KANSAS STATE UNIVERSITY

NEXT-GEN CAMPUS MASTER PLAN

APPENDICES

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A

EXISTING CONDITIONS ANALYSIS

A1 OVERVIEW

To establish a clear and comprehensive understanding of the campus at the outset of the project, a multi-faceted analysis was undertaken. This effort aimed to document existing conditions, identify key challenges and uncover opportunities that would inform the planning and design process.

The analysis included Digital Surveys, a Data-Driven Facilities Assessment and a Site Analysis.

The findings from this analysis are organized into three categories:

FACILITIES

LANDSCAPE

MOBILITY

ANALYSIS TOOLS

Digital Surveys

- MapMyCampus, Parking and Mobility and Alumni and K-State Foundation Surveys were conducted to gather input from students, faculty, staff, the K-State community and alumni.
- These surveys gathered both quantitative and qualitative data on user experiences, perceptions of campus spaces and priorities for improvement.

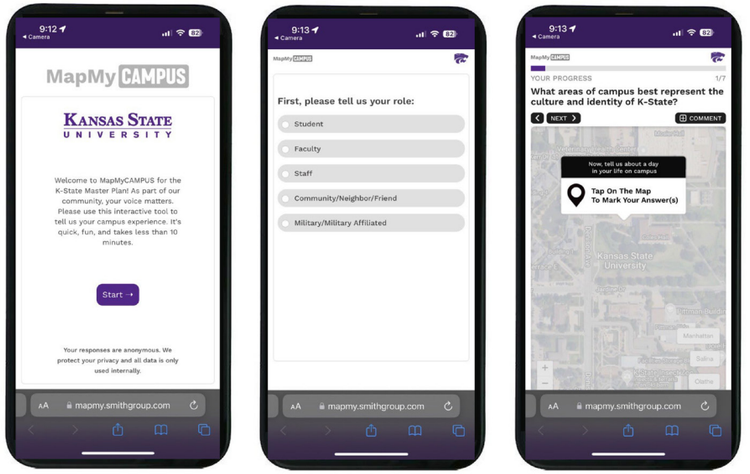
Data-Driven Facilities Assessment

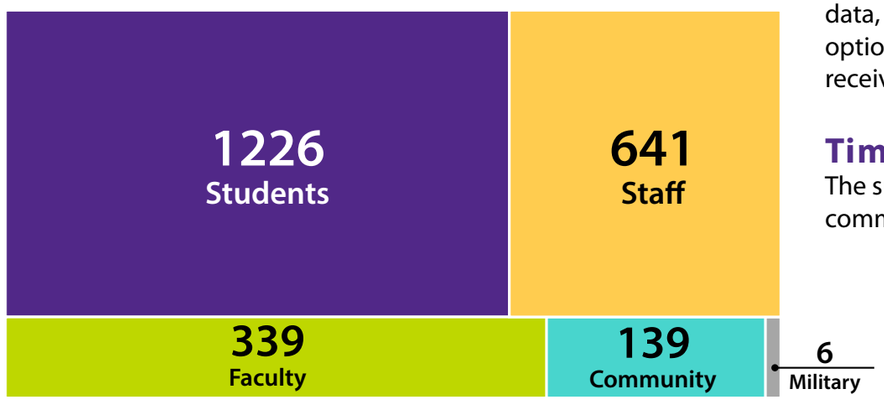
- A systematic evaluation of campus buildings was conducted using a range of performance metrics, including building condition, intensity, accessibility, safety and some additional criteria.
- This assessment supported the development of the Building Scorecard tool, which enabled a comparative analysis of facilities and helped prioritize areas for investment and improvement.

Site Analysis

- A detailed examination of the campus's physical environment was carried out to understand spatial relationships, land use patterns, circulation systems and open spaces.
- This included mapping pedestrian and vehicular flows and assessing the condition and connectivity of open spaces.

DIGITAL SURVEYS - SUMMARY





MAPMYCAMPUS SURVEY

2,351 *TOTAL SURVEY RESPONSES*

Purpose

To solicit feedback from the K-State community to help define and prioritize near-and long-term goals for the K-State Next-Gen Campus Master Plan. Digital outreach has become increasingly important in reaching those that may be unable to participate in in-person events.

Methodology

The survey included questions about how the physical campus is currently used, as well as preferences of existing facilities and amenities, followed by optional demographic related questions. The results were then compiled anonymously to reveal patterns in campus use and identify important topics in future campus planning.

Privacy

Participants' names and e-mail addresses are not included in response data, ensuring privacy of the respondents. Participants received the option to provide their e-mail address at the end of the survey to receive periodic project updates.

Timing

The survey was sent to students, faculty, staff and the K-State community during Phases 1 and 2 of the planning process.

ALUMNI & FOUNDATION SURVEY

1,438 *TOTAL SURVEY RESPONSES*

PARKING & MOBILITY SURVEY

4,865 *TOTAL SURVEY RESPONSES*

DIGITAL SURVEYS - KEY TAKEAWAYS

What should be the TOP PRIORITIES for the upcoming campus plan?

Facilities
Modernize and upgrade facilities while preserving the historical and aesthetic appeal of the campus.

Open Spaces
Preserve and enhance for community interaction, campus beautification, integration with facilities and to create an inviting environment for students, contributing to campus aesthetics and sustainability.

Community Spaces
Foster a sense of community and belonging among students, faculty and staff.

Classroom Upgrades
Modernize with well-equipped learning spaces to enhance the quality of education.

Parking & Traffic Flow
Promote accessibility and ease of movement within the campus.

Sustainability
Implement environmentally friendly practices in campus development and operations.

Building Preservation
Respect K-State's history and heritage while balancing the need for modernization.

Pedestrian-Friendly Campus
Promote a walkable, bikeable campus environment.

A2 FACILITIES

Update, modernize and rethink campus facilities. Balance beauty with function:

- *Determine future of iconic buildings: Ahearn Field House, Anderson Hall and nearby landscape areas.*
- *Increase dedicated labs for the College of Veterinary Medicine.*
- *Be purposeful in planning library spaces.*
- *Provide equitable space for all colleges.*
- *Provide more interdisciplinary and collaborative spaces.*

WHAT WE HEARD

- *Old buildings need to keep their historic charm but bring in modern conveniences, making them accessible to all.*
- *Many facilities on campus do not reflect or support the academic/research functions reflective of an R1 Institution.*

HALE LIBRARY

HALE LIBRARY

DINING

HALE LIBRARY

CAMPUS IMPROVEMENTS

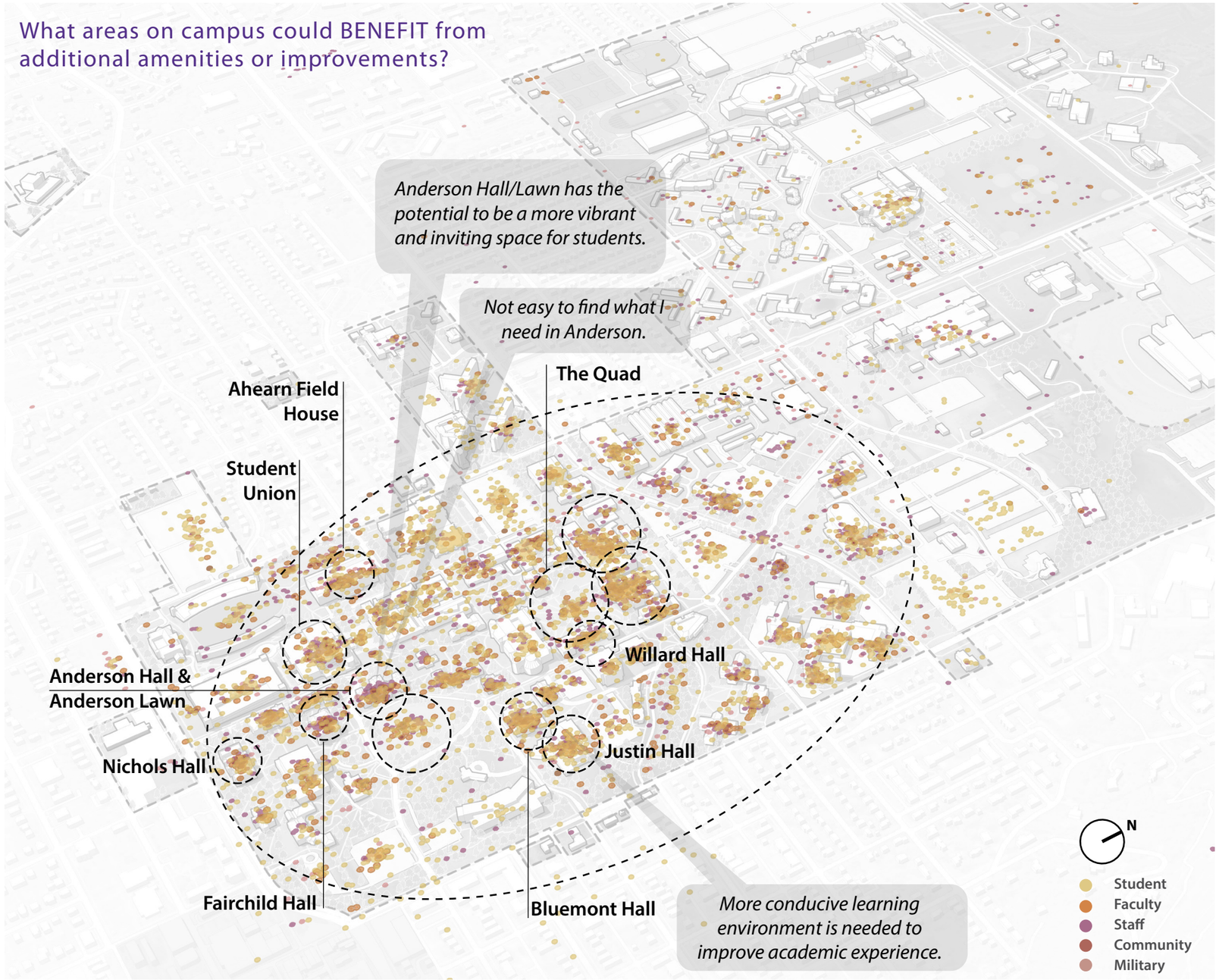
What should be PRIORITIZED to help improve K-State's physical campus environment?

