executed through strategic additions to existing buildings.
- As part of this reorganization, the university should consider, where appropriate, using themes (rather than departments) as the organizing principle.
- The task force identified swing space as a key limitation in implementing any such strategy, and from a prioritization perspective, unanimously preferred renovation over new construction.
- Moving forward, it is also important the university balance investment between the core campus and STAR campus.

RESEARCH SPACE

KEY FINDINGS

With the assistance of the The Research and Laboratory Working Group, the following findings and recommendations outline the space needs around research space on the campus. This includes an understanding of the current utilization and future space needs to meet the continued growth on campus. The findings use the prior 2015 Utilization Study as a base with updates to represent current conditions provided by the University.

Research Space Utilization



Ideally research space utilization will fall into the "Very Good" or "Tight Fit" categories.

Current Occupancy Demand

The comfortable, loose fit occupancy identified in the 2015 utilization capacity study is quite close to being fully consumed by rapid growth of 100 or so net new PI teams recruited over the past two years.

The occupancy model anticipates it will be more than full when the new recruit's research efforts fully mature in a few years and reach performance targets. In fact, their space needs are projected to grow well beyond 2019's available research capacity, even if there were no further net add recruit growth.

- Strains of addressing rapid growth are apparent today in all the Colleges.
- The utilization model indicates that all Colleges exceed a comfortable occupancy condition and are experiencing a relatively uncomfortably tight occupancy fit.
- Vacant space and other reserves appear to be substantially consumed while non-PI contingent-use space assignments in the Colleges will be increasingly squeezed and more difficult to justify.
- Although certain existing facilities may not perfectly suit exacting technical demands for science and engineering research, they are fully subscribed.
- With reserves mostly consumed and compacted tightly, research space capacity is now characterized as over-utilized.
- Office space is especially highly-utilized and will continue to be in short supply for PI recruits in both experimental and computational research.
- Collaborative conference rooms are being expediently cannibalized to create multiple new private offices.
- Decision-makers should note that when research offices are fully assigned, the experimental lab spaces associated with the offices are also characterized as full, despite underutilized SF, bench or seat capacity within the experimental lab space. This applies to both compartmentalized and open laboratory floor plans.

New Recruit Space Needs

The need for additional research space capacity to fit the current un-met space needs for those already recruited is further impacted by the need to develop additional space to house the remaining 150 PIs yet to be recruited by 2024. That is a substantial challenge.

- Without development of additional space capacity, net add recruiting efforts will certainly be impacted.
- What we understand from young recruits is they can rationally acknowledge not being assigned a full-sized research space allotment first thing, yet they all expect to be shown reasonable assurance that when they merit it, enough space will be available.

Viability for Research-Use Renovation

If existing, worn research space is renovated, a substantial increase in PI occupancy needs to be obtained to warrant the investment.

- A 20-25% increase is reasonable.
- If this can't be achieved, consider that a "refresh" renovation is far less compelling than a state-of-the-art addition, or replacement, where increased utilization is readily achieved.
- Do not re-create facilities which continue to support low occupancy utilization.
- In some cases, adaptive re-use from wet lab to computational research, or other office-based function may be a better choice, understanding replacement is not always viable.

RESEARCH SPACE

RECOMMENDATIONS

Projected Research Space Needs

The following projected research space need assume an average “Business” class quality space allotment for each PI recruit team @ 1500 Net SF per experimental PI and 750 Net SF per computation/quantitative PI.

At a 3:2 experimental to computational recruit ratio, this averages to 1,340 Net SF per PI recruit.

Note that the working assumption of 3:2 is based upon a rough analysis of the actual net add 100 PI recruiting efforts 2017-2019.

The Net SF figure is then scaled up to an average of 3,400 Gross SF per PI recruit team once research space reserves which include platform core labs, research administrative space, vivarium, building amenities and support spaces are added as well as adding SF for restrooms, structural, interior and exterior architectural walls, life safety exit stairs and corridors, mechanical, plumbing, and electrical support spaces.

These projected “Business” class quality research SF needs per PI recruit can be reduced in size if the University decision-makers commit to adopt an assertive, sustainable research space policy which reduces expectations for the average PI team space allocation by as much as either a:

- GSF reduction of 20% for an “Premium Economy Plus” class allocation; or a
- GSF Reduction 30% for an “Economy Plus” class allocation; or a
- GSF Reduction of 45% for an “Economy” class allocation.
- Each PI SF allocation reductions listed above are realistic having been applied on many real-world projects designed by Jacobs Laboratory Planning Group at multiple new facilities serving top academic research institutions.

2017-2019 PI Recruit Growth Period

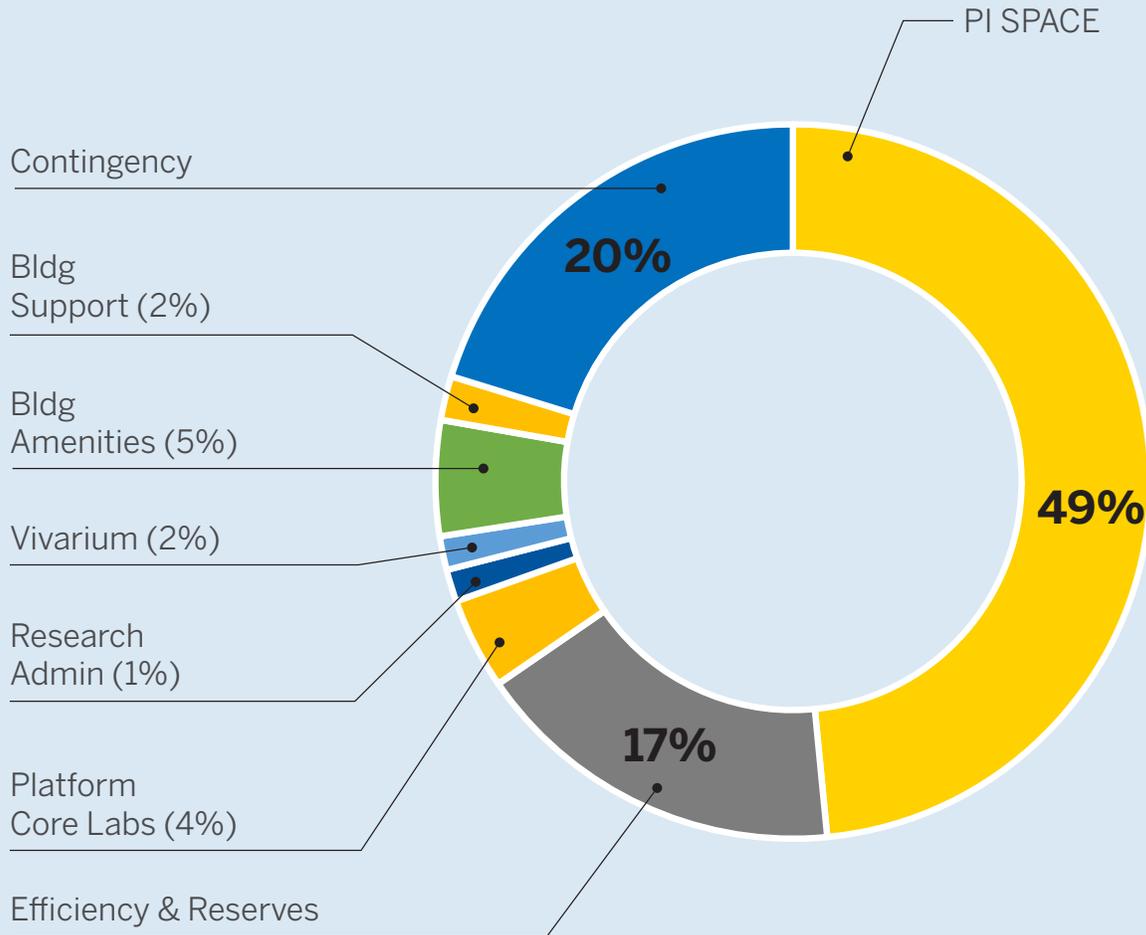
All GSF projections based on “Business” class space allocations to PI recruits. Future recruits have projected space “needs”, while recruits hired and in place have space “demands”.

The working assumption is that the 2017-19 new recruits space demand has been resolved by assigning them within existing SF reserve capacity = 130,000 Net Square Feet (NSF) or by assigning them in an undetermined amount of space vacated by those who left UD over the last 3-4 years.

Future NSF capacity is planned to re-capture the 130,000 NSF reserves occupied by the 2017-2019 recruits.

- Of the 198,000 NSF modeled need subtracting 130,000 NSF housed in existing NSF reserves = 68,000 NSF space demand as the remaining calculated space needed for direct assignment to fully mature PI recruits.
- Assume for a few years, that all PI, especially the less than fully mature PI recruits will adapt to less than ideal NSF availability as they await impending increased capacity.
- Also, assume the 130,000 NSF of reserve space occupied between 2015 and 2019 remains occupied to be replenished in the late 2020s.
- The new AP BIO facility features 48,300 NSF reserved for NIIMBL and is not included as available PI recruit capacity.
- The remaining AP BIO capacity of 87,800 NSF is available NSF capacity. 87,800 NSF less the 68,000 NSF space need = 19,800 NSF to support future recruiting efforts. For reference, this calculates at a about 75% of an AP BIO floor.
- Available private PI office capacity likely limits the potential PI occupancy potential here. (See analysis of AP BIO below for further findings.) Consider the potential for the available unassigned capacity as potential renovation swing space.
- A known unknown exists with additional capacity developed post-2015 research space study on the STAR campus. The significant NSF figure is not yet available (NSF) for this report, but it is understood this space accommodates current SF shortfall and significant recent PI recruit growth.

PI-Count Driven Building Size Calculator



"Business Class" PI Research Space Demand Model

(similar to current planning for proposed building "X")

Net add	Recruit Count	PI Allotted Net Sq Ft.	Gross Sq. Ft
2015-2019	110	198,000	371,000
2019-2024	140	254,000	476,000
2024-2029	51	93,000	175,000
2029-2034	55	100,000	188,000
2015-2034 Overall Impact	356	645,000	1,210,000

* The Net Square Ft include an added 10% planning contingency.

RESEARCH SPACE

RECOMMENDATIONS

Future PI Growth Periods

An additional 254,000 NSF is needed to house the continued rapid growth of PIs recruited over the next five (5) years once they reach mature performance.

- Assume 100% NSF capacity at University of Delaware in 2019 is all but fully occupied or reserved for renovation swing space. Perhaps more space becomes available from de-compacting associated with on-going retirements and moves;
- Building “X” planning adds a net additional 79,000 NSF. (See analysis of Building “X” below for further findings);
- Unmet demand is: 254,000 NSF (need) – 79,000 NSF (Bldg “X”) = 175,000 NSF (need) to house the remainder of those not housed in Building “X” of the 150 PI recruited between 2019 and 2024;
- Another 130,000 NSF (replenishment) is needed to release the NSF Reserves consumed (occupied) between 2015-2019;
- The net remaining total need (demand) developed through the 2024 PI recruit period is then 175,000 (need) + 130,000 (replenishment) = 305,000 NSF;
- Note that research facilities permanently removed from available NSF inventory capacity are not included in these calculations and once removed, would increase overall NSF space need;
- The further five-year periods ending in 2029 and 2034 assume a much slower growth rate of PI recruits whose space needs are estimated at 93,000 NSF and about 100,000 NSF more, respectively inclusive of related reserves. Total estimated future need for the period from 2024-2034 is an additional 193,000 NSF.

The Need for Swing Space

Replacement and renovation both require relocation of current occupants. As available research space approaches effective full occupancy with dwindling reserve SF, the option of having current occupants tolerate further space tightening to free up SF and absorb dis-located colleagues becomes increasingly intolerable, if not unworkable. More space capacity is a straight-forward solution.

Does a permanent research swing building make sense? If occupancy utilization is low, it's generally much better for neighboring research occupants to take a deep breath and temporarily accommodate dislocated guest scientists and engineers. More difficult, but not impossible when research space occupancy is high. Relocation into a temporary swing space is only recommended if the planned swing place move(s) is reasonably short-term, less than three to four months occupancy. Longer than that becomes less tenable over time. Two moves within a short period most always disrupts active research, negatively impacting career trajectories.

A common alternate approach develops new research space capacity specifically fit to the PI who occupy space targeted for major renovation. The new space becomes their new permanent new workplace. Additional swing space capacity is then developed for the next renovation target. Also, note that relocations are a rare opportunity to improve PI occupancy utilization aligning new space allocation policy with high quality new space. It is rarely a 1:1 SF transfer.

How Much Swing Space?

How big a space needs to be developed? Enough NSF to effectively vacate significant swathes of contiguous space in facilities targeted for renovation, whole multi-story wings, or at least whole floors to allow for economical construction.

- Recommended minimum size of contiguous space = 20,000 to 24,000+ Net SF / 34,000 to 41,000 Gross SF.

PI-Count Driven Research Building Size Calculator Example

DESCRIPTION	UNIT	RATE	2019-2029	RANGE	NOTES
wet : dry ratio			3:1		wet:dry ratio set as future target
A DRY PI EQ	QTY		22		target quantity
B WET & DAMP PI EQ	QTY		68		target quantity
C TOTAL PI RECRUIT COUNT	QTY		90		(A+B)
D SF / DRY PI EACH	NASF		400		best practice; 3-4 occupants @ 100 SF/seat
E SF / WET PI EACH	NASF		800		best practice; 3-4 occupants @ 200 SF/seat
F SPACE DEMAND	NASF				
G DRY PI RESEARCH SPACE			8,800		(A x D) rounded (100)
H WET PI RESEARCH SPACE	NASF		54,400		(B x E) rounded (100)
I SUBTOTAL PI SPACE	NASF		63,200		(G+H)
J DESIGN EFFICIENCY	NASF	10%	6,300	0-15%	Bldg design-specific; 0% = perfect match to model 250SF Faculty Office & FTE Office SF + 600SF Wet Lab / 150 SF Dry Research SF ; variables include SF/lab bay module dimensions; structural bay; PI office SF; ...
K DEAN'S RESERVE	NASF	15%	9,500	10-15%	
L VACANCY RESERVE	NASF	10%	6,300	5-10%	
M TOTAL PI SPACE	NASF		85,300		(I+J+K+L) rounded (100)
N PLATFORM CORE LAB	NASF	10%	5,400	5-15%	% of WET PI SPACE (H) SHARED RESOURCE
O RESEARCH ADMIN	NASF	3%	1,900	3-5%	% of SUBTOTAL PI SPACE (I)
P VIVARIUM	NASF	15%	2,000	15-20%	% of WET PI RESEARCH SPACE (H)
Q BLDG AMENITIES	SF	8%	6,800	7-10%	% of TOTAL PI SPACE (M) LOBBY, CAFÉ, BREAK-OUT, SOFT SEATING
R RESEARCH BLDG SUPPORT	SF	3%	2,600	4-5%	% of TOTAL PI SPACE (M) RESEARCH-SPECIFIC BACK OF HOUSE SF
S CLINICAL SPACE	SF			0%	Add As Applicable
T ACADEMIC TEACHING SPACE	SF			0%	Add As Applicable
U NON-RESEARCH ADMIN SPACE	SF			0%	Add As Applicable
V SUBTOTALS	SF		104,000		(M+N+O+P+Q+R+S+T+U)
W CALCULATED TOTALS	GSF	59%	176,000	55-60%	Divide Rate by SUBTOTAL (V) (inverse)=1.7 x NSF=GSF (rounded 1.00)
X PLANNING CONTINGENCY (+)	GSF	15%	26,400	0-15%	% of CALCULATED TOTALS (T) (UNKNOWNNS)
Y GRAND TOTAL PLANNING	GSF		202,000		w/contingency (rounded 1000)