Student Responses
- Building renovations: Classroom technology and furniture
- ADA accessibility in old buildings

Faculty Responses
- Upkeep of building exteriors and landscaping
- Anderson Hall and Ahearn Field House
- Building renovations: Classroom technology and furniture
- Improved office spaces
- ADA accessibility in old buildings
- Gathering spaces for faculty and staff

Staff Responses
- Deferred maintenance in old buildings
- Celebrate the history: Anderson Hall

Community/Military Responses
- Preservation and aesthetic enhancement
- Accessibility and functionality



ANDERSON HALL

Survey Responses Summary:

Campus Preservation & Community Integration

- Enhance pedestrian connection and community integration: Anderson Hall to Aggieville
- Strong call for building restoration to maintain its status as symbol
- Preservation of key campus landmarks within the campus identity

Infrastructure Improvements

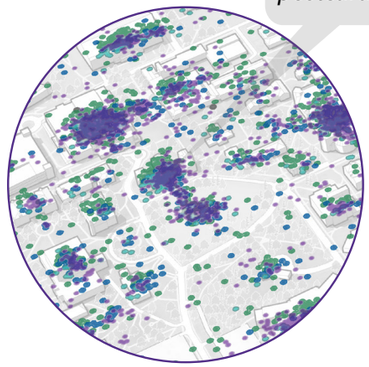
- Urgent need for renovations which include updating the exterior with new windows, addressing drainage issues and refreshing the interior to create a more welcoming atmosphere
- Enhancing heating and air conditioning systems, renovating restrooms to improve functionality and cleanliness and modernizing amenities
- Accessibility enhancements including creating common entrances for wheelchair users and ensuring clear identification of accessible entrances, better lighting and signage
- Maintenance of basement areas including refreshing walls and carpets, updating furniture and ensuring a clean and comfortable working environment for staff

Historic Preservation

- Need exterior refurbishment to restore its iconic status and preserve its historical significance

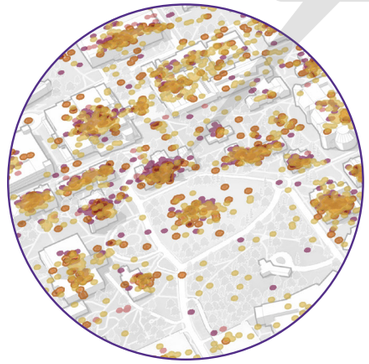
What areas on campus BEST REPRESENT the culture and identity of K-State?

Anderson Hall is the postcard image of K-State.



What areas on campus could BENEFIT from additional amenities or improvements?

Anderson Hall: Building restoration to maintain its status as symbol.



ANDERSON HALL

Old buildings need to keep their historic charm but bring in modern conveniences like outlet banks, charging stations.

Making Anderson and other administrative units more accessible to all people. Creating common, not separate, entrances for people using wheelchairs.

It would be better if there was a better pedestrian connection to Aggieville and if the previous global campus location on Anderson could be redeveloped into something that could bridge better to the community.

AHEARN FIELD HOUSE

Survey Responses Summary:

Enhance Sports & Recreational Facilities

- Enhance pedestrian connection and community integration: Anderson Hall to Aggieville
- Strong call for building restoration to maintain its status as symbol
- Preservation of key campus landmarks within the campus identity

Utilize Historical Spaces for Modern Teaching Purposes

- Use the space in Ahearn as a modern lecture facility with reference to its history

Address Infrastructure & Space Challenges

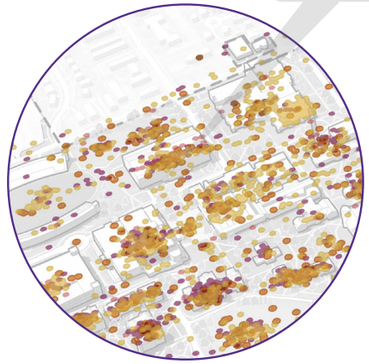
- The community learning program used to provide the credit or non-credit classes at Ahearn Field House. Due to the construction, it seems they are struggling to find classrooms especially for non-credit classes
- The area around Ahearn. Holding on to the history but enhancing it
- Would recommend putting a building in the old Ahearn Natatorium area
- Refurbish Ahearn. It would be cool to have K-State wrestling and house them in that facility. Big 12 wrestling could be poppin' in there

What areas on campus best REPRESENT the culture and identity of K-State?

I attended K-State from 1979 -1984. The old field house represented to me why I attended K-State. It was truly a special place with special players and games!!

What areas on campus could BENEFIT from additional amenities or improvements?

Doing something with Ahearn and the adjacent space.



AHEARN FIELD HOUSE

Ahearn Field House should be preserved, upgraded and used regularly for a variety of campus activities.

Repurpose Ahearn so it's not sitting there empty!

Do something interesting with Ahearn.

STUDENT UNION

Survey Responses Summary:

Enhance Union Facilities & Accessibility

- Places for gathering or activities closer to Union
- More green space between engineering building, Seaton and the Union
- More study spaces by the Union
- Having guests on campus with ADA needs to stop at the Union garage
- Either make the Union pretty or build a new pretty structure that attracts new students
- Many of the Union spaces need updating as we host events, lectures and conferences in spaces that do not have updated technology

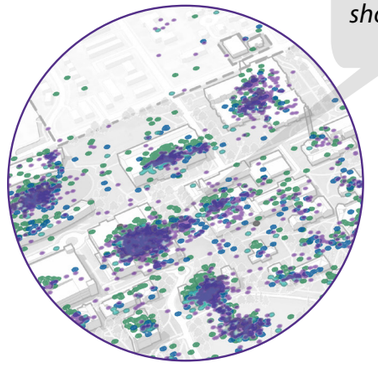
Reduce Costs & Improve Usability of Spaces

- The Student Union and other organizations always charge faculty fees to utilize space for social activities. As a result, there's a lack of venues for socializing outside of direct teaching duties
- Make meeting space scheduling easier to encourage use

Modernize the Union

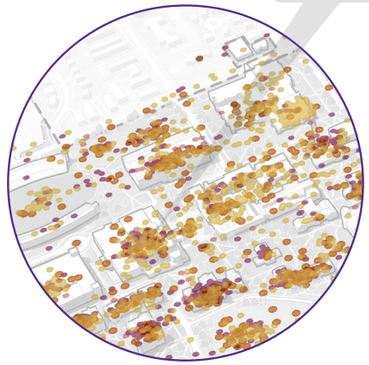
- Upgrading and modernizing the Union
- The walkway from the garage to the Student Union needs more clearness

What areas on campus BEST REPRESENT the culture and identity of K-State?



The Union and Multicultural Center show K-State's heart for its family.

What areas on campus could BENEFIT from additional amenities or improvements?



Main floor works great. The rest needs upgrades.

BOSCO STUDENT PLAZA

I like the Student Union because it is always active in some way. It's a great place to just chill or walk around, and I enjoy bowling!

I love to watch the current K-State students come and go from the Student Union. It brings me back to my days on campus and ties the current time with all alumni that have graduated from the university.

The Student Union seems to be a central gathering spot which could be enhanced to create a multi-use facility for all.

BUILDING SCORECARD

A Dynamic Decision-Making Tool for Campus Stewardship

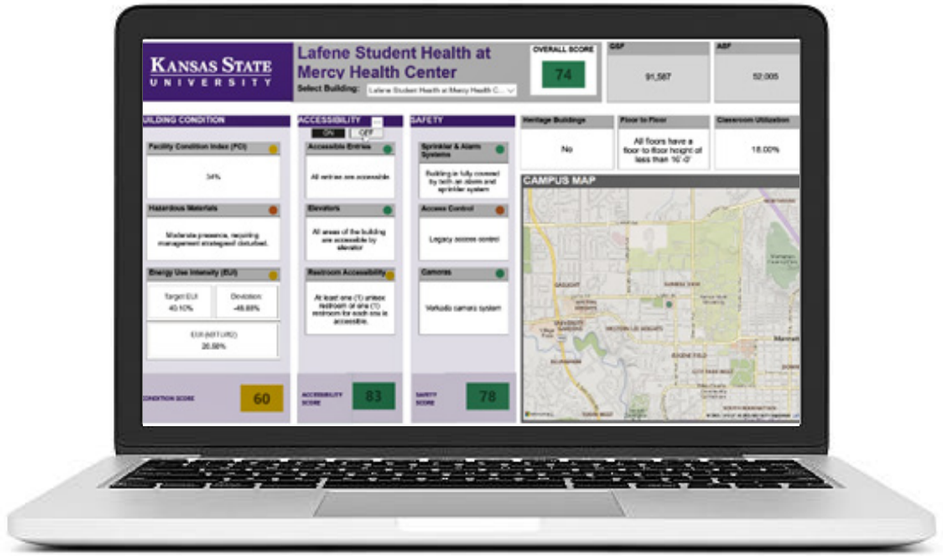
The ability to make data-informed decisions about K-State's physical campus assets has never been more critical. Historically, facilities planning has relied on static reports and periodic assessments that often lacked the flexibility to respond to changing priorities or emerging challenges. To address this gap, SmithGroup developed the Building Scorecard—an interactive, Power BI-based platform designed to provide a dynamic, holistic view of K-State's building portfolio. This tool empowers the Facilities Team to evaluate facilities through a multi-dimensional lens. Moving forward, K-State will be managing and updating this platform independently to ensure it continues to meet their evolving needs.

Moving Forward

As K-State continues to refine our data inputs and incorporate feedback from stakeholders, the Building Scorecard will become increasingly predictive and prescriptive. Future iterations may include integration with deferred maintenance forecasting, carbon reduction modeling and academic space utilization analytics.

Ultimately, the Building Scorecard represents a return in how K-State stewards its physical assets—from reactive maintenance to proactive, strategic investment that supports the long-term mission of K-State.

Categories	Rating Criteria
Building Condition	Facility Conditions Index (FCI) Hazardous Materials Deviation from Target Energy Use Intensity (EUI)
Accessibility	Accessible Entries Elevators Restroom Accessibility
Safety	Sprinkler & Alarm Systems Access Controls Cameras
Additional Criteria	Heritage Building Classification Floor to Floor Height Classroom Utilization



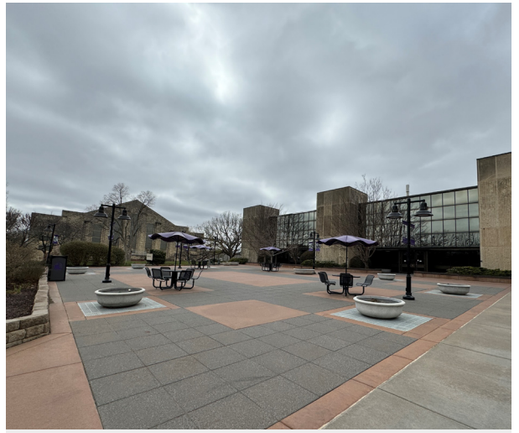
A3 OPEN SPACE & LANDSCAPE

Activate and diversify campus open spaces by revitalizing Campus Creek, creating outdoor classrooms and adding social amenities. These enhancements will promote health and wellness, transform underutilized areas and foster opportunities for building campus traditions.

WHAT WE HEARD

- *Campus is beautiful to look at, but not to be in.*
- *Need more meaning and flexibility in open spaces.*
- *We need to emphasize well-being across campus to attract and retain students.*
- *Anderson Hall and its lawn is iconic but does not contribute to daily campus use.*
- *Campus Creek and other natural areas of campus should be considered an asset and model for sustainable use.*
- *The Quad has potential to have more engaging outdoor programming.*
- *Outdoor classrooms or more areas like Seaton's outdoor theatre space could be integrated.*

OPEN SPACE NEAR HALE LIBRARY & EISENHOWER HALL



PLAZA OUTSIDE DURLAND HALL

THE QUAD

OPEN SPACE NEAR KING HALL

ANDERSON LAWN

CULTURE & IDENTITY

What should be PRIORITIZED to help improve K-State's physical campus environment?

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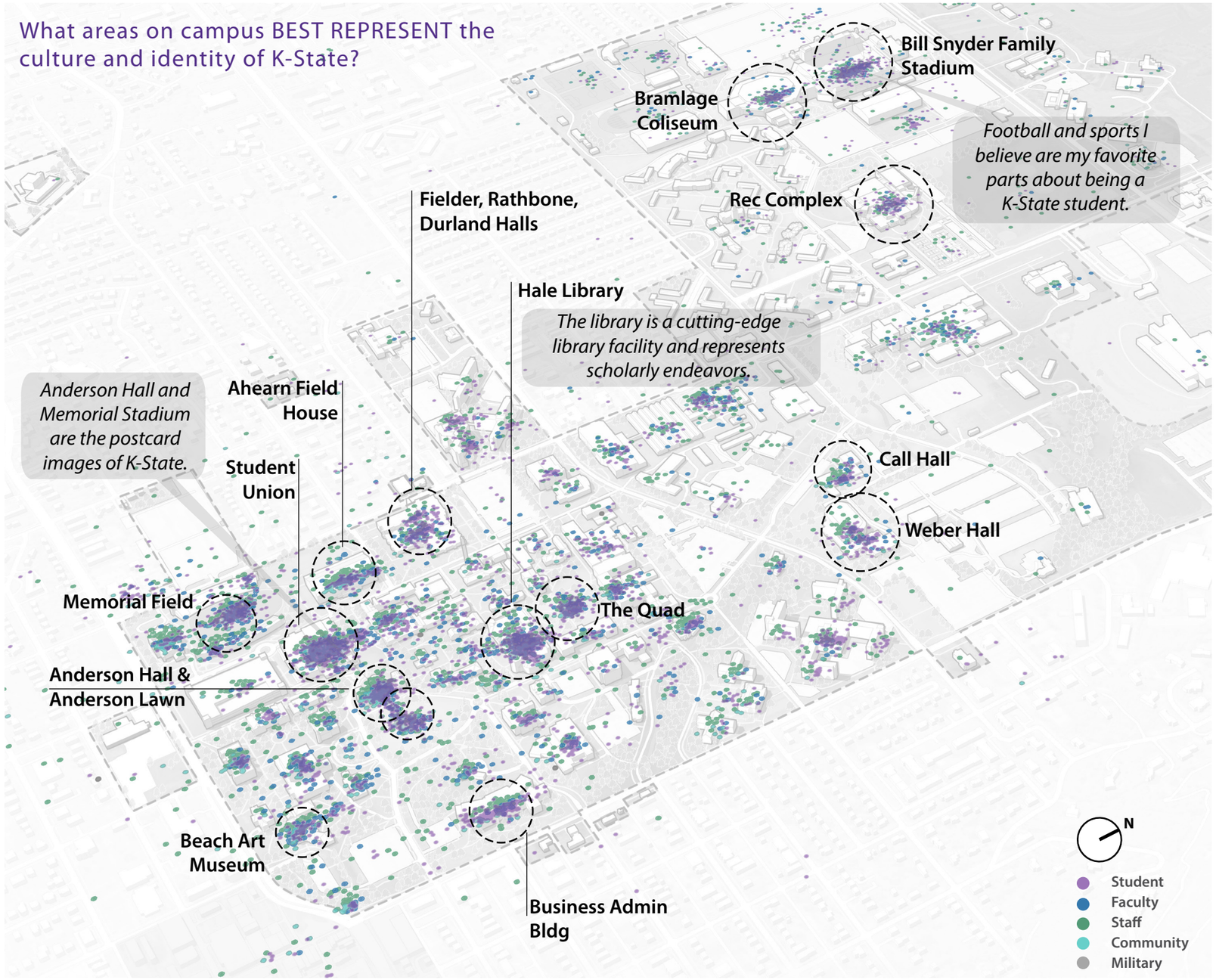


OUTDOOR SPACES

What kind of outdoor recreational space is currently MISSING on the campus?