* convert net assignable sq ft to building gross sq ft

PI Research Space Demand Model

DESCRIPTION	UNIT	RATE	NSF/PI	2015-2019	2019-2024	2024-2029	2029-2034	2015-2034	NOTES
wet : dry PI Recruit ratio (hybrid=wet)				3 : 2	3 : 2	3 : 2	3 : 2		wet:dry ratio set as future constant based upon 100 PI recruits
A DRY PI EQ	QTY			45	56	20	22	143	
B WET PI EQ	QTY			65	84	31	33	213	
C TOTAL PI RECRUIT COUNT	QTY			110	140	51	55	356	
D SF / DRY PI EACH (Economy Class)	NASF		400						3-4 occupants @ 100 SF/seat
E SF / WET PI EACH (Economy Class)	NASF		800						3-4 occupants @ 100 SF/seat
F SPACE DEMAND									
G DRY PI RESEARCH	NASF			18,000	22,400	8,000	8,800	57,200	rounded (100)
H WET PI RESEARCH	NASF			52,000	67,200	24,800	26,400	170,400	
I SUBTOTAL PI SPACE	NASF			70,000	89,600	32,800	35,200	227,600	
J DESIGN EFFICIENCY	NASF	0%							apply to extg facility to align structural bay; lab module size;
K DEAN'S RESERVE	NASF	15%		10,500	13,400	4,900	5,300	34,100	allotted outside individual PI space;
L VACANCY RESERVE	NASF	10%		7,000	9,000	3,300	3,500	22,800	allotted outside individual PI space;
M TOTAL PI SPACE	NASF			87,500	112,000	41,000	44,000	284,500	rounded (100)
N PLATFORM CORE LAB RESERVE	NASF	10%		5,200	6,700	2,500	2,600	17,000	% of WET PI ASF
O RESEARCH ADMIN RESERVE	NASF	3%		2,100	2,700	1,000	1,100	6,900	% of SUBTOTAL PI ASF
P VIVARIUM RESERVE	NASF	15%		1,900	2,400	900	1,000	6,200	% of WET PI ASF
Q BLDG AMENITY RESERVE	SF	8%		7,000	9,000	3,300	3,500	22,800	% of TOTAL PI SPACE
R RESEARCH BLDG SUPPORT RSRV	SF	3%		2,600	3,400	1,200	1,300	8,500	Research facility-specific back of house space
S ACADEMIC TEACHING SPACE	SF								Research facility-specific back of house space
T NON-RESEARCH ADMIN SPACE	SF								Research facility-specific back of house space
U SUBTOTAL PI NSF + RESERVES	SF			106,300	136,200	49,900	53,500	345,900	
V CALCULATED TOTALS	GSF	59%		180,000	231,000	85,000	91,000	587,000	(inverse) = 1.7 x NSF = GSF (rounded 1,000)
W PLANNING CONTINGENCY (+)	GSF	10%		18,000	23,100	8,500	9,100	58,700	rate range (0-15%)
X GRAND TOTAL PLANNING			GSF/PI	2015-2019	2019-2024	2024-2029	2029-2034	2015-2034	w/contingency (rounded 100)
X1 Economy Avg PI Allocation	GSF	100%	1.810	198,000	254,100	93,500	100,100	645,700	800/400 NSF allotted 1050 NSF / 1775 GSF per PI
X2 Economy Plus Avg PI Allocation	GSF	125%	2.270	247,500	317,625	116,875	125,125	807,125	1000/500 NSF allotted 1225 NSF / 2100 GSF per PI
X3 Premium Economy Avg PI Allocation	GSF	150%	2.720	297,000	381,150	140,250	150,150	968,550	1200/600 NSF allotted 1475 NSF / 2,500 GSF per PI
X4 Business Class Avg PI Allocation	GSF	188%	3.400	371,250	476,400	175,300	187,700	1,210,650	1500/750 NSF allotted 1850 NSF / 3,125 GSF per PI
X5 Premium Business Avg PI Allocation	GSF	225%	4.080	445,500	571,725	210,375	225,225	1,452,825	1800/900 NSF allotted 2200 NSF / 3,750 GSF per PI

Notes & Assumptions

- Projections are for research related needs/functions only; Excludes teaching, non-research administration, etc.
- 100% Model Calculations are based upon an "average" Principal Investigator (PI) Baseline = "Economy Class" space allocation
- Assumes goal to recruit 250 net add PI teams 2017-2024 following by continued net add PI recruitment at a much slower 2% annual rate in following years.

RESEARCH SPACE

Recent New Construction and Proposed Research Facility Supply

AP Bio Building

- Upon review, the AP BIO Floor plans are configured with relatively few faculty (PI) offices that effectively anticipate an average PI having a large team of 10-12 FTE, a surprising finding as the average PI team at University of Delaware featured 3-4 FTE members during the 2015 research space study.
- On the surface, this new facility appears to be significantly under-officed compared with UD and peer institution averages, embedding high aspirations for an average PI team count.
- An airline seat class analogy would be equivalent to a "First" class SF assignment per average PI. Under-officed research floors are not particularly unique, a result of referencing facility benchmarks from the past when larger PI teams were the norm.

Building "X"

- The proposed Building "X" floor plans currently feature a slightly higher density of faculty (PI) offices per floor than AP BIO. It is designed to accommodate an average PI team count of 6-8, one-third higher than the average counted in the 2015 study.
- An airline seat class assignment analogy to the SF and seats provided would be an "Business" class quality.
- If this proves to be too gracious, a simple approach to achieve increased PI assignment concentration is to add (carve out) at least 1/3 more offices on each floor, with no additional SF, effectively converting experimental space into offices.
- If considered, this approach to potentially develop an average SF assignment equivalent to an "Economy" class, increases the PI occupancy utilization while reducing the facilities construction cost due to rebalancing the functional space with more office SF & less experimental SF.
- Another design consideration is to fully eliminate the territorial "compartments" defined by even the partial walls dividing lab space assignments that PIs effectively use to defend their space assignment from encroachment. Intervening full or partial walls of any kind are a well-understood compartmental territorial advantage that defeats the concept of more easily sharing space across under-utilized space within an open lab.

New Research Facility Development Guidelines - Recommended Policy

Reserve new construction investment, whether free-standing or major additions to fulfill needs for the most technically-challenging research space. New construction should substantially improve the technical quality of the research facility portfolio. Where reasonably and feasible, locate less environmentally demanding research into existing facilities at good occupancy concentrations, while expecting full-utilization that features tightly fit occupants in newly constructed facilities.

- Abundant space is a recruiting tool of the past. More intimate, higher quality space works quite well and may counter-intuitively be even more attractive to recruits who, not surprisingly thrive in actively more social, collegial and interactive close quarters.
- Not to be dismissed as a passing fad, what is now a long-term continuing trend assigns much fewer square feet to individuals while simultaneously creating more shared use space, such as platform core labs and a broad functional array of strategic, subsidized research functions. This results in a more concentrated research occupancy for both experimental and computational research space.
- The recommended approach is for the University to employ a campus-wide policy which encourages higher occupancy PI assignment / occupancy potential. It should mandate physically embedding enabling features into new facilities:
- Firmly embed “Economy” class quantities of private PI offices on each floor to avoid the under-assignment excuse created by under-officing floor plan layout.
- Too few private offices guarantee a long future of low occupancy utilization. If for some unanticipated reason the offices are not all needed for experimental PI recruits, there will be abundant computational PI recruits to fully occupy them. Offices utilization is typically high.
- Reserving seats (SF) within each PI's private space allotment for every possible occupant, full-time, seasonal, occasional or future is nothing less than extravagant, not to mention operationally weakly sustainable in the long run. PI assignments for seat capacity beyond 4-6 on average should be a maximum target, with larger teams an increasingly rare exception. The 4-6 assumed size of an average team is the literal equivalent of assigning every PI a 180 SF office, another feature of the past. Right-sizing down to space designed for an average team size of 3-4 is a sustainably prudent approach which coincidentally aligns with the 2015 census average and a 120 SF PI office.
- Additional capacity can be added via free-standing construction, or through additions to current facilities. Where practical, additions are an enriched choice in terms of proximity to existing resources, especially peers.
- Researchers benefits greatly when quite close to other researchers. Why else do research campuses exist? Co-locate and physically connect research facilities.
- Planning space to support complex multidisciplinary clusters teams close together is an exciting research facility design challenge. Yet, also consider that (re-) developing state-of-the-art disciplinary space is also needed, a strategy not in fashion today, but, perhaps in fifteen (15) years.

CAMPUS EXPERIENCE

The UD Campus Experience

The UD experience today is largely defined by the relationship to the Green and walkability of the campus core. The campus has distinctive characteristics similar to a small liberal arts college but with some supporting programs of a larger University. One primary challenge with the future growth at UD will be a balance to maintain the feeling of compactness and community while growing to meet the aspirations of the institution.

The UD campus experience includes a variety of elements that impact how students, faculty, staff, alumni, and the surrounding Newark community interact with the campus environment. The Campus Master Plan, with the Campus Experience Working Group, evaluated the needs and opportunities in each of these areas and how they could be improved or adjusted to further enhance the overall campus experience at UD.

Student Experience

Today's undergraduate student is becoming more diverse with also informs the evolving needs and support services required. There is a continued need to foster community at many scales, including campus wide student centers, residence halls, and the variety of student groups.

A separate student center study is currently underway looking at expansion and space utilization in Perkins Student Center and Trabant University Center. Refer to this study for additional findings and recommendations related to these two facilities.

Student Hubs

- Transform the role of the campus hub to include a greater mix of uses, mobility, integration of core educational components and support services. In addition to campus-wide hubs, integrate additional hubs and resources in other key campus locations.
- Morris Library as the learning and collaboration hub
- Reimagine hubs to include common core facilities
- Community engagement center - a dedicated place where campus and community can come together.

- Student hubs at the College level are needed.
- Locate a student success center at a key location maximizing visibility and use
- Integrate multi-cultural spaces into renovated or new space.
- Rethink central open spaces as hubs.(The Green / Old College)

Recreation

- A large number of students participate in intermural activities, these numbers are continuing to increase.

Gathering Spaces

- .Student center currently does not provide appropriate meeting space and conference center. (2-300 seats of multi-purpose room needs for graduate students)
- Conference space at the graduate student level or various types of larger groups are needed.
- Lack of performance and gathering spaces
- Integrate a gathering place / living room for commuter students.

Support Services

- Considerations for graduate student are evolving with the increase in students and student diversity. These include library hours, bus system hours, operations, and housing
- Retail programs, dining, community building spaces needed on South Campus.

Visitor Experience

- Visitor's Center today does not have the space needed for all student recruitment activities.
- Integrate Perkins/Trabant with visitor center elements
- Consider how the campus can become more of a "year-round" campus. In addition to more students on campus in the summer, there has also been an increase in "pre-college" summer programming.
- Consider how the visitor experience and arrival can be enhanced

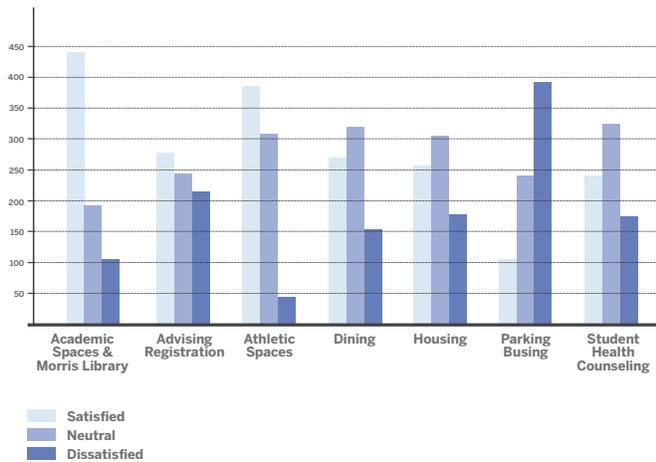
Student Feedback Survey

In Fall 2018 the University conducted a student feedback survey evaluating a variety of spaces, services, and student support elements impacting the daily life of a UD student. Over 750 students participated in the survey.

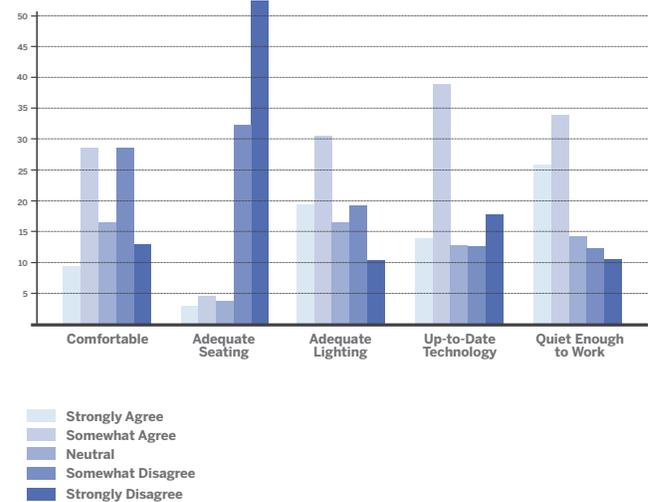
The survey included students from all Colleges and years and includes over 750 student opinions. A selection of the results is to the right and include student feedback on the Library, Little Bob, and Student Housing which included some of the most telling results for areas of need. Refer to the full study for additional details, areas of study, and specific student comments.

- Student Housing - 60% of students in the study find the residence halls unclean and not spacious
- Morris Library - While the space is quiet for study, 92% of the students believe there is not have adequate seating in the library
- Little Bob - 70% of students surveyed state there are not enough exercise machines
- Mobility - 53% of students are dissatisfied with the parking and shuttle system today

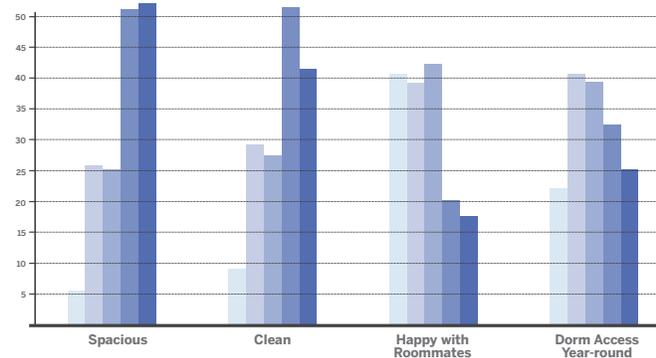
Overall Level of Satisfaction



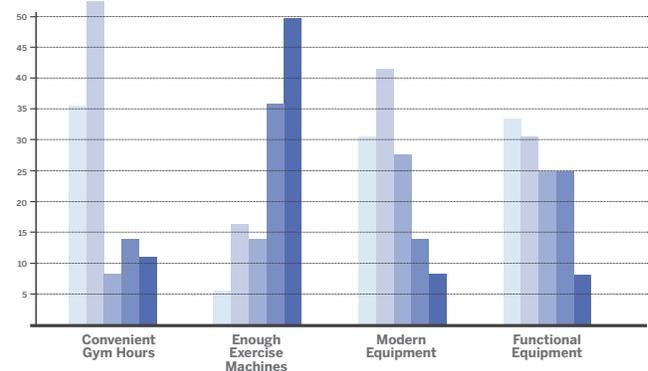
Morris Library



Student Housing



Little Bob



CAMPUS EXPERIENCE

Student Success

Explore opportunities for synergies with student services and support programs.

- As the student population expands and diversifies, integrate support programming for the evolving student body. (International students, growing DE student base, graduate students)
- Services that address large numbers of students should be more centrally located. (tutoring, advising) These are also important services to amplify visibility.
- Consider the best approach for career counseling services at the college level or as a campus wide resource.

Residential Life

Address evolving and diversity of student housing needs.

- Graduate housing and needs beyond graduate students:
 - International graduate students
 - Graduate students with families
 - Short term housing (faculty and new hires)
- Locate first years near the Green for a central campus experience.
- Expand housing choices for upper division students within walking distance.
- Develop graduate student villages at key locations.
- If the honors program continues to expand, a second honors dorm could be needed.
- Consider the growing requests for single occupancy rooms.
- Affordability is the issues for the graduate housing.

Campus Connectivity

The Green continues to be a defining moment / place that informs how prospective students feel about the campus experience.

- Connections to the Green continue to be important.
- Consider opportunities to expand ground floor transparency along exterior walls, primary paths and connections.
- Enhance the connectivity - Dining, gathering and support programs linked to transportation.
- East-west diagonal corridors to be important for the gathering space opportunities.

Open Space

Expand areas where the landscape strategies can incorporate wellness, education, and collaboration. The University should focus on the environment and open space opportunities that expands study, engagement and circulation experiences.