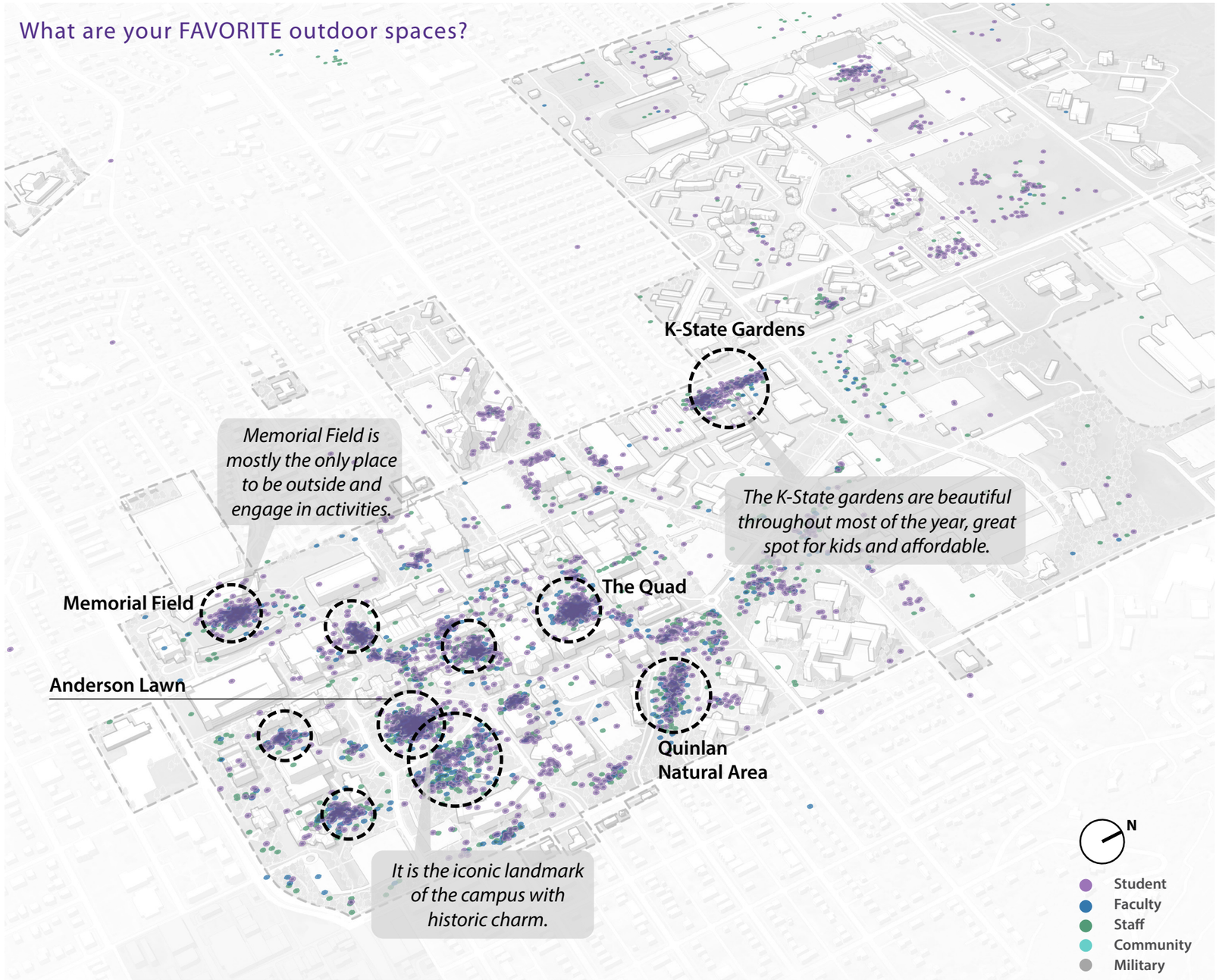
Student Responses

- Outdoor seating and gathering spaces
- Seating along revitalized campus creek
- Outdoor/indoor pool/natatorium
- Outdoor gym
- Running trails/loop
- Pickleball courts
- Spaces to put up hammocks
- Multi-use recreation fields
- Picnic tables, park benches
- Shaded spaces (wind and sun protection)

What kind of outdoor space could make learning on campus even BETTER?

Student Responses

- Outdoor classroom/study spaces
- More amphitheater spaces
- Shaded structures with plug ins for laptops and Wi-Fi
- Quiet study spots in nature
- Outdoor patios
- Covered outdoor library extension
- Movable tables and chairs



A4 MOBILITY & CIRCULATION

Enhance mobility and safety across K-State and Manhattan by reimagining surface parking lots, campus edges and key gateways. Explore strategic trade-offs to balance improved access with parking needs.

WHAT WE HEARD

- *Parking location is an issue. Quantity is ok, but proximity to buildings is not ideal.*
- *Focus on transit is needed. K-State is the only Big12 campus without dedicated student supported transit system.*
- *Safe pedestrian experience, wayfinding systems and access to campus from town need to be improved.*

FLINT HILLS AREA TRANSPORTATION AGENCY (ATA) BUS ON CAMPUS

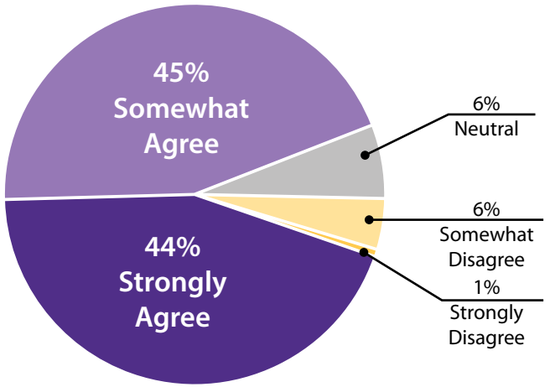
PEDESTRIAN PATHWAY NEAR HALE LIBRARY

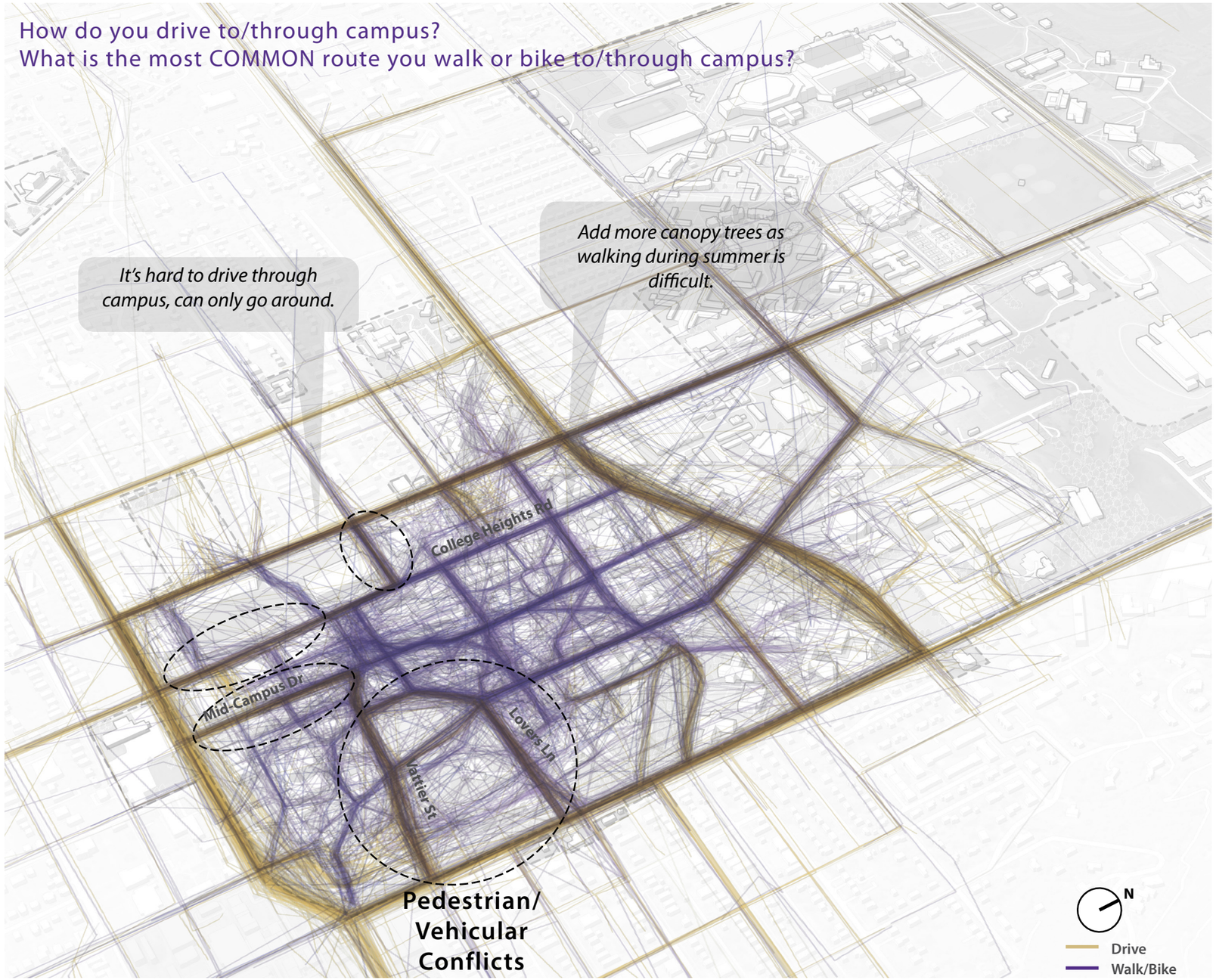
VIEW OF PARKING LOT A28, FACING EAST

CIRCULATION SYSTEMS

Throughout the open houses, stakeholder committee meetings, MapMyCampus survey and parking survey, students reported limitations in their ability to conveniently and safely cross major roadways when entering or leaving campus on foot. While the core campus provides convenient and safe pedestrian roadways and paths, the surrounding streets including Denison Avenue, Manhattan Avenue, Claflin Road and Anderson Avenue have limited bike and pedestrian infrastructure and higher traffic volumes. Anderson sees the largest volume exceeding 25,000 vehicles per day. While Denison Avenue, Claflin Road and Manhattan Avenue are significantly lower, an Average Daily Traffic (ADT) above 10,000 is considered unsafe for shared bike facilities, warranting separated bike lanes or shared-use paths.

It is easy and intuitive to NAVIGATE around campus. Do you agree?

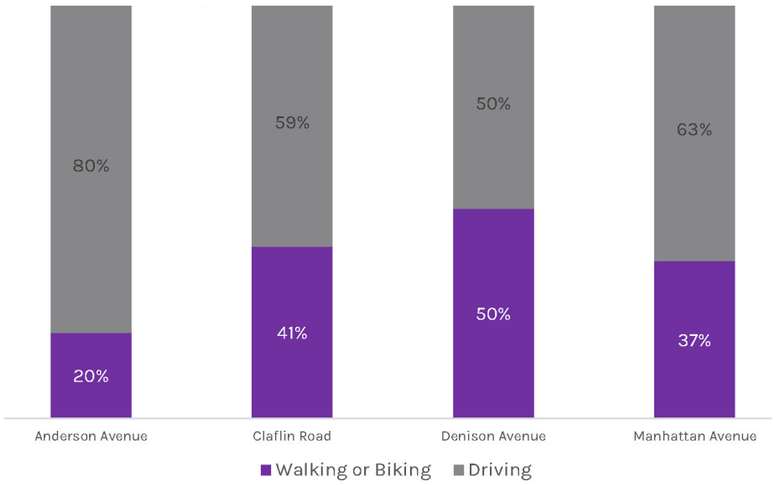


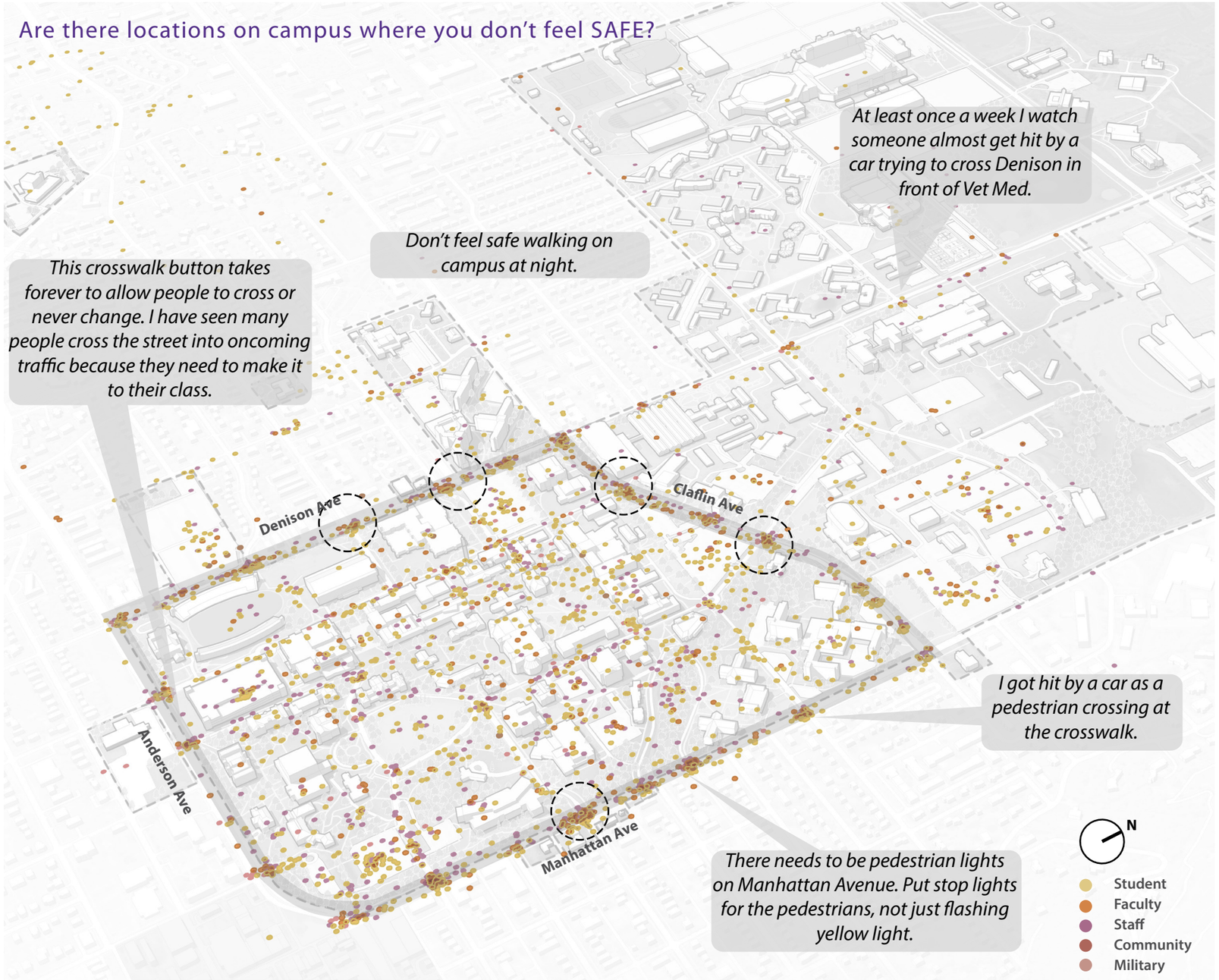


MULTI-MODAL SAFETY

Anderson Avenue, Claflin Road and Kimball Avenue are the only roadways connecting the east side of campus to the west side of campus. With Anderson and Kimball Avenues having ADT volumes exceeding 20,000, cyclists and pedestrians avoid these roadways and are focused along Claflin Road. Over 40% of Claflin Road's roadway users are walking and biking.

This larger volume of cyclists and pedestrians creates more potential points of conflict between vehicles and cyclists/pedestrians. When MapMyCampus respondents were asked where they feel unsafe on campus, the most common intersection identified was Claflin Road and Mid-Campus Drive, where there is a constant flow of vehicles, pedestrians, cyclists. Roadways like Claflin Road and Denison Avenue that have a higher ratio of bike/pedestrian volumes have a greater need for separated bike/pedestrian amenities to mitigate potential crashes.





Key Issues:
Vehicular/pedestrian/bike conflict points

- Limited bike and pedestrian infrastructure leads to more people use unintended paths when moving around campus, increasing conflict points and other safety issues.

Perimeter roadways can be congested & unsafe

- Roadways along the campus perimeter are congested and have conflict points between bikes, pedestrians and vehicles.

Sidewalk & crossing gaps are a top issue

- Safety concerns at key intersections was most prevalent on surveys, particularly at campus adjacent roadways.

Bike network is not continuous & clear

- Resources on bike infrastructure on campus is limited.
- Most cyclists use sidewalks, creating potential conflicts with pedestrians.

Opportunities & Strategies:
Identify roadway types for different users

- Develop hierarchy of roadways on campus to prioritize functionality of streets on campus.

Increase continuous bike network

- Work with the City of Manhattan and the county to leverage K-State bike infrastructure beyond campus to increase comfort of cyclists.

Upgrade key intersections & pedestrian amenities to enhance pedestrian experience

With a known high volume of potential safety conflict points along Anderson Avenue, Claflin Road, Denison Avenue and Manhattan Avenue, it is critical to pursue safety design interventions and initiatives along these roadways. Specific intersections to prioritize include

- Claflin Road and Mid-Campus Drive
- Manhattan Avenue and Lovers Lane
- Anderson Avenue and Manhattan Avenue
- Denison Avenue and Claflin Road
- Denison Avenue and College Heights

Additional east-west street through campus

With the limited east-west connection points through campus, there is an opportunity to create an additional east-west connection point through Jardine. This connection would offer a much-needed route for cyclists and pedestrians, safely separated from the high-traffic Claflin Road. It would also improve efficiency for the adjacent storage and service areas.

Key Findings:

On Denison Avenue, walking and biking were just as common as driving. In contrast, more people chose to drive than walk or bike on Anderson Avenue, Manhattan Avenue and Claflin Road.

Roads with greater percentages of bike/pedestrian use indicate greater need for bike/pedestrian amenities.

Honestly, everywhere, including the entire City of Manhattan, could use more bike paths/lanes. I don't ride my bike to class as often as I'd like because it's not the most bike-friendly.

The Mid-Campus Dr and Claflin Rd crosswalk takes forever to switch so people jaywalk all the time.