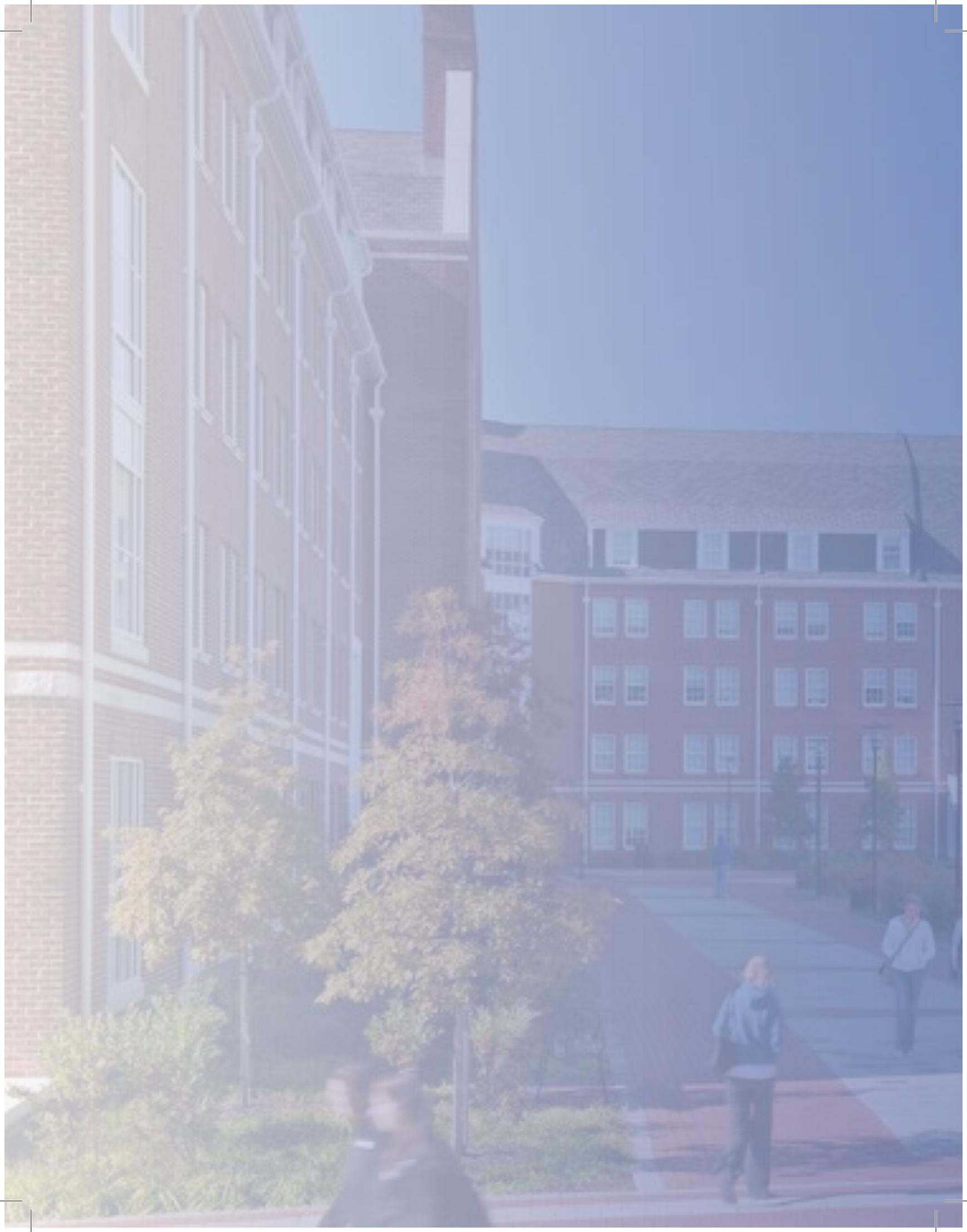
- Expand the use and programming of the open spaces beyond the Green.
- Gathering space opportunity at intersection between East Delaware and South College avenue.
- Consider creating Amphitheatre at Laird campus tying with other activities.
- Reuse existing open space by type of program/activities / scale / people engagement.
- Identify hierarchy of each open space and developed programs with ecotone idea
- The use of the plaza space outside of Perkins could be better utilized.
- Need for shading area for student gathering.
- Need to prioritize experience from Amstel Avenue to mentor circle.

Recreation and Athletics

Athletics and large events are often the first point of engagement with UD.

- Student recreation facilities are beyond capacity at key times of day.
 - Additional play fields for club sports/ intramurals are needed
 - Consider the recreational value on Laird campus, interpreting natural trail to come down to South campus. (White Clay Creek trail / Pomeroy trail to South campus could be valuable recreation assets for campus)
 - Expand the trail and bike network.
 - Hartshorn Hall as a student recreation hub on the South Green.
- Improved pedestrian connections to surrounding districts.
 - STAR campus and emerging amenities and resources
 - Botanical Garden and trail network
 - Campus Core
 - Improve walkability along the College avenue which provides increased access to parking facilities.
 - Explore interim field uses at STAR. (club sports / intramurals)
 - Consider the multi-purpose program opportunity on campus. (Fitness and sports equipment space, basketball, hotel and conference site)





CAMPUS COMPONENTS



PROGRAM ELEMENTS

POTENTIAL PROJECTS FROM WORKING GROUPS

Teaching and Research Spaces

Key Considerations:

- Limited capacity for reuse as labs (floor size, floor-floor height, building systems)
- Limited potential to renovate for active learning
- Limited room to enable renovations and swing functions (office and lab)
- Spaces need upgrades for flexibility - equipped with new technologies
- ADA and universal accessibility needs

Academic + Classrooms

- Prioritize investments in classroom renovations or replacement that better meets pedagogy goals
- Need for room sizes of 40 seats and 120 seats
- Target 30-35 ASF per station for active learning
- Focus technology investments on infrastructure \

Morris Library and Collaboration Space

- Prioritize reinvestment in Morris Library as a University hub
- Continue to expand areas for collaboration space and seating for individual and group study
- Expand graduate student collaboration space

Research Space

- With recent faculty hires, research space went from a “loose fit” to a “tight / aggressive” fit
- Additional faculty hires will generate a need for expanded research growth
- Continue to explore opportunities for partnerships

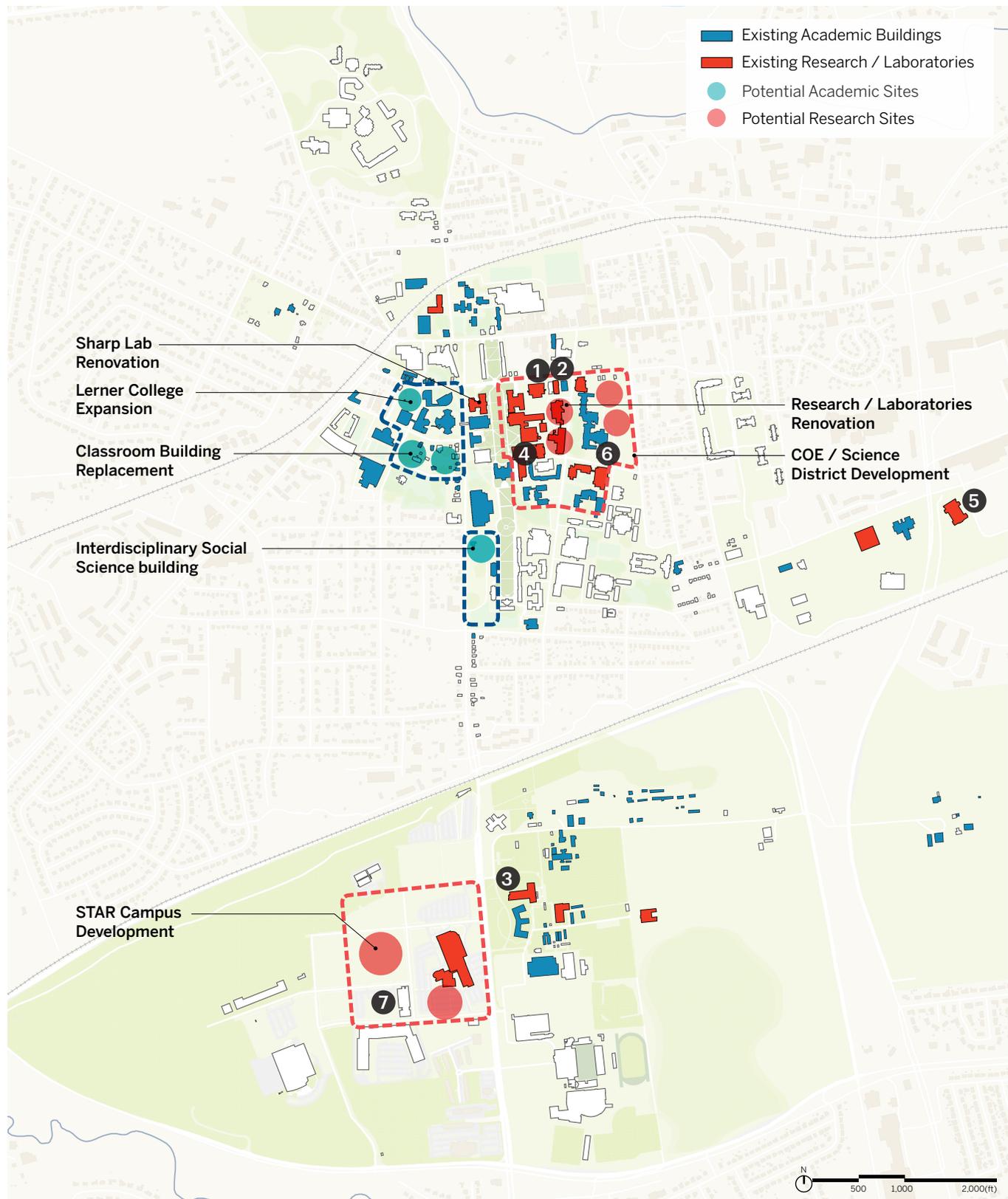
Office Space

- Projected faculty growth will generate a need for additional office space
- Office growth may be best met through a series of smaller scaled additions and renovations (not a single building)
- Need to create more collaborative environments
- Do not provide private offices for graduate students or staff

Teaching and Research Projects Underway

- 1 Building "X"
- 2 Life Sciences Addition
- 3 Worrilow Hall Renovation
- 4 Drake Lab Renovation / Addition
- 5 Delaware Biotechnology Institute Backfill
- 6 Maker Space in Pearson
- 7 Biopharmaceuticals Building / NIIMBL

Potential Academic + Research Opportunities



PROGRAM COMPONENTS

POTENTIAL PROJECTS FROM WORKING GROUPS

On-Campus Housing

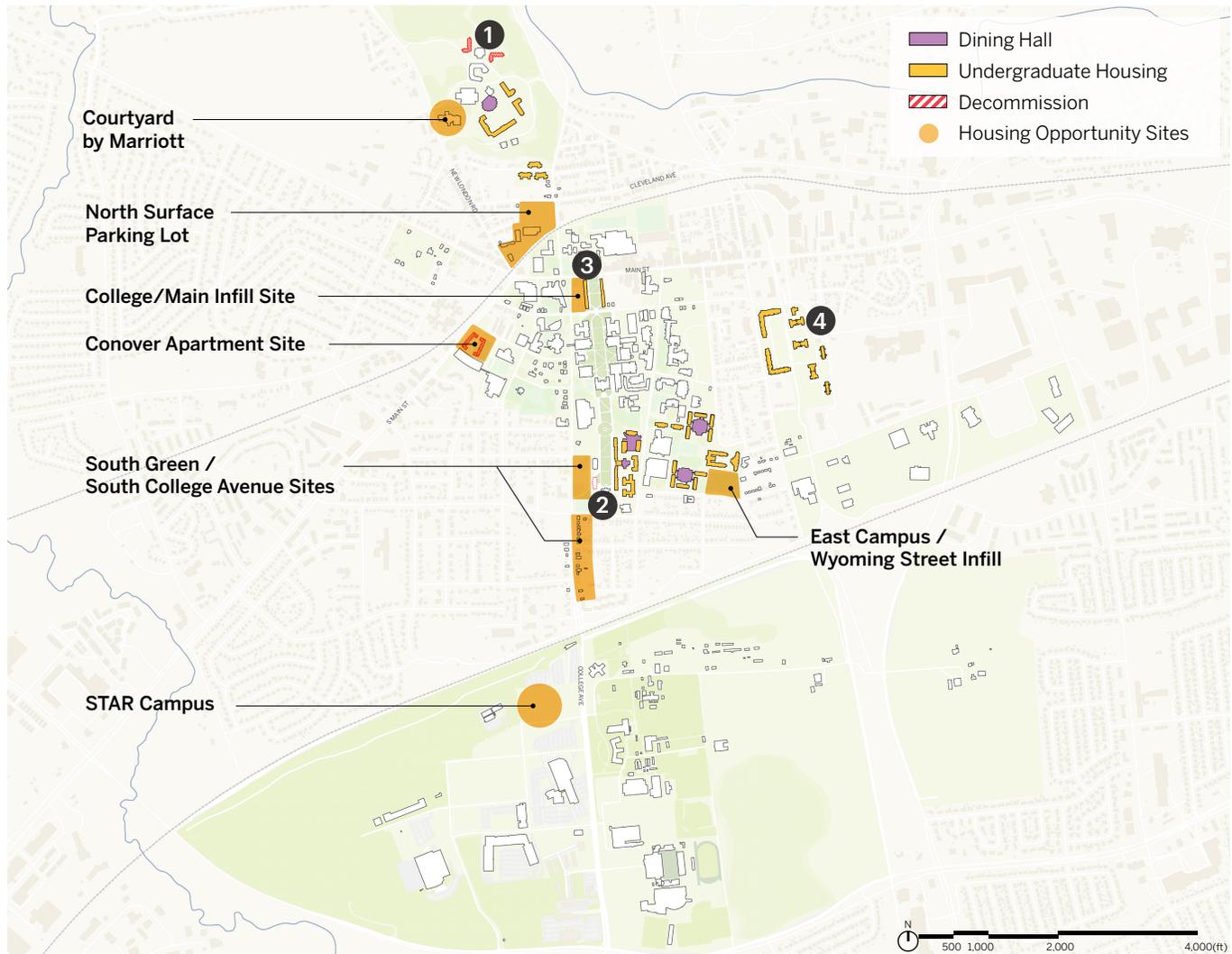
Near Term Housing Projects

- 1 Decommission Christiana Towers (-1,259 Beds)
- 2 Decommission Warner Hall for housing (-65 Beds)
- 3 Renovate Brown / Sypherd (temporary removal of -213 Beds)
- 4 Acquire University Courtyard Apartments (+880 Beds)

Following decommissions and acquisitions:
38% of student body will live on campus
(down from 43% today)

Potential Longer Term Housing

- Locate first years near the Green for a central campus experience
- Build and renovate to the design capacity (remove triples)
- Expand housing choices for upper division students within walking distance
- Develop upper class / graduate student villages at key locations
- Address evolving and diversity of student housing needs
- Provide some shorter term housing options for new and visiting faculty



Recreation and Athletics

Key Considerations:

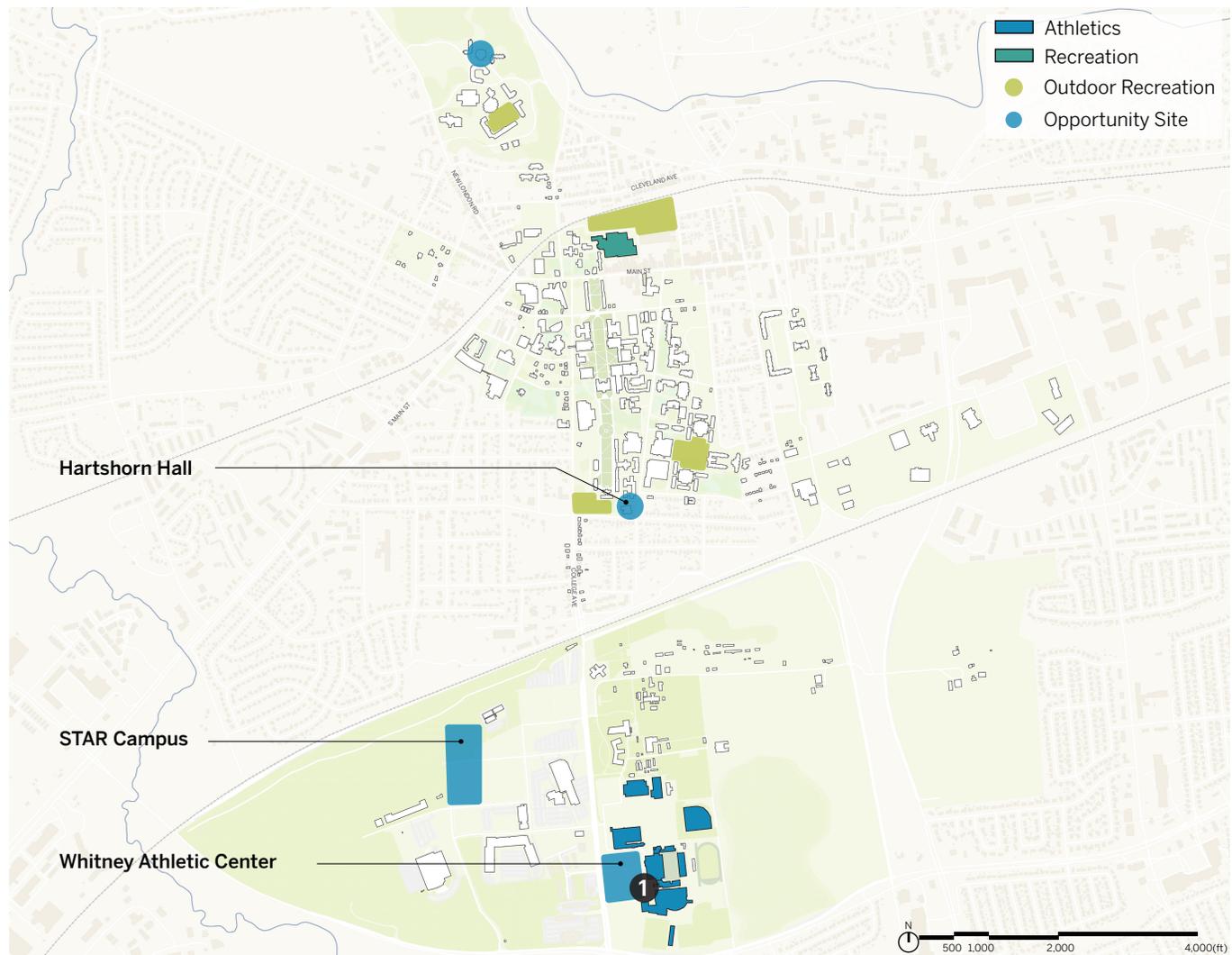
- Student recreation facilities are beyond capacity at key times of day
- Additional play fields for club/ intramural sports are needed

Additional Opportunities:

- Expand the trail and bike network
- Explore Hartshorn Hall as a student rec hub on the South Green
- Explore interim field uses at STAR (club sport / intramural)
- Longer-term Athletic Center expansions

Near Term Projects

- 1 Whitney Athletic Center



MOBILITY

In 2017, University of Delaware conducted a campus sustainability survey of approximately 1,500 undergraduates and 3,000 graduates and employees. The survey questioned mode choice to campus, commute distance, parking habits, factors that inhibit bike and shuttle bus use.

- The University is facing issues of traffic congestion on key corridors and limited parking availability in high-demand areas—attributed by a combination of campus-related traffic and cut-through traffic bound to the nearby highways. Thus, improving and expanding convenient and safer access to other modes (walking, biking, and transit) is key for the future.
- The campus is compact enough for walking, but has significant physical barriers, particularly active rail lines and at-grade crossings.
- Bicycling could be bolstered by safer facilities and more secured, covered bike parking.
- The shuttle system is well used during peak times but operates less frequently off-peak and has many indirect, one-way segments.
- Existing transportation resources (e.g. the website and shuttle app) could better allow users to compare mobility options and make spontaneous decisions based on real-time conditions.
- The University could benefit from hiring a transportation demand management (TDM) coordinator to “spoon feed” transportation information to students, faculty, and staff, facilitate partnerships with mobility providers, and promote transportation programs.



Limiting Factors

Four broad issues stand out as mobility limiting factors for the University: campus culture around transportation, physical constraints of rail and street right of way, parking allocation, and the financial structure for transportation/sustainability programs.

1. Campus Culture

- A “two-block” threshold for walking creates pressure for more on-campus parking, thus resulting in induced auto demand/circulation and conflicts with vulnerable roadway users.
- Perception that pedestrians and cyclists cannot mix safely on campus pathways, creating obstacles to expand active transportation connections in/around campus.
- Staff and faculty are reluctant to use transit and mix with students.
- High commuter population (“drive-in, drive-out”) limits feeling of community (“home away from home”) and makes it difficult to strengthen sustainability initiatives around campus mobility.

2. Physical Environs

- Rail lines separating the central campus from the north and south create barriers that concentrate traffic flows and limit opportunities to improve bicycle and pedestrian access and safety.
- Street right-of-way ownership and limited widths present challenges to re-prioritize neighborhood streets for active transportation modes and to siting shuttle bus shelters.
- Placement of existing campus buildings restricts desire lines for on-campus walking and biking opportunities.

3. Parking

- Surface lots are desirable locations for campus redevelopment, but there is limited opportunity to add capacity in existing lots/garages and new parking is costly.
- There is a misalignment between University and City parking management and pricing system, resulting in an imbalance of parking utilization.
- There are public safety concerns with remote parking due to lack of street lighting and internal pathway conditions.
- There is a lack of designated off-street zones and parking spaces for service vehicles and ADA-accessibility.

4. Financial Structure

- Parking is main revenue generator and financial mechanism for funding the campus shuttle program. This structure results in competing goals and interests for University.
- Current agreements with private entities have led to an extended shuttle service area that adds to travel time and indirectness/circuitousness of existing routes.

MOBILITY

RECOMMENDATIONS

Key Considerations:

- Serviceability
- Accessibility
- Mobility efforts as an opportunity to improve community relations (e.g. by reducing congestion)
- In the immediate term, strategies should focus on education, enforcement, and encouragement

Recommendations:

Recommendations are categorized on a priority matrix and include mobility strategies for the near, mid and longer term. The strategies were classified into categories:

- Physical interventions
- Policies
- Programs
- Mobility category (pedestrian, parking, shuttles, street design, etc.).

Coordinating partners were identified, and the result was a priority scale from 1 to 3 (high to low).

The matrix will allow the University to understand at a glance both the items more easily implemented and the more challenging, time-intensive actions to improve mobility.

Encouragingly, the University some of the immediate-term recommendations identified in the matrix (e.g. covered bike parking, orientation materials) are already being implemented.

Mobility Strategies Priority Matrix

Near-Term Recommendations (1-3 Years)

Category	Type	Strategy	Priority Rank*	Coordination**
Bike	Policy	Establish strict bike parking regulations to reduce level of abandoned bikes on existing racks	1	UD
Bike	Physical	Identify areas for new bike parking and install secured (covered) bike parking adjacent to residential buildings and key academic buildings	1	UD
Bike	Physical	Replace U-rack bike parking spaces with inverted/multi-U racks to increase supply and maximize capacity at building entrances	2	UD
Bike	Physical	Install Class III bike sharrows and signage along Academy Street north of Lovett Ave to Main Street to create shared auto-bike-transit lanes	2	UD, City
Bike	Physical	Restripe Class II bike lanes along both sides of Wyoming Rd between Chapel and Library to allow for continuous facilities and mixing lanes with autos at intersections	2	UD, City
Bike-Pedestrian	Physical	Create new access points and wayfinding to Pomeroy Trail from North Campus	3	UD, City
Bike-Pedestrian	Physical	Coordinate with property owners and widen north side sidewalk along Park Place between Orchard and Academy to 10'-wide multi-use pathway	3	UD, City, Property Owner
Parking	Physical	Designate parking spaces for service vehicles at Drake, Colburn, Rodney buildings	1	UD
Parking	Policy	Coordinate with City to balance parking pricing for on-/off-street facilities along Main and Delaware	1	UD, City
Parking	Program	Determine parking utilization for service vehicles at specific buildings	2	UD
Parking	Policy	Establish EV parking regulations to increase turnover of EV vehicles. Install monitoring and pricing system per kWh (e.g., ChargePoint) to track usage by vehicle and increase parking price beyond set charging duration (e.g. 4 hrs max)	3	UD
Pedestrian	Physical	Install painted pathways within parking areas to delineate pedestrian pathways and enhance access for those on foot or wheelchair	1	UD
Pedestrian	Physical	Install traffic calming devices along Academy St, including intermittent speed humps and/or rumble strips to notify drivers to maintain slow speeds (reduce/eliminate need for crossing guards)	2	UD, City
Shuttle	Program	Perform shuttle stop inventory to determine upgrades (e.g., ADA-access, signage, maps, benches, shelters, garbage receptacles)	1	UD
TDM	Program	Update University website and shuttle app to provide trip planner capabilities and provide information on how to access campus by multiple modes	1	UD
TDM	Policy	Create carpool incentive program for faculty, staff, and commuter students and prioritize carpool spaces at most desirable locations	1	UD
TDM	Program	Create a "Transportation Day" event (and partner with Bike Newark) to advertise about current transportation programs and resources, public safety, and advertise sustainable travel habits	2	UD
TDM	Policy	Expand Enterprise carsharing program. Provide additional off-street parking locations in campus garages/lots and work with City/DelDOT to convert on-street spaces to carshare vehicles	3	UD
TDM	Program	Develop "Transportation Packet" for new students, faculty, and staff, including personal orientation, materials/pamphlets, online resources, and contact information of all transportation providers	1	UD

Mid-Term Recommendations (3-7 Years)

Category	Type	Strategy	Priority Rank*	Coordination**
Bike	Program	Implement Campus Bikeshare Program	1	UD, City
Bike	Physical	Install bikeshare stations/bikes at designated campus locations: Courtyard Apts at Chapel & Delaware, CFA garage, STAR hub, Trabant	1	UD, City
Bike	Physical	Install Class III sharrows, signage, and traffic calming devices (e.g., intermittent speed humps) along Orchard Road between Ritter Lane and Delaware Avenue	1	UD
Bike	Physical	Install sharrows and signage along N. College, between Cleveland Ave and White Clay Drive	1	UD, City, DeIDOT
Bike	Physical	Install continuous Class II bicycle lanes along both sides of New London Road between Main Street and Fremont Road-Country Club Drive, including green, staggered pavement markings at intersections to notify drivers of bicycle lanes	1	UD, City, DeIDOT
Bike	Physical	Remove on-street parking and extend Class II bike lanes along Academy Street north of Lovett Ave to Main Street.	1	UD, City
Bike	Physical	Install Class IV Cycletrack along both sides of Academy Street between Park Place and Main Street with rumble treatments or flex posts, and install intermittent raised side boarding islands for shuttle stops	2	UD, City
Bike	Physical	Coordinate with City and install bikesafety treatments, such as double-striped (buffered) painted barrier and flexible posts, to create one-way cycletrack along Delaware Avenue between S. Main Street and Tyre Avenue	2	UD, City, DeIDOT
Bike-Pedestrian	Physical	Install additional street lighting along New London Road between Fremont Road-Country Club Drive and Main Street.	2	UD, City, DeIDOT
Parking	Program	Explore feasibility of upgrading campus parking facilities with centralized management and sensory systems	2	UD
Pedestrian	Physical	Install pedestrian-scaled street lighting along Winslow Road, Sunset Road, and West Park Place between Apple Rd and College Ave	2	UD, City
Pedestrian	Physical	Install mid-block crosswalk along Academy Street, between Delaware Ave and Lovett Ave	2	UD, City
Shuttle	Program	Review existing routes to streamline one-way loops and eliminate out of the way stops; use resulting time savings to increase frequency and add service to STAR	1	UD
Street Design	Physical	Remove on-street parking along Amstel Ave between College and Main, install 10' auto lanes, 6' Class II bike lanes.	3	UD, City
Bike	Physical	Install buffered bike lanes along both sides of Wyoming Rd between Chapel St and Library Ave	3	UD, City
TDM	Program	Hire Transportation Demand Management Coordinator to build, operate, maintain, communicate about transportation programs and resources	1	UD
TDM	Program	Conduct transportation survey each semester of all campus community members to understand their needs, experiences, and opportunities	2	UD
TDM	Program	Develop ride-matching service (via online and mobile platform) to allow for faculty/staff and students to find carpools and schedule rides	2	UD, Vendor
TDM	Program	Establish an Eco-Pass Program for DART, UniCity, and shuttle buses for students, faculty and staff	2	UD, DART, WILMAPCO, Vendor
Intersection Design	Physical	Remove right-turn slip lane from westbound Wyoming Rd at S. Chapel Street and add crosswalk on the northern side of the intersection	3	UD, City

Long-Term Recommendations (7+ Years)

Category	Type	Strategy	Priority Rank*	Coordination**
All	Physical	South Campus Mobility Hub "East": reconfigure surface lot at Field House for shuttle/DART bus terminal, real-time transit info, bikeshare, carshare parking, priority carpool parking and dedicated ride-hail loading zones	1	UD, City, DART
All	Physical	South Campus Mobility Hub "West": coordinate with the City to ensure redevelopment of Newark Station includes shuttle bus/DART terminal, real-time transit info, wayfinding, carshare parking, bikeshare, priority ADA/carpool parking, and dedicated ride-hail loading zones	1	UD, City, DART, WILMAPCO
All	Physical	North Campus Mobility Hub: reconfigure Trabant Center for shuttle and DART bus turnout area, bikeshare station, bike parking, enhanced station amenities	1	UD, City, DART
All	Physical	Central Campus Mobility Hub: reconfigure Perkins Student Center for shuttle/DART bus turnout area, bikeshare station, bike parking, enhanced station amenities	1	UD, City, DART
Bike-Pedestrian	Physical	Expand existing sidewalks to install 10'-wide (minimum) multi-use pathways along both sides of S. College between bridge and State Route 4	1	UD, City, DeIDOT
Intersection Design	Physical	Reconfigure intersection of S. College and Discovery Blvd to a protected intersection. Eliminate channelized right-turn lanes, install crosswalks and ped signals along all intersection approaches. Repurpose additional capacity at corners of intersection for shuttle bus and bikeshare hub.	3	UD, City, DeIDOT
Intersection Design	Physical	Reconfigure intersection of Delaware and S. Main to a standard T-intersection to control traffic flow, provide shorter/safer crossings and access for bikes and pedestrians.	3	UD, City, DeIDOT
Parking	Policy	Consider public-private partnerships for future parking needs (i.e., new construction of parking facilities)	1	UD
Parking	Policy	Enact "Transportation Fee" or similar policy to decouple sustainability initiatives from parking revenue	2	UD
Bike-Pedestrian	Physical	Consider feasibility of expanding pedestrian bridge (Pencader Way) to North Campus to accommodate pedestrian and bicycle traffic	3	UD, City
Transit	Physical	Relocation and/or determine additional Mega Bus locations at planned mobility hubs and dense concentration of on-/nearby campus residences	3	UD, Vendor
Bike-Pedestrian	Physical	Consider feasibility of constructing a dedicated, multi-use bike/ped bridge south of Academy Street and Kells Avenue over railroad tracks and connect to South Campus	2	UD, City, Property Owner, DeIDOT, FTA, SEPTA, freight rail companies

*Priority Rank "1" is HIGH, "2" is MODERATE, "3" is LOW

** UD = University of Delaware; City = City of Newark, DeIDOT = Delaware Department of Transportation; Vendor = Contracted Business; DART = Delaware Area Transit Agency; FTA = Federal Transit Administration, WILMAPCO = Wilmington Area Planning Council

LANDSCAPE

The University of Delaware's primary identity is the formal open space in the campus core - The Green. Today the Green includes two sections, a north area and south area. The two quadrangles historically divided the men's and women's campus.

Today many of the historical elements of the campus still inform the identity and character of the place. The scale of the Green is organized around and informed by the size of the open space and relationship to the surrounding buildings and tree canopies.