MULTI-MODAL CULTURE

There is interest in bike & micromobility but limited infrastructure and/or support for programs.

Bike infrastructure was identified as a common mobility issue. While a significant number of students and commuters live within a 2- to 5-mile radius of campus—an ideal biking distance—surveyors stated an absence of infrastructure, lack of connection and unclear signage as key barriers to biking on or around campus. Students also brought up the desire to bring back micromobility options on campus, stating the convenience of accessing a scooter for 1- to 3-mile trips within campus. Despite these limitations, the volume of bike permits increased by 6% since 2019. In comparison to 12 peer institutions with similar land use characteristics, 60% included bike share or escooter program for students and 85% included zipcar as an option.

Analytical Highlights

- The 2024 parking survey found that 88% of faculty, staff and student respondents drive and park when traveling to and from campus.
- Beyond core campus lots, on-site surveys observed a less than 30% utilization rate at the larger surface lots on the periphery of campus
- Approximately 50% of comments from the K-State parking survey stated the lack of reliable and predictable parking as a key parking issue and priority across user groups.
- Denison Avenue, Claflin Road and Manhattan Avenue have average daily traffic volumes exceeding 10,000 which is considered unsafe for shared bike facilities, warranting separated bike lanes or shared-use paths.
- The number one intersection where MapMyCampus respondents felt unsafe on campus was Claflin Road and Mid-Campus Drive
- Bus ridership at K-State is 77% below ridership of peer institutions.
- K-State's bus service/ridership has recovered from pre-pandemic levels, seeing a 20% increase in rides per student between 2022 and 2023.

Inadequate Bikeway Infrastructure

Bike infrastructure throughout the Manhattan Campus is variable and not a part of a connected network. Per feedback from the MapMyCampus survey, current bike infrastructure along major roadways—including Denison and Anderson Avenues—are narrow and not protected. Shared lane markings in the heart of campus encourage vehicles to share the road with bikes but can be stressful for bikes to maneuver. With limited bike infrastructure, cyclists use the sidewalk which can create conflicts between cyclists and pedestrians.

Inadequate Pedestrian Infrastructure

Infrastructure throughout campus, especially across through streets, is inadequate for safe walking. Pedestrians have limited visibility of vehicles when crossing to campus and are not prioritized over vehicles in certain instances. Crossings that are used daily by students, staff and faculty do not have marked crosswalks, ADA compliance or continuous sidewalk connectivity. The prioritization of pedestrians over vehicles by modernizing key crossings and walkways is vital for pedestrians to cross through streets safely. Overall, the lack of dedicated bike and pedestrian infrastructure has led many people to use informal or unintended paths when navigating campus. This increases the number of potential conflict points and raises safety concerns.

MULTI-MODAL PEER COMPARISON

Supportive Programs

After researching the types of transportation supportive programs at 12 peer institutions with similar land use characteristics, many offered programs that supported the education, awareness and use of bike/pedestrian infrastructure through a variety of initiatives. Eight of which included bike share or escooter program on campus, 11 include zipcar as an option for students without a vehicle on campus and 9 include a carpool or ride-matching program. Including these programs fosters support and increases the comfort and likelihood of campus members using alternative modes of transportation.

Opportunities & Strategies:

Increasing the use and confidence of pedestrian safety on campus starts with increasing the space dedicated to non-vehicular users and enhancing the legibility and consistency of existing infrastructure. The proposed plan increases the volume of bike/pedestrian only roadways on campus including MLK Jr. Drive, College Heights and Old Claflin Road to nearly double the pedestrian campus core, while maintaining emergency and service access.

	ZIPCAR/ CAR SHARE	EMERGENCY RIDE HOME	CARPOOL/ RIDE-MATCHING	BIKE SHARE OR E-SCOOTER	BUS INCLUDED IN STUDENT ORIENTATION?	BIKE/PED EDUCATION	BIKE CLUBS OR EVENTS?	STUDENT TRANSPORTATION OR SUSTAINABILITY FUND ?
K-STATE		✓						
BU	✓				✓	✓	✓	✓
TT	✓	✓	✓		✓	✓	✓	
ISU	✓	✓	✓		✓			
OSU	✓		✓	✓	✓	✓	✓	
WVU	✓				✓	✓		
ILSU	✓	✓	✓	✓	✓		✓	
MSU	✓	✓		✓	✓		✓	
PU	✓	✓	✓	✓	✓	✓		✓
KU	✓	✓	✓	✓	✓	✓	✓	✓
CSU	✓	✓	✓	✓	✓	✓	✓	✓
NU	✓	✓	✓	✓	✓	✓	✓	✓
UA	✓	✓		✓	✓	✓	✓	✓
MSU		✓	✓		✓	✓	✓	✓

Data Source: 2024 Transportation Demand Management Audit

IMPLEMENTATION

Recommendations & Additional Studies

K-State students, faculty and staff voiced interest in learning more about bike, micromobility and other programs to increase mode choice on campus. The following programs will assist K-State in familiarizing campus users with other mode options and their associated benefits.

	IMMEDIATE	NEAR-TERM	MID-TERM	LONG-TERM
Micromobility	Deploy ebike and escooter program on campus, monitor devices	Collect ATA ridership data to understand potential microtransit or internal campus circulator needs and interests	Create and construct mobility hub network across campus, establish typologies and scale hubs based on data, travel patterns and available resources	Increase fleet size and expand mobility hub network
Programmatic	Work with K-State leadership to determine and establish mode split goals	Identify potential mobility programs and support services to achieve mode split goals (zipcar, bike clubs, etc.)	Identify dedicated staff responsible for communicating campus mobility choices and provide/advertise information	Monitor impact of programs and continue to grow/modify as desired
Infrastructure	Collect data on where the K-State community does and does not park bikes and other preferences	Increase/improve bikeway signage and connections to broader network. Identify phasing for additional bike facility construction	Build bike facilities per phasing plan	Establish indoor bike lockers, bike barns and other accessible bike parking opportunities across campus
Roadway	Identify key intersections for pedestrian/bike safety improvements, prioritizing locations of highest non-motorized traffic at intersections and crossings	Implement low-cost intersection safety improvements (i.e. paint crosswalks, signage, etc.)	Implement more intensive safety improvements at high-need intersections (curb extensions, signalized crossings, etc.)	Continue to work with the city to connect Jardine as a through street, ensuring bikeway facilities is included in final design, in alignment with the plan

PARKING

The majority of campus users choose to drive and park as their primary mode of transportation.

The 2024 parking survey found that 88% of faculty, staff and student respondents drive and park when traveling to and from campus. With a concentration of academic and non-academic activities occurring in the campus core, centrally located surface lots have the highest demand, specifically the engineering lot and the business center lot. The occupancy count report shows that centrally located lots experience occupancy levels above 100% during peak morning (9:00 to 10:00 AM) and afternoon (1:00 to 2:00 PM) classes, but are otherwise below 80% full.

Beyond core campus lots, on-site surveys observed a less than 30% utilization rate at the larger surface lots on the periphery of campus, including the stadium lot. Staff, faculty and students echoed this pattern during open houses and in survey comments, concerns focused around a lack available space in core campus lots and that finding a space on campus is not 'guaranteed' after early morning hours in the campus core. Approximately 50% of comments from the K-State parking survey stated the lack of reliable and predictable parking as a key parking issue and priority across user groups.

Additional research on peer institutions was completed to identify how K-State's parking system compares to their peers regarding parking permit costs for students, staff and faculty, as well as the price range among these groups. While K-State's permit prices are on the lower end compared to peer institutions, those peers typically offer a broader pricing range—from $300 to $700—whereas K-State's range is narrower, from approximately $50 to $300. Having a wider range of parking permit options and lots provides drivers with more options and balances demand across products.

Key Issues:

- Maintaining parking access to buildings is important for visitors and deliveries; however, there are limited prime spaces at certain times with the current parking system.
- Parking is inconvenient for respondents of the survey as it was expressed that there are limited spaces available in the campus' core lots. Beyond core campus lots, on-site surveys observed a less than 30% utilization rate at the larger surface lots on the periphery of campus, including the stadium lot.
- Staff, faculty and students echoed this pattern during open houses and in survey comments, concerns focused around a lack available space in core campus lots and that finding a space on campus is not 'guaranteed' after early morning hours in the campus core. Approximately 50% of comments from the K-State parking survey stated the lack of reliable and predictable parking as a key parking issue and priority across user groups.

Opportunities & Strategies:

- While the master plan seeks to balance future growth with existing infrastructure, we recognize that the reduction in parking, particularly in high-demand areas, will be felt by the campus community. Continued evaluation of parking demand and future mitigation strategies will be necessary as the plan evolves.
- With the introduction of a new garage, parking spaces will be restored for a 3 to 6% total loss in parking.