Components of Landscape Framework

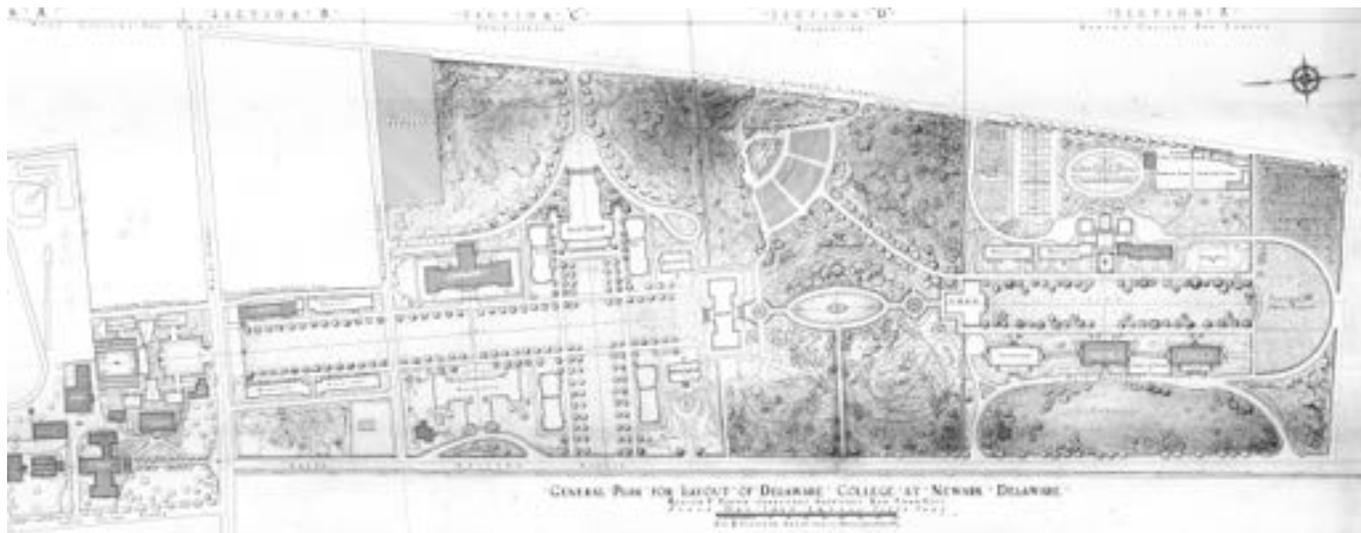
1. Natural Landscape / Ecotones
2. The Green - Historic & Culturally Significant Spaces
3. Open Spaces and Opportunities
4. Campus Paths / Edges

Existing Open Space Typologies

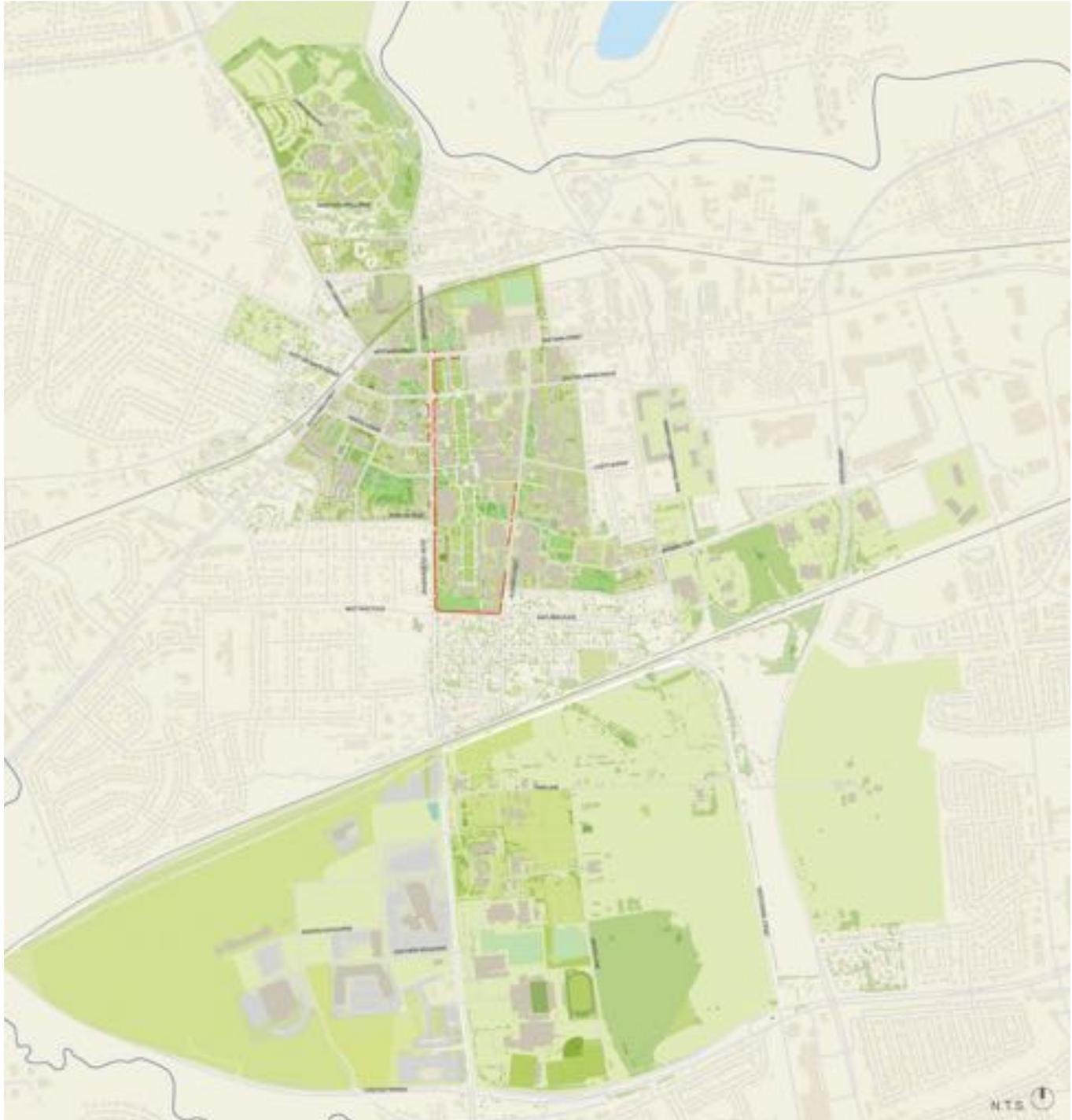
The campus today includes a variety of open space and landscape typologies. These include more formal open spaces, most notably the Historic Green which is often surrounded by a brick perimeter wall. The campus also includes a variety of smaller quadrangles and lawn areas organizing other areas on campus. The South Campus is defined by athletic fields and agriculture fields. The Laird Campus is primarily defined by the woodlands that form as an extension of White Clay Creek Park. Surface parking lots are scattered throughout the campus.

Limiting Factors

- A historical, siloed approach to infrastructure and open space planning
- Knowledge and expertise of current land management provider
- Capital and operational budgets



Coffin's 1919 Campus Plan and The Green



Existing Campus Open Space Structure

- Historic Green
- Perimeter Walls
- Open Lawn
- Athletic Fields
- Woodlands
- Campus Parking

LANDSCAPE

Function

The University's existing open spaces are predominantly designed and used for a single purpose, such as recreation or stormwater management. This is incongruous with current practice at other, urban universities, which layer multiple functions into a single landscape.

The design of most open spaces do not relate to, nor directly support, adjacent building uses. Peer universities increasingly design and program outdoor space so that building use can "spill out" to occupy the landscape when needed. This creates a rich, educational experience with enhanced opportunity for varied experiences.

Hierarchy

Some open space areas, such as the Green and Mentor's Circle, were thoughtfully designed, and consequently, well used. Other areas of the campus—particularly between buildings, along fire lanes, and along pedestrian connections between the campuses—have received less attention. This has created a system of interstitial spaces that are not designed adequately for recreation, relaxation, or outdoor learning.

The resulting dichotomy leaves little room for meaningful spaces that should lie between the two extremes. Many successful campuses combat this dichotomy by creating an intentional hierarchy of open spaces with a corresponding hierarchy of pedestrian/bike circulation routes.

Character

The campus open space character lacks continuity, and as a result, the University lacks a sense of physical identity. This is particularly prevalent in the Laird and South Campuses, which feel distinctly "other" than the Central Campus.

In general, varying parts of a university campus should feel distinctive, but not disparate. Stepping through intentional gateways, onto the University's campus, should come with a feeling and knowledge that one has arrived.

Safety

Some of the interstitial spaces mentioned previously experience an added conflict between back-of-house use and pedestrian access. This conflict is unusual in campuses, but more importantly, is can be dangerous. Pedestrian - vehicular conflicts could easily arise in these close quarters, as well as at major road crossings and railroad crossings.





Historic Green



Streets



Passages



Perimeter Walls



Open Lawn



Athletic Fields



Woodlands



Campus Parking

LANDSCAPE

Existing Ecotone / Ecological Heritage

Piedmont Uplands

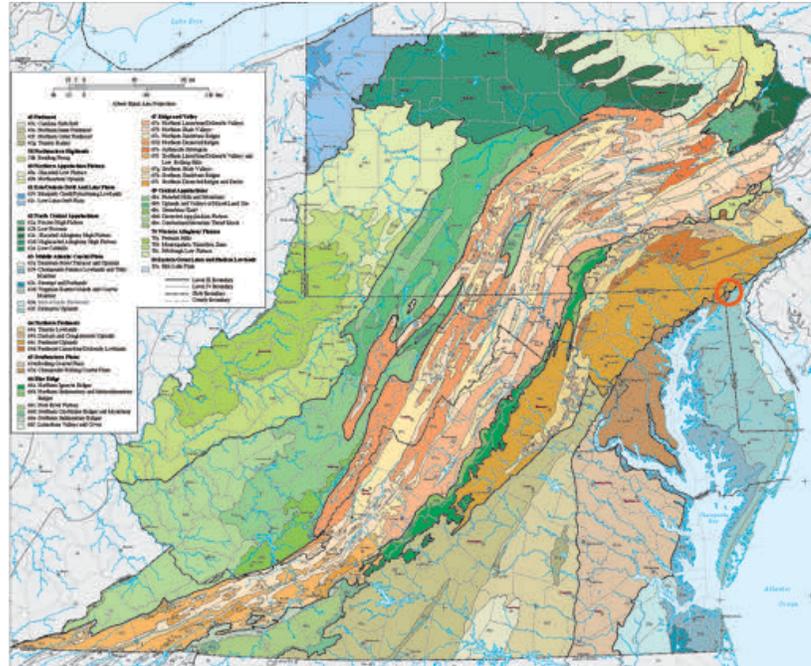
- Rounded hills, low ridges, narrow valleys
- Streams and waterfalls
- Metamorphic rock and serpentine barrens

Chesapeake Rolling Coastal Plain

- Hilly upland
- Narrow streams
- Well-drained, nutrient-poor, loamy soils
- Oak-Hickory-Pine forest
- Appalachian Oak forest

Delmarva Uplands

- Flat to gently rolling
- Sandy, nutrient-poor soils with low water-holding capacity
- Seasonally wet swales
- Oak-Hickory-Pine forest
- Pine-Birch barrens



Level IV Ecoregion

Piedmont Uplands



Quercus Rubra



Appalachian Oak Forest



Quercus Rubra



Aster Ericoides



Schizachyrium

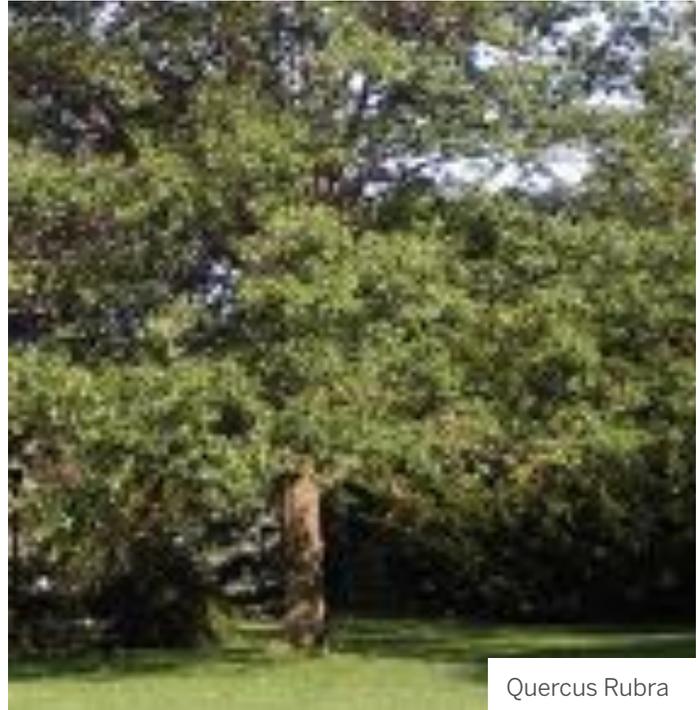
Chesapeake Rolling Coastal Plain



Quercus Alba

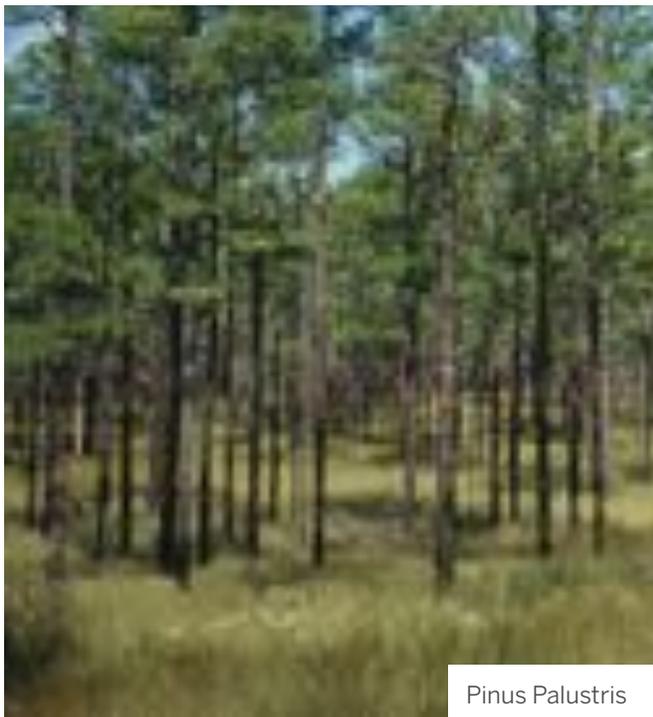


Pinus Echinata



Quercus Rubra

Delmarva Uplands



Pinus Palustris



Carya Spp



Pinus Echinata

LANDSCAPE

RECOMMENDATIONS

Key Considerations

- View open space as a connective tissue
- Strengthen “neighborhood” identities
- Re-frame open space as use-driven landscape zones
- Pair open space with building use
- Celebrate unique, indoor-outdoor adjacencies
- Strengthen east-west connections
- Enhance the pedestrian circulation hierarchy
- Enhance landscape function
- Celebrate ecological heritage
- Continue stewarding the campus' natural resources
- Leverage open space to create campus identity

East-West Connections

While some of the open spaces on campus are clearly defined and have a distinct character and quality, other campus open spaces and streetscapes are lacking a clear identity, ease of way finding and opportunities for increased programming. Establishing clarity and definition on the east-west pedestrian movement on campus will help unify the campus together.



Improve East-West Connections



Example: Proposed College Avenue Improvements

Reprogram Open Space

Many of the open spaces on campus have the potential to be more activated and connected - with each other, the adjacent buildings, and as identifiable hubs throughout the campus. Increasing the visible programming in these spaces will have impacts on how the campus functions as well as providing greater amplification and utilization of the open spaces. In addition to areas for gathering, the streetscapes in and around campus can also be reconsidered with definition around campus gateways, thresholds between districts, and primary corridors.