PARKING SURVEY SUMMARY

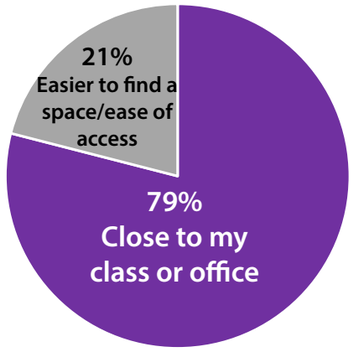
In the spring of 2024, K-State solicited students, faculty, staff and visitors to participate in a parking survey to collect data on parking behaviors, travel preferences and overall parking opinions on campus. The survey found that the vast majority of people drive and park when traveling to and from campus (87%), with 11% walking, 1% biking and 0.5% using the ATA Bus service. When there is a high concentration of drivers commuting to campus at the same time, a larger volume of parking is required to accommodate vehicles at specific time periods, typically morning and afternoon class periods. When asked about the location of their preferred lot, 79% of respondents stated they choose to park close to their classroom or office, creating surges of parking demand during specific time periods in centrally located lots. These peak demand periods in the core of campus create inadequate supply during certain time periods, as reflected in the 43% of respondents stating that they do not feel there is adequate parking; 46% of respondents stating they allot over 15 minutes to search for parking; and 40% of respondents stating they feel it takes them 15 minutes or more to find parking when on campus.

If I get to campus no later than 8:15 am, there are no available spots.

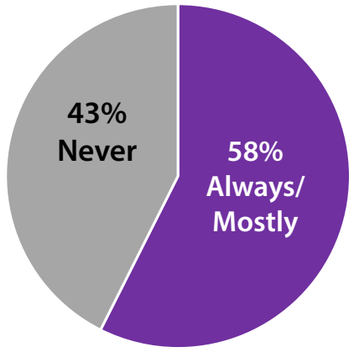
If I don't get to campus early, I find myself looping and looping around parking lots to find a spot for a 9:30 class.

Campus parking is a nightmare, especially before and during morning classes.

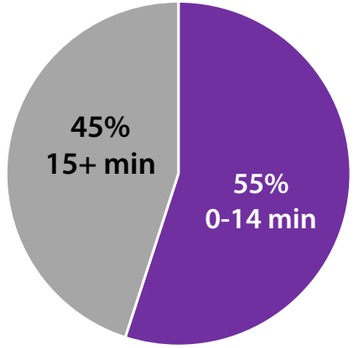
Why do you CHOOSE to park in your preferred lot?



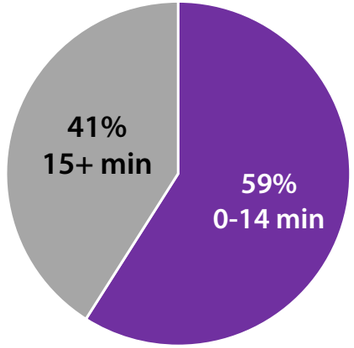
Do you feel like there is ADEQUATE parking?



How much TIME do you allot to find a parking space?



How much TIME do you feel it takes to find a parking space?



PEER PARKING RATE COMPARISON

A peer institutional research comparison was conducted to evaluate how K-State's mobility system performs in terms of parking permit costs for students, staff and faculty, as well as the price ranges across these groups.

The peers in the table to the right were selected for comparison based on their similarity to K-State in key institutional characteristics—such as being R1 research institutions, land-grant universities, or large campuses with comparable or greater size, complexity and urban-rural context. This ensures that the comparison reflects institutions facing similar operational and spatial challenges. Additionally, a subset of peers was hand-picked for their innovative transit and mobility practices, offering valuable insights into best practices that could inform future strategies.

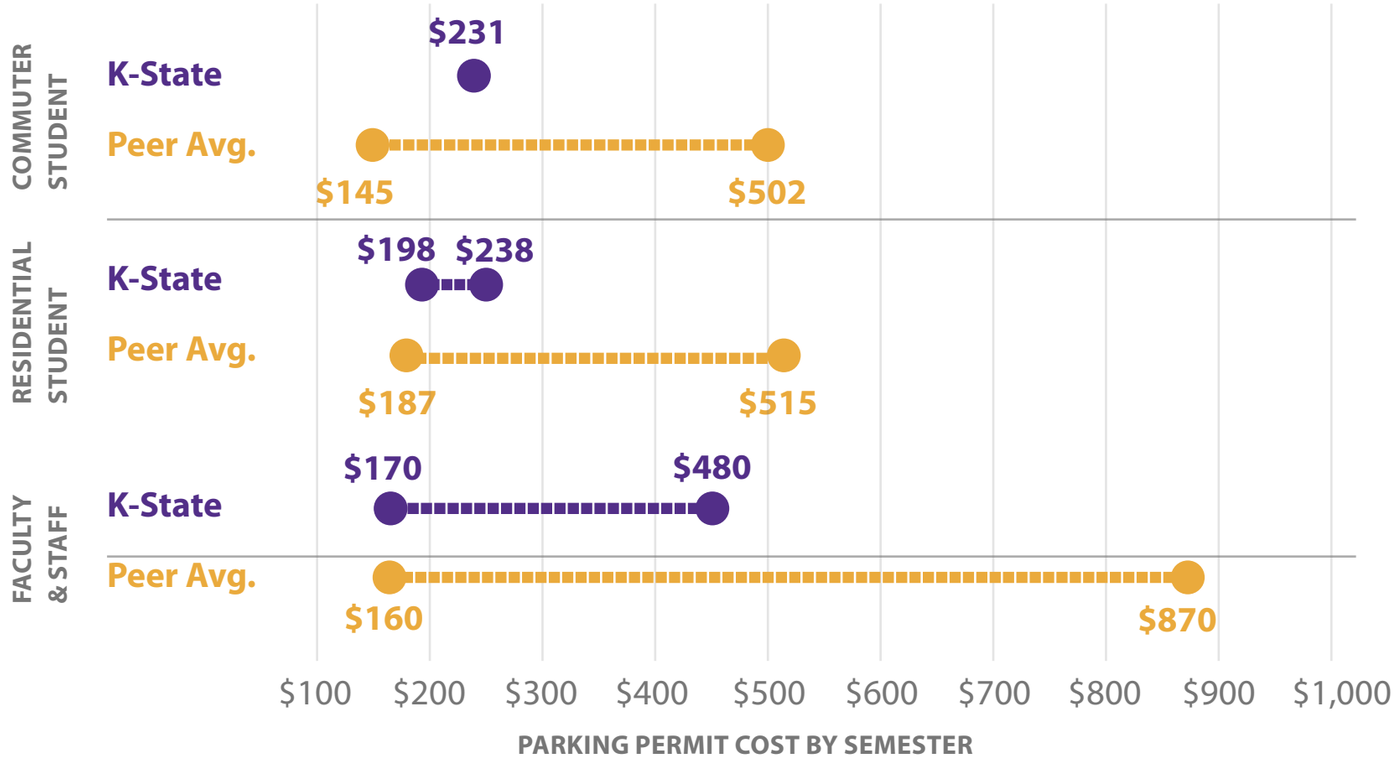
	Faculty/Staff			Resident Student			Commuter Student			Daily Visitor		Citation Fee
	Low	High	Range	Low	High	Range	Low	High	Range	Low	High	
Kansas State University	**$170**	**$450**	***$55***	**$198**	**$238**	***$40***	**$231**	**$231**	***$0***	**$6.00**	**$16.00**	**$17**
Baylor University	0	0	*$0*	0	$400	*$400*	0	$365	*$365*	$0.00	$0.00	$35
Texas Tech University	$131	$1,321	*$1,190*	$263	$689	*$426*	$44	$143	*$99*	$0.00	$9.00	$25
Iowa State University	$205	$1,105	*$900*	$132	$176	*$44*	$0	$176	*$176*	$5.00	$5.00	$20
Oklahoma State University	$204	$492	*$288*	$168	$492	*$324*	$204	$300	*$96*	$3.00	$3.00	$15
West Virginia University	$252	$888	*$636*	$252	$858	*$606*	$252	$858	*$606*	$1.00	$1.00	$20
Illinois State University	$97	$562	*$465*	$226	$361	*$135*	$97	$458	*$361*	$8.00	$8.00	$20
Michigan State University	$107	$588	*$481*	$107	$388	*$281*	$147	$480	*$333*	$15.00	$48.00	$20
Purdue University	$20	$1,000	*$980*	$100	$250	*$150*	$100	$250	*$150*	$10.00	$10.00	$35
Kansas University	$302	$663	*$361*	$331	$331	*$0*	$302	$350	*$48*	$3.00	$36.25	$15
Colorado State University	$193	$762	*$569*	$208	$823	*$615*	$193	$572	*$379*	$4.25	$13.00	$30
University of Nebraska	$276	$1,176	*$900*	$276	$459	*$183*	$276	$540	*$264*	$7.00	$7.00	$15
University of Arkansas	$25	$1,020	*$995*	$25	$1,020	*$995*	$25	$1,020	*$995*	$8.25	$8.25	$20
Montana State University	$100	$878	*$778*	$150	300	*$150*	$100	$878	*$778*	$8.00	$12.00	$35
Peer Avg.	**$160**	**$871**	**$712**	**$18**	**$512**	**$326**	**$145**	**$502**	**$357**	**$6**	**$13**	**$23**

NOTE: DATA REPRESENTS 2024 FALL SEMESTER RATES

While K-State offers fewer distinct price points, peer universities provide a broader spread of rates, giving drivers more flexibility to choose based on their needs and helping to distribute demand more effectively.