Reprogrammed Open Space



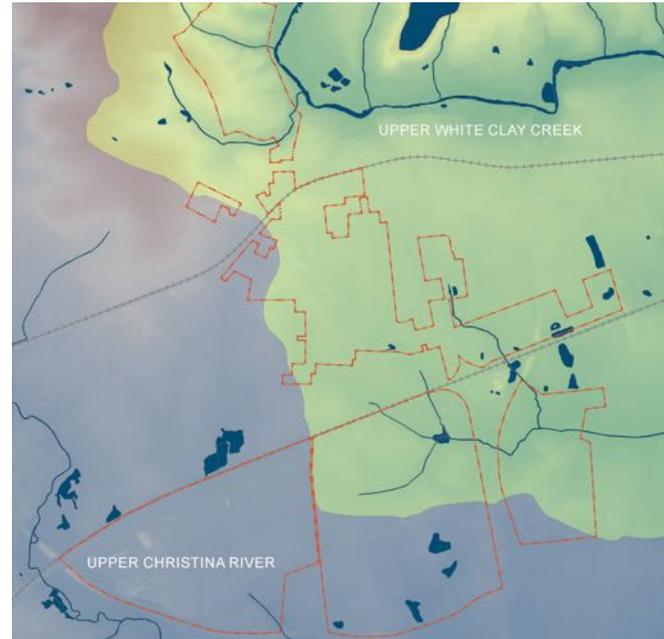
Example: Current UD Botanical Garden Master Plan

LANDSCAPE

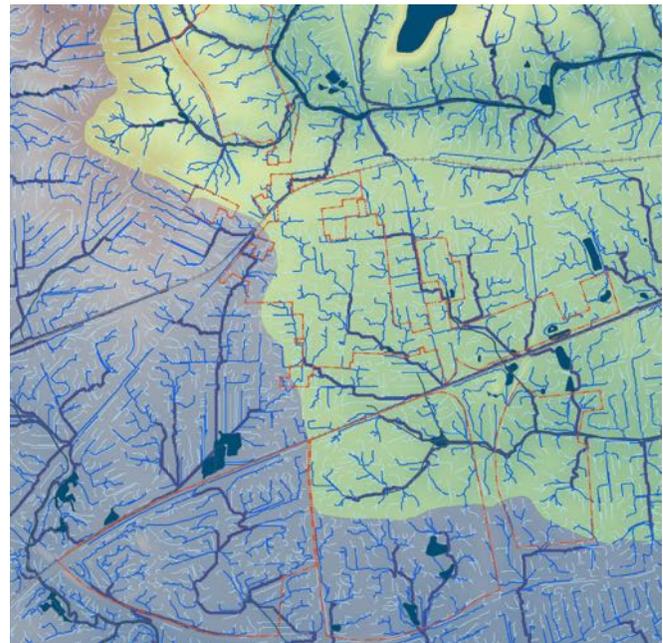
Stormwater Management

Upgrades to the existing system are regulatory focused and prioritized based on the following:

- Problem areas
 - Current project developments
 - Areas identified by the City/University of Delaware
- Stormwater management on campus is generally project-oriented versus campus oriented.
 - The Stormwater Working Group manages the projects, but the campus focus is on coming into compliance rather than exceeding requirements.
 - In general, space limitations and lack of funding restrict management options. Strategies are predominantly limited to what is approved by DNREC.
 - There are flooding issues on campus and within the City of Newark as a result of poor soils, high groundwater and system surcharge.
 - Approach - project-by-project approach vs. a more holistic take on stormwater management makes every project responsible for their own increases and doesn't address problem areas outside of construction projects. No campus standards to follow
 - Capacity - the City system is known to be overtaxed and undersized in areas (does not appear to be limited to one portion of campus) that creates flooding issues. New development may be required to oversize stormwater systems to offset downstream capacity issues or upgrade pipes within city streets
 - Condition - CMP pipe is beginning to fail, maintenance of some aboveground basins is limited by facilities department capabilities
 - Building Flooding - prevalent across campus, renovation work should consider methods to address potential interior flooding (backflow preventers, waterproofing, new/more sump pits, foundation drainage, etc
 - Environmental Factors - high water table and poor soil conditions in areas constrain stormwater management capabilities and options (need for more holistic approach)



Watersheds



Flow Paths

Stormwater Recommendations

- Retain and treat stormwater from campus on campus to the maximum extent possible
- Focus on, and complete, previously identified priority stormwater improvement projects
- Generate and enforce campus standards and maintenance schedules for stormwater BMPs
- Video inspect and inventory existing pipes and structures. Implement infrastructure repairs identified in inventory and in conjunction with redevelopment
- Coordinate landscape improvements with stormwater management practices to maximize dollar investment and impacts, such as: conversion of hardscape to green space or pervious materials; - bioswales at pedestrian routes; over-size stormwater management areas to offset future development
- Consider new strategies such as: daylighting piped conveyances; collecting and storing natural spring surface discharge on East Campus for irrigation to reduce water usage and alleviate downstream stormwater capacity issues



SUSTAINABILITY & INFRASTRUCTURE

University of Delaware previously developed Climate Action Plan in 2008 to target a 20% reduction in greenhouse gas emissions by 2020. Feedback from the University indicates that this goal is not on track to be achieved, and the Climate Action Plan is being re-evaluated.

The most recent campus Greenhouse Gas (GHG) Inventory from 2016-2017 indicates a GHG reduction of 5.9% from the 2007-2008 baseline. The primary driver for this reduction is a greener regional power grid; the RFC East eGrid subregion experienced a decrease in per-MWh emission factor of 19.4% during this ten-year period.

Multiple sustainability efforts are underway on campus, including but not limited to:

- Improvements to utility infrastructure, including piping extensions and updates to operations of Ewing CHW plant.
- Improved metering of building energy and water consumption for more comprehensive and detailed building-level data.
- Ongoing upgrades to and monitoring of stormwater management features by the Stormwater Task Force
- Coordination with the City of Newark to establish framework for a plan to decrease the City's dependency on electrical consumption for revenue and to further encourage greening of the grid
- Development of faculty-led report for achieving carbon neutrality by 2020
- Reporting is in progress for AASHE STARS and updated information will be submitted by the end of the year
- Development of Green Labs Guidance to encourage labs to incorporate sustainable design/operations measures
- Expansion of Vehicle to Grid (V2G) electric vehicle charging infrastructure on campus
- Aerobic digester for composting on campus, with plans to expand to an anaerobic digester at a larger scale for the campus

The Project Planning & Delivery Technical Construction Standards provide design requirements and guidelines for development work on campus. The standards incorporate some sustainable design strategies, and can be further updated to incorporate best practices for sustainable design.

Domestic Water

- The campus water supply is provided by the City of Newark from two separate sources.
- Capacity and pressure are not generally an issue but water quality can be a problem especially in labs.
- A number of underground springs exist within the campus but they are not currently utilized as water supply.
- The City of Newark has identified three unique Source Water Protection Areas protecting the public water system, each type is located within the extents of the UD campus
 - Excellent recharge area
 - Wellhead protection area
 - Surface water protection area

Sanitary Sewer

- The campus is served by City of Newark wastewater-collection system that conveys sewage to the New Castle County interceptors located at city limits.
- Sewage is treated at a regional wastewater-treatment plant located in the City of Wilmington.
- There are no known capacity issues.

CHW Distribution

CHW distribution north-south on campus is generally good, but east-west has some bottlenecks, including going west across South College Ave to potential new program opportunities.

The Plant also suffers from low-delta-t syndrome, which is not surprising given the size and scope of the CHW plant.

CHW Redundancy

Only 2 of the 3 chillers at the Ewing CHW plant can currently operate at a time. This is a critical issue for redundancy and is currently being addressed by the University for existing areas of campus.

As the campus expands, more capacity will be needed to maintain N+1 redundancy.

Steam Distribution

Steam does not serve Laird, South Campus, Technology Park or STAR.

The team recommends no new steam infrastructure, and instead a shift from steam to hot water for new buildings that come online, especially for potential new buildings/ significant program West of South College Ave.

Domestic Water

- Pipe Condition - aging infrastructure internal to campus has caused water quality issues (ie. high iron) which has damaged lab equipment – pipe age within and near buildings identified for lab uses should be considered and potentially upgraded and/or internal water filtration installed
- Supply - No known limitations

Sanitary Sewer

- Capacity - there are no known capacity issues at this time, but any increased flow to the city system would have to be reviewed with the City and / or County

Lack of Funding and Staff Support

Continued under-funding for deferred maintenance and current limited capacity of sustainability support staff poses challenges for implementing recommendations. Additional staff dedicated to University's sustainability efforts would enable more integration of sustainability across campus.

Connection between South Campus and South Green Precinct

The ability to create a safe and welcoming pedestrian and bicyclist connection between South Campus and the South Green Precinct is limited by the existing S College Ave overpass over the railroad tracks.

City of Newark Renewable Energy Generation Cap

The City of Newark's limit on the University of Delaware's generation of renewable energy is a future limiting factor if the University desires to expand renewable energy infrastructure.

SUSTAINABILITY & INFRASTRUCTURE

RECOMMENDATIONS

Sustainability Priority Matrix

The Sustainability Priority Matrix outlines near-term, mid-term, and long-term recommendations for a more sustainable campus.

Each recommendation is further subdivided by type:

- Policy/Program
- Physical: Campus Infrastructure
- Physical: Building and Site Specific
- Research

The recommendations are categorized into four primary sustainability goals for the campus, including:

1. Reduced Energy & Carbon Emissions

Reduce reliance on fossil fuels, incorporate passive design strategies and energy efficiency measures, and encourage alternative transportation options.

2. Water Conservation & Management:

Reduce potable water consumption for buildings and site, and incorporate green infrastructure strategies to manage site runoff.

3. Human Health & Well-Being

Cultivate a rich occupant experience by enhancing physical, mental, and social wellbeing.

4. Performative Landscape

Conserve healthy ecosystems and enhance landscape to provide multiple ecosystem services.

- NEAR - TERM RECOMMENDATIONS

PRIORITY RANK 1= HIGH PRIORITY 2=MEDIUM PRIORITY 3=LOWER PRIORITY

Category	Priority	Type	Strategy Name	Strategy Description	Precinct
Reduced Energy & Carbon Emissions	1	Policy	Climate Action Plan	Update Climate Action Plan.	
		Policy	Green Labs Guidance	Finalize Green Labs guidance: labs will be required to adopt mandatory sustainable design/operations measures and choose at least two additional sustainable design/operations measures to implement per semester.	North Green
		Physical: Campus Infrastructure	Valve Actuator Sizing	Investigate whether valve actuators on the building chilled water return lines are correctly sized, particularly for buildings close to the CHW plants which likely experience high differential pressures. Replace any incorrectly sized valve actuators.	
	2	Physical: Building & Site Specific	Building Efficiency Upgrades	Continue to develop plan to recover chilled water capacity through efficiency upgrades in campus buildings to reduce chilled water load and improve N+1 redundancy without requiring the addition of more chillers.	
		Policy	Lighting Design Standard	Update sustainable design standards to incorporate best practices for sustainable design: all LEDs or other efficient lighting for interior and exterior site lighting.	
		Physical: Campus Infrastructure	CHW Pump VFD and CW Pump VFD Sequence Update	Develop sequence for CHW Pump VFDs and CW Pump VFDs that allows variable flow through the chillers to help manage the Low-Delta-T issue. Consider setting different leaving Evaporator Temperatures on the chillers as they stage to maintain secondary CHW Temperature.	
	3	Research	Laird Campus CHW & HW Research	Evaluate CHW and HW capacities for the Laird campus and determine potential limiting factors or recommended upgrades to plant in order to implement campus master plan. Identify energy efficiency measures for the plant.	Laird Campus
		Physical: Campus Infrastructure	Vehicle-to-Grid Car Charging	Double Vehicle to Grid (V2G: electric car charging) infrastructure on campus.	South Campus West College Ave South Green
		Physical: Building & Site Specific	Solar PV Lighting	Integrate solar PV into site lighting on STAR campus.	South Campus
		Research	Facilities Condition Update	Incorporate "Mission (Program) Score" to Facilities Condition Index to help clearly identify which buildings do not adequately meet current programming requirements; this exercise would be particularly valuable for buildings in the Interdisciplinary precinct in particular.	
Water Conservation & Management	1	Policy	Holistic Stormwater Design	Develop holistic approach for stormwater management across campus and updated stormwater management design standards.	
		Policy	Stormwater Management for Parking Areas	Develop policy for new parking infrastructure on campus to minimize surface parking and prioritize consolidated parking in multi-level garages. Require new surface parking to incorporate stormwater management strategies to manage volume from 95th percentile rain event.	
		Physical: Building & Site Specific	Stormwater Management Repair/Upgrades	Carry out priority stormwater projects established by UD stormwater task force, including upgrade of Harrington Basin to wet retention pond with new outlet, regrading and revegetation; update/re-design Gore basin; and repair erosion gullies and failing outfalls in Laird campus to stop sediment erosion in the White Clay Creek.	South Green Laird Campus
		Physical: Building & Site Specific	Stormwater Strategies	Integrate additional stormwater strategies near Amy DuPont music building and library, which have known flooding issues.	West College Ave South Green
	2	Program	Educational Signage	Expand educational stormwater signage across campus to increase student awareness of stormwater initiatives.	
		Research	Basement Dewatering	Evaluate potential uses for capturing and reusing naturally occurring, non-potable, but potentially useful water.	
		Research	Green Roof Lessons Learned	Develop lessons-learned from green roof projects on campus to advise future projects on design, construction, and maintenance.	
Human Well-Being & Engagement	1	Program	Increased Student Awareness	Identify opportunities to increase student awareness of sustainability initiatives across campus.	
		Program	AASHE STARS reporting	Update AASHE STARS reporting and submit by end of 2019.	
	2	Policy	Air Quality for Labs	Develop policy/design standards for improving air quality for campus buildings, particularly for lab buildings.	North Green
Performative Landscape	1	Physical: Building & Site Specific	Diversion from Landfill	Target at least 75% diversion rate from landfill for demolition of Christiana Towers.	Laird Campus
		Policy	Light Pollution Design Standards	Update sustainable design standards to incorporate best practices for sustainable design: reduce light pollution with zero upright fixtures.	
		Physical: Building & Site Specific	Construction Pollution Prevention	Implement construction activity pollution prevention measures during decommissioning of Christiana Towers to limit impact of demolition on the White Clay Creek	Laird Campus
	2	Physical: Building & Site Specific	Engineered Soils for the Green	Pilot project for the green to increase stormwater retention and performance.	South Green North Green
		Policy	Vegetation Protection Zones	Identify special status trees/vegetation and areas of ecological importance to protect from future development efforts.	
		Program	Anaerobic Digester	Anaerobic digester for composting at larger scale for the campus. Collect from agricultural waste and dining organic waste.	South Campus
	3	Policy	Paving and Roofing SRI Design Standards	In an effort to improve outdoor thermal comfort and reduce heat island effect: update sustainable design standards to incorporate best practices for sustainable design: require SRI >82 for flat roofs on new buildings.	
		Policy	Integrated Pest Management	Formalize integrated pest management plan for the campus.	

Near-Term Recommendations

Physical interventions critical for campus operations, or are “low-hanging fruit” supporting campus sustainability goals. They often build from in-progress initiatives on campus. They also include policies, programs, and research to help frame future sustainable campus development.

Mid-Term Recommendations

Focus on physical interventions that require additional cost and time to implement. They also include the next tier of policies, programs, and research that build on the near-term recommendations.

Longer-Term Recommendations

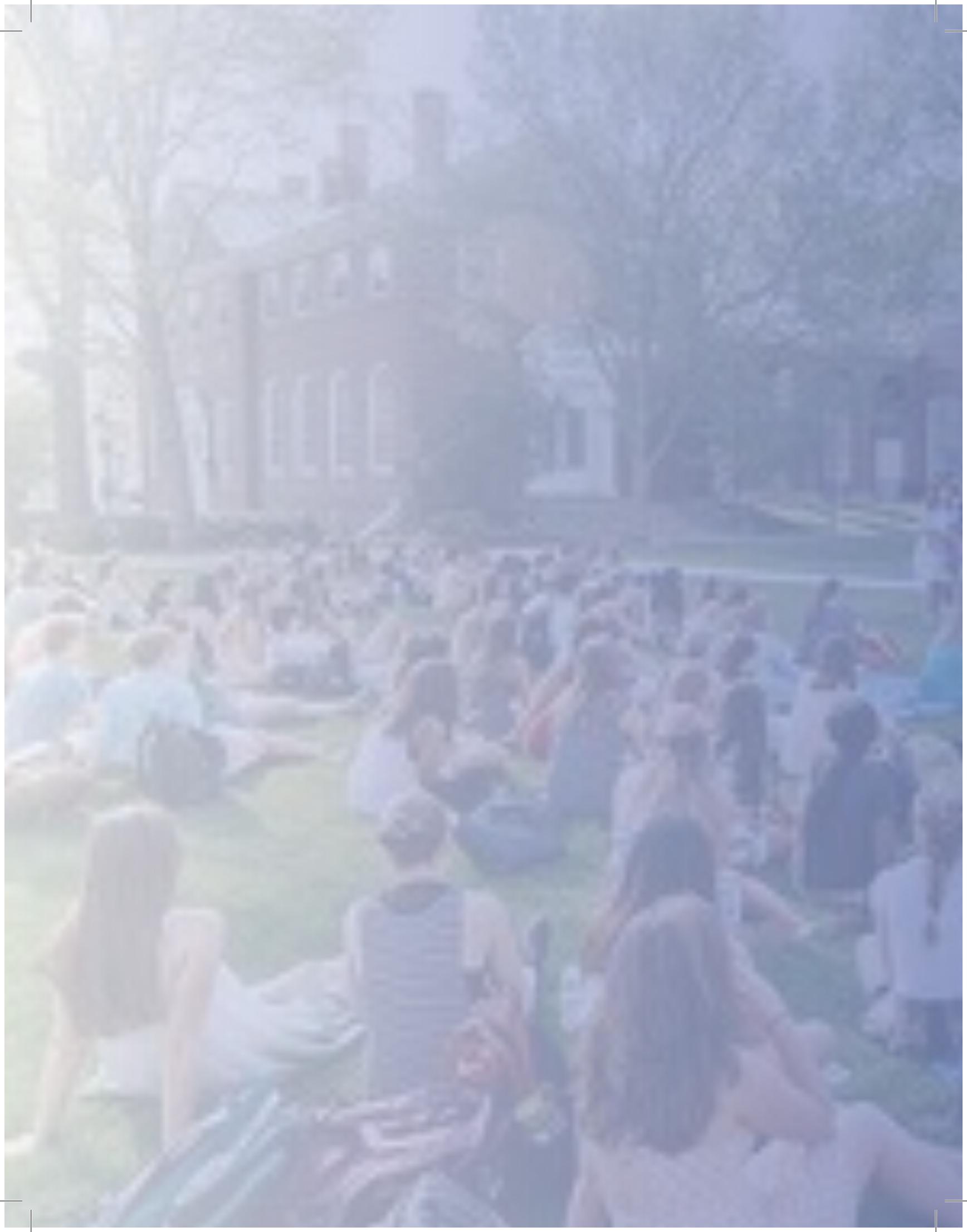
More progressive infrastructure goals and policies to establish the University as a leader in sustainability amongst peer institutions.

- MID-TERM RECOMMENDATIONS

Category	Priority	Type	Strategy Name	Strategy Description	Precinct
Reduced Energy & Carbon Emissions	1	Physical: Campus Infrastructure	Upgrade/Replace Ewing Plant	Upgrade/Replace Ewing Plant to provide heating and cooling to support new development west of S College Ave.	West College Ave
		Physical: Campus Infrastructure	New Hot Water Loop	Install new hot water loop or condenser water loop for new buildings west of S. College Ave.	West College Ave
		Physical: Building & Site Specific	Continued Building Efficiency Upgrades	Recover chilled water capacity through efficiency upgrades in campus buildings to reduce chilled water load and improve N+1 redundancy without requiring the addition of more chillers.	
	2	Policy	Building Energy Performance Benchmark	Require new buildings to demonstrate a reduction in regulated building energy use by XX% compared to baseline building performance determined by ASHRAE Standard 90.1-2016, Appendix G.	
		Policy	Process Steam Standard	Develop design standard for process steam: require new buildings to have their own process steam.	
		Physical: Building & Site Specific	Heat Recovery Chillers for New Buildings	Integrate heat recovery chillers to further reduce load and deal with simultaneous heating and cooling needs in new building projects or major renovations. Heat recovery chillers could be particularly beneficial in the CUP, where HW could be piped to several lab buildings adjacent to the CUP.	
		Physical: Building & Site Specific	Heat Recovery Chiller Heat Sink	Install heat recovery chiller heat sink with the ice rink.	South Campus
		Research	Ground Source Heat Pumps Lessons Learned	Develop lessons-learned from ground source heat pump project at the President’s House, to inform potential future geothermal projects in residential areas on campus.	
Research	Independent Control Valves	Study opportunity to replace building chilled water return line control valves with pressure independent control valves to better manage chilled water flow at each building.			
Water Conservation & Management	1	Physical: Building & Site Specific	Rainwater Collection for Irrigation	Develop pilot project for capturing rainwater for new proposed developments along south green and reusing for irrigation.	South Green
		Physical: Building & Site Specific	Rainwater Collection for Irrigation	Develop pilot project for capturing rainwater for in South Campus to reuse for irrigation of Botanic Gardens and/or Athletic Fields.	South Campus
	2	Physical: Building & Site Specific	Condensate Collection for Cooling Tower Make-up	Develop pilot project for capturing condensate and reusing as cooling tower makeup for new lab buildings within North Green precinct.	North Green
		Policy	Water Use Reduction Benchmark	Target at least 40% water use reduction for plumbing fixtures in new projects by installing low-flow, low-flush fixtures.	
		Policy	Irrigation Water Use Reduction Benchmark	Target at least 50% reduction in water used for irrigation through efficient systems/controls, and native plantings.	
Human Well-Being & Engagement	1	Physical: Campus Infrastructure	Improved Bike Network	Expand bike network and improve existing bike paths. Improve bike connection between South campus and South Green.	South Campus South Green
	2	Policy	Daylight Access	Require new buildings to design for improved daylight access in regularly used spaces.	
	2	Policy	Banned Materials	Establish list of banned materials and limits on product VOC content and emissions in new building projects.	
	3	Policy	Active Design Standards	Require new buildings to incorporate active design guidelines.	
Performative Landscape	1	Physical: Building & Site Specific	Streetscape Bioswales	Incorporate bioswales along S College Ave as part of streetscape upgrades to improve pedestrian experience and manage stormwater.	North Green South Green South Campus
		2	Physical: Building & Site Specific	White Clay Creek Trail Connection	Celebrate connection to White Clay Creek Trail by improving wayfinding to the trailhead, integrating more outdoor spaces with seating for student relaxation and mental restoration.
	3	Physical: Building & Site Specific	Green Roofs	Consider green roofs for new buildings to manage stormwater, increase infiltration, and provide more biodiversity based on lessons-learned from UD green roofs	West College Ave
		Policy	Native/Adaptive Vegetation	Require 90% native/adaptive vegetation for restored landscapes.	
		Physical: Building & Site Specific	SITES Certification	Consider pursuing SITES certification for Botanic Garden Master Plan and new developments on South Campus.	South Campus

- LONGER-TERM RECOMMENDATIONS

Category	Priority	Type	Strategy Name	Strategy Description	Precinct
Reduced Energy & Carbon Emissions	1	Policy	Greening of the Grid	Continue coordination with City of Newark to establish framework for a plan to decrease the city’s dependency on electrical consumption for revenue and encourage greening of the grid.	
		Policy	Review of Climate Action Plan	Evaluate progress towards goals of updated Climate Action Plan (XX% carbon reduction by 2040) and identify additional strategies for the next 5+ years.	
		Physical: Campus Infrastructure	CHW Loop Expansion	Expand distribution piping to improve CHW loops: - Extension from ECUP up past Russel and Thompson to create better loop with CUP - Extension from corner of Lovett and Academy down academy and up into Spencer Lab to better serve buildings in Delaware/Academy area. - Extension down Academy and up Delaware to Ewing. New line from Delaware past Sharp hall and across Main St to Carpenter Sports. - Extension from Ewing up Orchard to Winslow and down into CHW lines between Morris and Robinson to handle future campus expansion into area between Amstel and Winslow.	West College Ave South Green North Green
		Physical: Campus Infrastructure	Electrification of Campus Fleet	Investigate electrification of entire campus fleet.	
	2	Physical: Campus Infrastructure	On-Site Renewable Energy Production	Increase on-site renewable energy production to generate XX% of campus’ total energy consumption.	
		Physical: Campus Infrastructure	Chilled Water Storage	Consider chilled water storage as part of a larger effort to reduce simultaneous heating and cooling.	
		Physical: Campus Infrastructure	Cogeneration Plant	Re-evaluate potential for cogeneration plant on campus.	
	Physical: Campus Infrastructure	Winter Free Cooling	Incorporate winter free cooling with flat plate heat exchangers. Must address distribution issues at the building level to maximize potential for this to work.		
3	Physical: Building & Site Specific	Ground Source Heat Pumps for Residences	Incorporate ground source heat pumps in two residential precincts (Laird Campus and South Green) to help take pressure off of the CHW and steam system, allowing campus expansion without expanding the CHW and Steam capacities.	Laird Campus South Green	
Water Conservation & Management	1	Policy	Non-Potable Water For Irrigation	Eliminate potable water used for drip irrigation of planting beds and trees through water reuse.	
	2	Physical: Campus Infrastructure	Consolidate Surface Parking	Consolidate larger surface parking lots in parking garages to minimize impervious areas.	
	3	Policy	Investigate Water Reuse	Require all new construction projects to investigate potential for water reuse system.	
Human Well-Being & Engagement	1	Program/Research	Monitor Sustainable Design Practices	Develop a plan for student and faculty performance monitoring of sustainable design practices on campus and publish results for public reference.	
	2	Policy	Bird-Safe Design	Require new buildings to design for bird safety, particularly on STAR Campus.	South Campus
Performative Landscape	3	Policy	Support Sustainable Plant Production	Require plants, sod, and seed to come from regional suppliers that have documented sustainable practices in plant production.	



CAMPUS OPPORTUNITIES

A blue-tinted photograph of a large group of students sitting on the grass in front of a brick building, possibly attending a lecture or event. The students are mostly seen from the back, looking towards the building. The building has a prominent arched entrance and several windows. The overall scene suggests a campus gathering or a lecture.

CAMPUS OPPORTUNITIES

ORGANIZATION OF THE CAMPUS

Goals

- Strengthen unifying elements and distinct character
- Define transition to adjacent precincts
- Align shared development interests
- Leverage programmatic synergies
- Enhance campus character, building, integration with campus wide strategies
- Near and long term development concepts

Align Strategic Vision with Campus Master Plan

The plan has identified three themes to guide future improvements of the physical campus. The themes for a more amplified, connected and translational campus coherently expand the ways to shape a shared future.

Amplified Campus – a mixed use campus focused on elevating the campus experience

Connected Campus – a campus where short distances and increased mobility connect our culture and campus life

Translational Campus – increasing campus-wide opportunities to expand research and industry partnerships and have greater global impact

Amplified Campus

Build on existing strengths

Programming
Engagement
Activation
Collaboration
Discovery



- Campus life / places of exchange
- A mixed use campus
- Old buildings, new uses
- Ability to participate
- Enhanced programming

Connected Campus

Create a unified campus

Walkability
Way finding
Multi modal hub
Enhanced shuttles
Integrated bike



- Improve campus links
- A campus of shorter distances
- Rethink campus arrival and mobility
- Public realm as the unifier
- Comprehensive mobility approach
- UD as a compact, walkable campus

Translational Campus

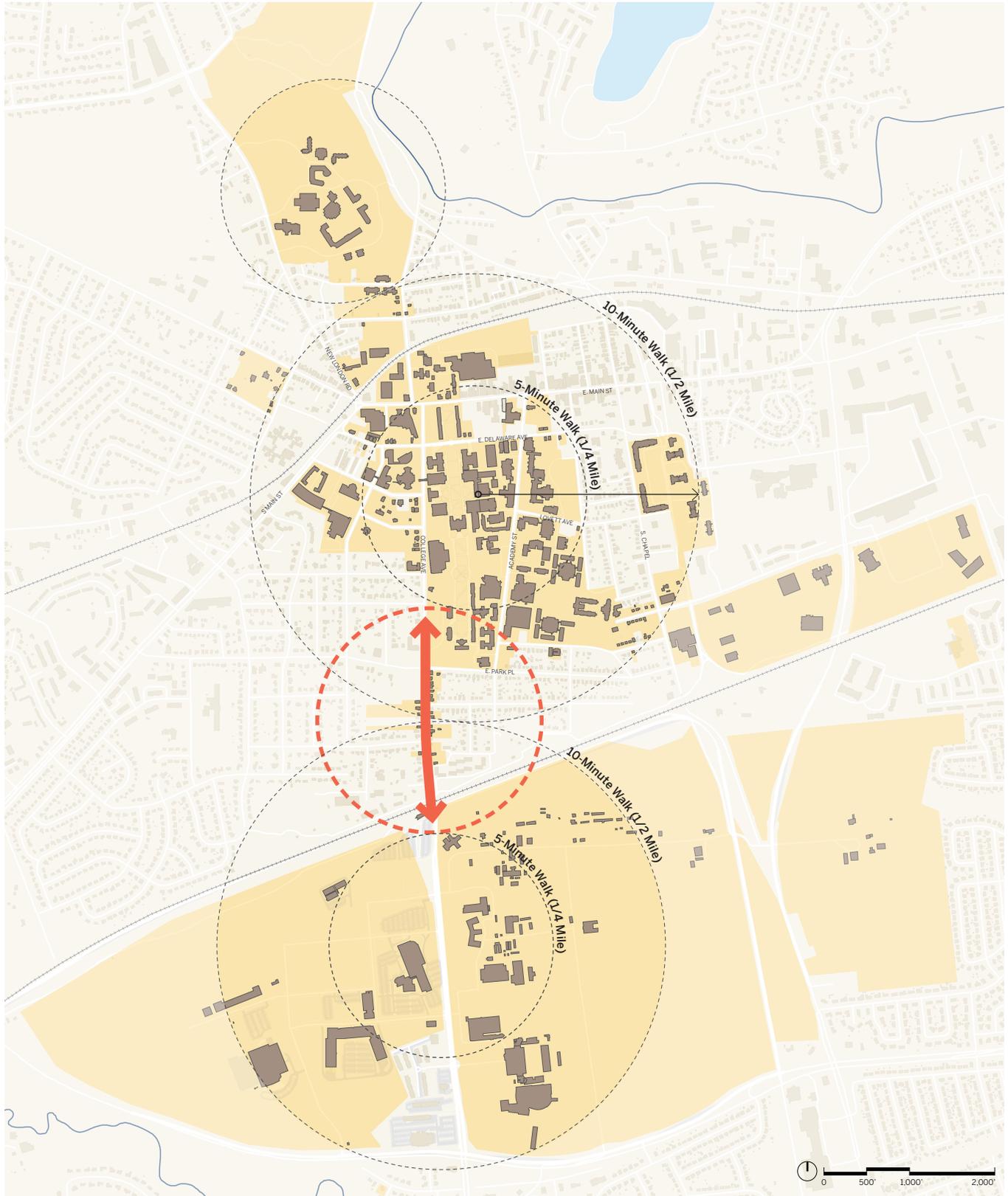
STAR Campus as a way to move UD forward

Making
New uses
Partnerships
Sharing
Convening



- Expand research and industry partnerships
- Leverage campus-wide opportunities
- Spaces for community and collaboration
- Global and local impact
- Translate to the market

"One Campus"



CAMPUS OPPORTUNITIES

DEFINE CAMPUS PRECINCTS WITH IDENTIFIABLE HUBS

Define Campus Precincts

The UD campus is loosely organized by smaller collections of buildings, open spaces, and corridors which create campus precincts. While some of the precincts have a clear identity and character, others are missing a sense of place or "hub". Future renovations, development, and open space improvements should consider how to strengthen identity of the campus precincts. Future improvements in the campus precincts should implement elements that create a unified campus area. Each precinct offers opportunity to amplify campus hubs. These can range in use, size and character.

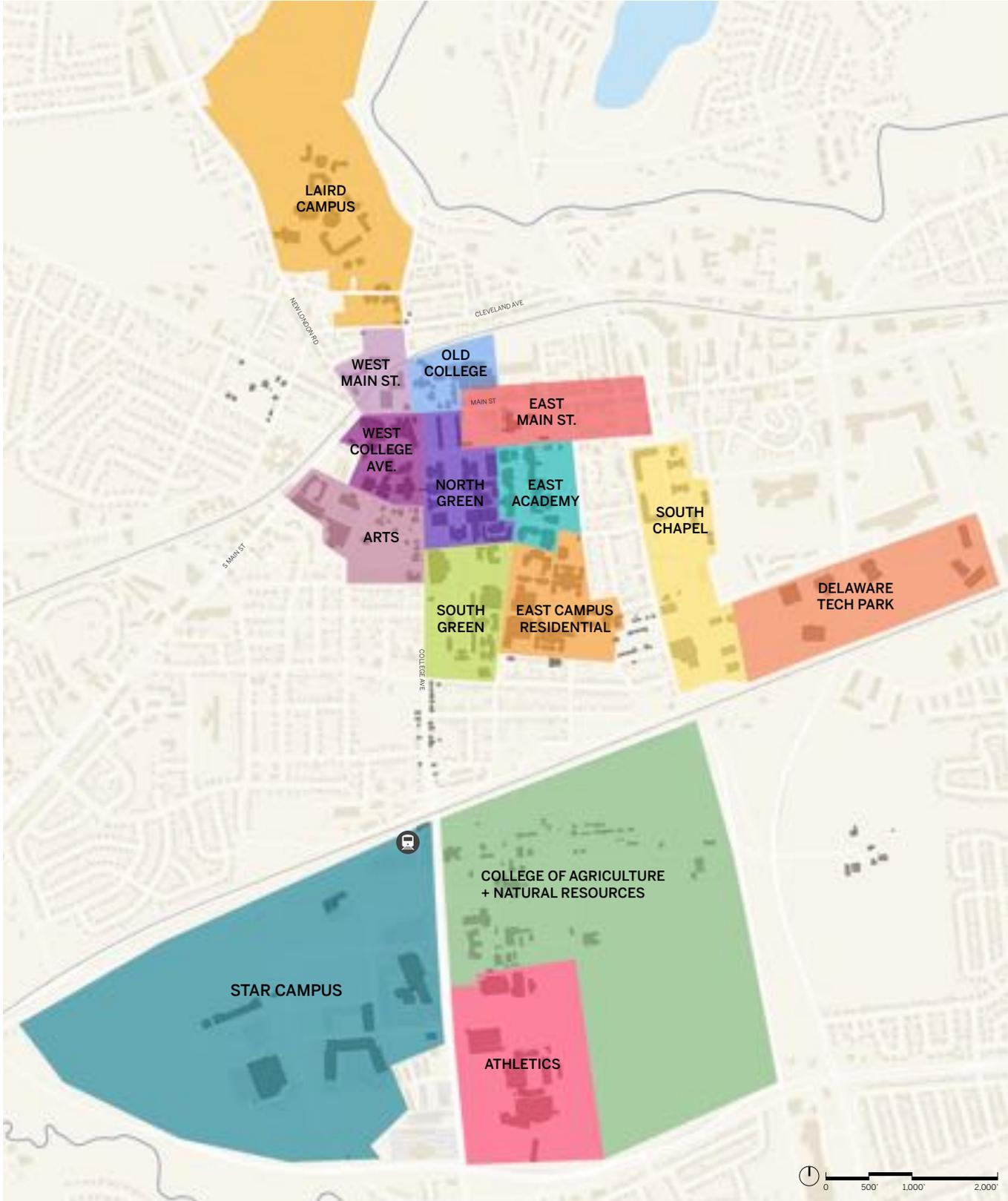
Reinforce Campus Hubs

Improve the sense of campus community.

- Renovate Perkins Student Center / Trabant University Center.
- Develop a series of networked and connected resource hubs:
 - Multiple scales and locations.
 - Centrally locate student support services such as tutoring and advising.
 - Integrate multi-cultural spaces into renovated or new space.
- Commuter student "living room" is needed.



Campus Precincts



CAMPUS OPPORTUNITIES

IDENTIFY OPPORTUNITIES FOR FUTURE GROWTH

Each potential project on campus should reinforce and strengthen the three themes identified - a connected, amplified, and translational campus. The plan has established a flexible planning framework with potential development and reuse opportunities to meet the programmatic needs and future requirements of the University. These opportunities include adaptations to existing buildings and landscapes, future building expansions and logical sites for new construction.

Future development projects can be categorized by the following:

1. Renovation / adaptive reuse
2. Infill / redevelopment sites
3. Underutilized sites outside the core of campus
4. Reserve sites to support strategic and long-term growth

Potential Project Lists

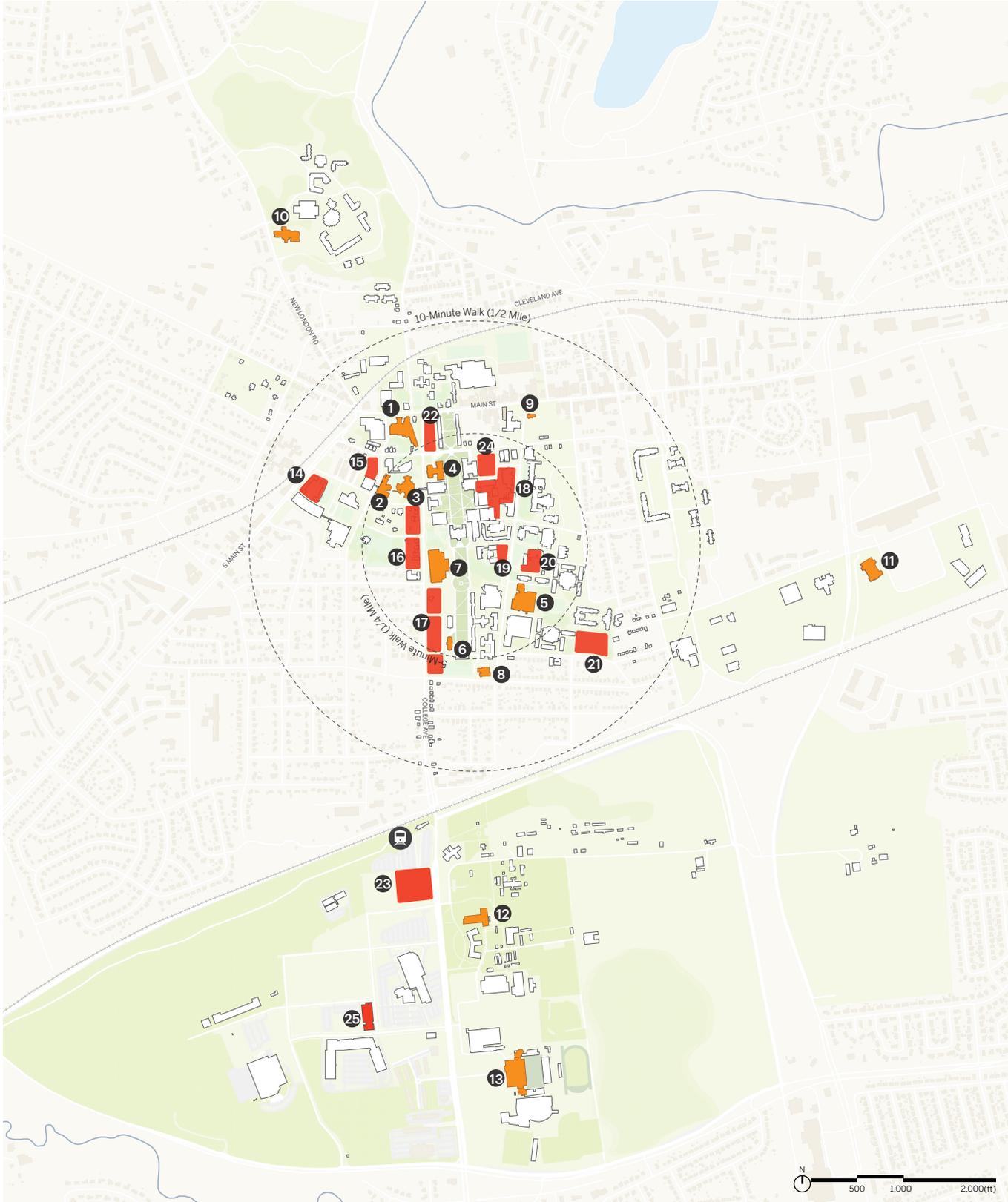
Renovation / Adaptive Reuse (± 1,224,000 sq.ft)

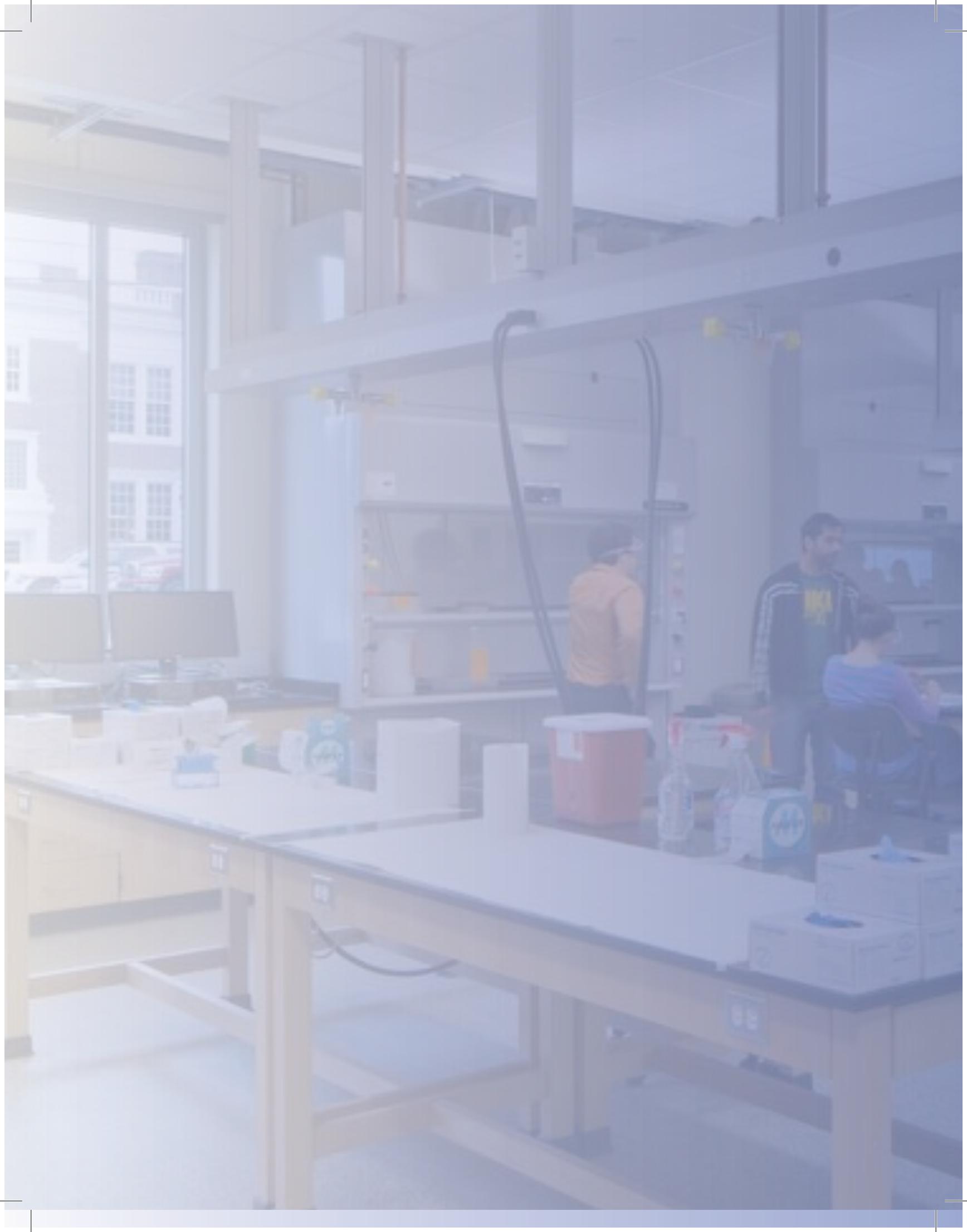
	Building Name	GSF
1	Trabant University Center	± 106,194
2	Purnell Hall	± 94,083
3	Smith Hall	± 90,163
4	Sharp Lab	± 95,876
5	Perkins Student Center	± 145,600
6	Warner Hall	± 28,040
7	Morris Library	± 294,018
8	Hartshorn Hall	± 33,287
9	Academy Building	± 13,385
10	Courtyard by Marriott	± 82,700
11	DBI	± 71,760
12	Worrilow Hall	± 65,884
13	Whitney Athletic Center Addition	± 103,050

Infill / Redevelopment Sites (± 17.34 Acres + 316,000 sq.ft)

	Site Name	ACRES
14	Conover Apartment site	± 92,896
15	Lerner Hall parking lot (not all owned by UD)	± 30,594
16	West of College Avenue sites	± 84,689
17	South Green / South College Avenue sites	± 148,101
18	Engineering and Science precinct infill	± 132,954
19	Alison Hall parking lot site	± 26,614
20	Penny Hall infill & redevelopment	± 48,466
21	East Campus / Wyoming Street infill	± 76,725
22	College / Main infill site	± 37,514
23	STAR Hotel and Conference Center	± 76,800
	Building Name	GSF
24	Building "X"	± 116,000
25	NIIMBL Headquarters	± 200,000

Potential Opportunity Sites





IMPLEMENTATION



ADMINISTRATION & FINANCE

Goals of the Campus Master Plan

As part of the Campus Master Planning process, the design team held multiple sessions with committee members and key stakeholders with the goal of understanding the physical and operational challenges facing the campus. Based on these sessions, the following key goals have emerged:

- Need to accommodate and strategically guide growth
- Focus on interdisciplinary collaboration
- Develop a single University identity
- Establish a future-oriented vision for the University to guide both physical and programmatic decisions on campus

Approach to Integrated Planning

There is a need for the Campus Master Plan to inform integrated planning, governance, and decision making around existing and future space, University growth, and strategic priorities. All decisions should continue to be informed by the University's Five Pillars as the foundational strategy:

- Enhance the success of our students
- Build an environment of inclusive excellence
- Invest in our intellectual and physical capital
- Strengthen interdisciplinary and global programs
- Foster a spirit of innovation and entrepreneurship

The University should establish a clear, transparent and streamlined process, which provides a comprehensive view and aligns the priorities with the long-term vision as well as available financial and capital resources.

Set Priorities in the Context of Longer Term Opportunities

As the University makes project decisions, the following evaluation criteria should be emphasized:

- Optimize underutilized sites and buildings
- Align near-term priorities:
 - Building removal
 - Building acquisition
 - New Renovation
 - Additions/replacement/new construction
- Align with longer-term strategies

All reuse, renovation, infill and new development should be considered in the context of the overall vision for the University.

- Re-balance the core of the campus
- Enhance campus district adjacent to the core as mixed use
- Identify key spaces to be repurposed as shared networked resource hubs in existing and new buildings
- Prioritize first-year experience connected to the Green
- Develop swing building(s) for office and research labs
- STAR campus to cater to technology and partnership opportunities

Operations and Governance

Create an organizational structure to enable successful implementation of the planning strategies defined in the Campus Master Plan. This should guide the following:

- Operational excellence
- Strategic investments (people, programs, infrastructure)
- Cost savings and refocusing resources to areas of innovation
- Finance and resource allocation
- Fundraising and development
- Expanded partnerships
- Future project delivery models phased

Implementing the Campus Master Plan

- The plan should focus on building a community plan.
- Capture and respond to the pivotal point the University is facing right now. Find the right balance between a desire to “keep it small and compact” highlighting a small campus environment, and evolving presence and direction of a research institution.
- Continue to emphasize the need for a more connected campus.
- Ensure the plan does not appear to promise new facilities that cannot be realized. Manage expectations of what the master plan implies is possible

COMMUNITY & EXTERNAL RELATIONS

City and Community Engagement

The University should coordinate planning between the City of Newark and the Campus. The University should continue to look for opportunities to expand programs, partnerships and engagement opportunities with the City and adjacent communities. The University should partner with the City on the following shared areas of interest. Some initiatives will also require engagement beyond City officials to the State and other governing agencies.

Strategic Housing Opportunities

- Coordinate housing policies with the City of Newark and Wilmington to develop off-campus housing with greater amenities and better access to campus
- Provide opportunities within a future housing market for retired and junior faculty as well as provide options for short-term housing
- Develop housing to meet the specific needs of the graduate and student population
- Develop improved transportation options for off-campus students, faculty and staff.

Shared Recreation and Athletic Amenities

- The larger recreation / trail network in the surrounding area should be integrated into the bike movement through the campus e.g. White Clay Creek
- Explore shared programming opportunities for campus Green
- Facilitate shared programming at the Bob Carpenter Center
- Create a new "green" space on the STAR campus to act as the community gathering space on the South Campus

Improved Circulation and Mobility

- Consider rerouting major truck routes on alternative paths to attain a more walkable pedestrian oriented environment on College Avenue
- Improved transportation between Newark and Wilmington
- Christina Parkway serves as an important arrival gateway into the campus

Expanded Arts and Culture Programming

- Integrate and coordinate with City of Newark for art / culture initiatives to include museums, performing arts, music programs, live music and other programming opportunities

Prioritize Shared Futures A Key Part of Delaware's Ecosystem

Connected, Compact and Walkable

- Prioritize improvements, transit, parking and land use

Diverse and Inclusive

- Housing, retail - building neighborhoods, not projects

Place and Identity

- Programming, culture, heritage, gateways

Health and Well-Being

- Nature, recreation, trails, botanic garden

A Catalyst for a Better Future

- Jobs, economy, new partnerships/investment, education, sustainability, global connectivity and local impact

SOM