K-State's parking rates tend to fall below those of peer institutions, especially at the higher end, with faculty and staff permits notably less expensive. Interestingly, K-State's lowest permit prices are slightly above those of peers, but its highest rates remain well below, particularly for employees.

Additionally, relatively low citation fees may reduce the incentive for some drivers to purchase daily or monthly permits, potentially undermining the system's effectiveness.



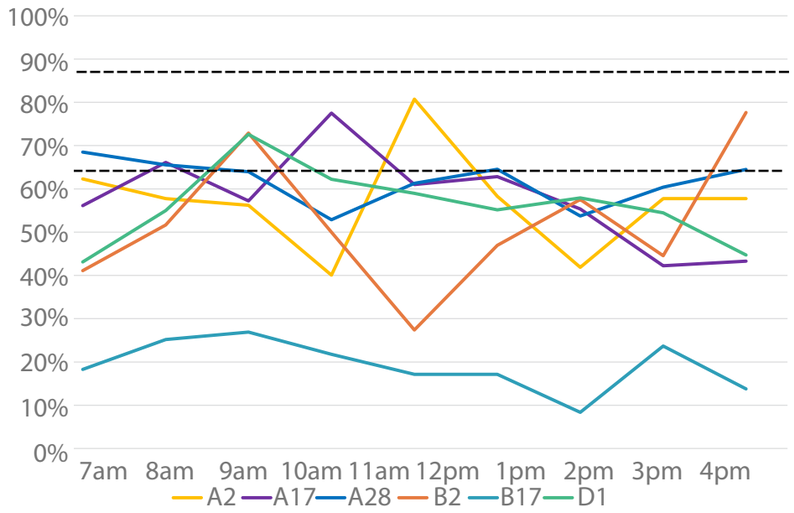
NOTE: DATA REPRESENTS 2024 FALL SEMESTER RATES

PERMIT UTILIZATION

High utilization of parking is concentrated in the morning and mid-day on campus for specific permit types.

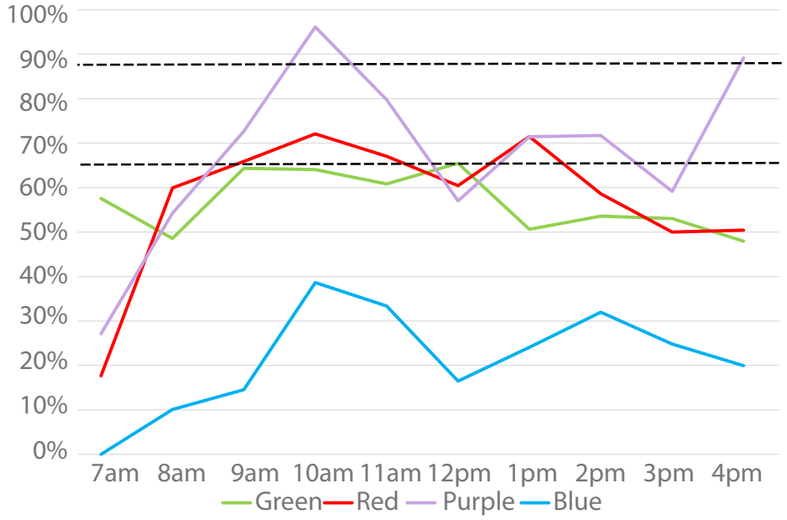
Hourly Utilization by Lot

Utilization per lot indicates that different lots experience distinct utilization patterns throughout the course of the day, but none of which exceed 80%. The effective and efficient turnover of convenient parking spaces is most successful when the facility reaches a 90% occupancy rate, meaning that 10% of spaces are not occupied at any given time and are available for incoming parkers. This translates to approximately 1 to 2 open spaces per block or parking lot row. From an economics standpoint, utilization under 90% at highest peak times during the day would be considered underutilized and inefficient use of financial resources, and demand above 90% would be considered as "constrained" parking conditions, which may result in excessive cruising or circulation with drivers searching for parking. Meaning that with K-States lot utilization not exceeding 80% their spaces are largely underutilized.



Hourly Utilization by Permit Type

Two primary parking permits are offered at K-State: Green permits, which are offered to students and Red permits which are offered to faculty/staff. The graph below summarizes the hourly permit utilization patterns for each of these permit types within the engineering lot (A28). While each permit type exceeds the 90% functional capacity throughout the course of the day, peak demand periods are concentrated during peak morning (9 to 10 am) and afternoon (1 to 2 pm) periods and otherwise within a comfortable occupancy rate. This could also indicate a need to better manage the distribution and allocation of permits at K-State. K-State allows any individual to purchase a permit and search for a space throughout campus. Setting a cap on the number of permits allocated to each lot or area would assist in maintaining a lower occupancy rate and ensure drivers will be able to find a space when driving on campus.



IMPLEMENTATION

Recommendations & Additional Studies

The continued presence of parking on campus was a key concern heard throughout open house comments and steering committee conversations. Accordingly, the K-State Next-Gen Campus Master Plan largely maintains K-State's parking supply, with a potential loss of 10% of total spaces.

At the same time, parking policies and programs will optimize the existing parking footprint, including streamlining the current permit structure, creating more rate options and introducing additional staff to support these initiatives.

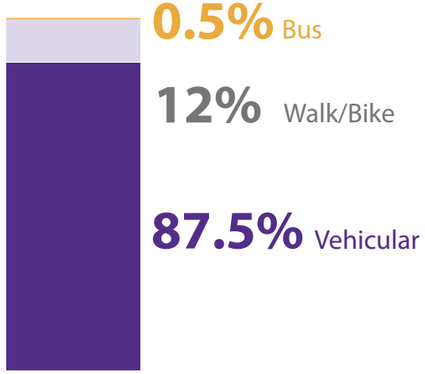
Permit	Complete campus parking study to determine systemwide utilization. Forecast parking supply/demand distribution by user group/permit type	Adopt 'streamlined' permit system to increase reliability of parking availability
Supply	Continue conversations with Athletics on shared parking facility during non-peak athletics hours of operation	Adopt contract with Athletics and introduce athletics Park 'n' Ride option (free)
Pricing	Complete campus parking study to build and verify plan parking rate recommendations. Forecast impact to overall transportation budget	Negotiate and approve pricing model and range
Staff	Expand parking services to 'mobility services' and take on responsibility for multimodal services and resources on campus	Rebrand Parking and Mobility Department. Falls in line with new student orientation

TRANSIT SYSTEM

An enhanced transit system will expand student access and promote equity, reduce parking and traffic pressures, advance sustainability and mobility goals, and help offset long-term parking losses due to new campus developments.

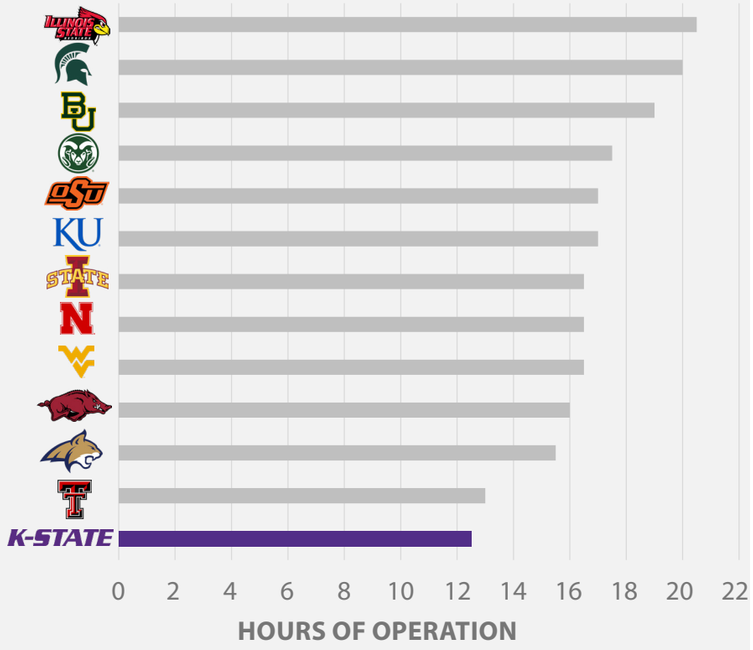
Students stated further limitations when using transit to move through campus. Through the open house feedback, students brought up experiences waiting for the bus for extended periods of time and frustrations with the absence of evening/weekend service, while many others stated they were not aware of a shuttle system on campus altogether. In comparison to 12 peer institutions with similar land use characteristics, K-State's bus ridership is 77% lower than peers. When looking at hours of operation, K-State's bus service operates five fewer hours than peer institutions.

What is your PRIMARY mode of transportation?



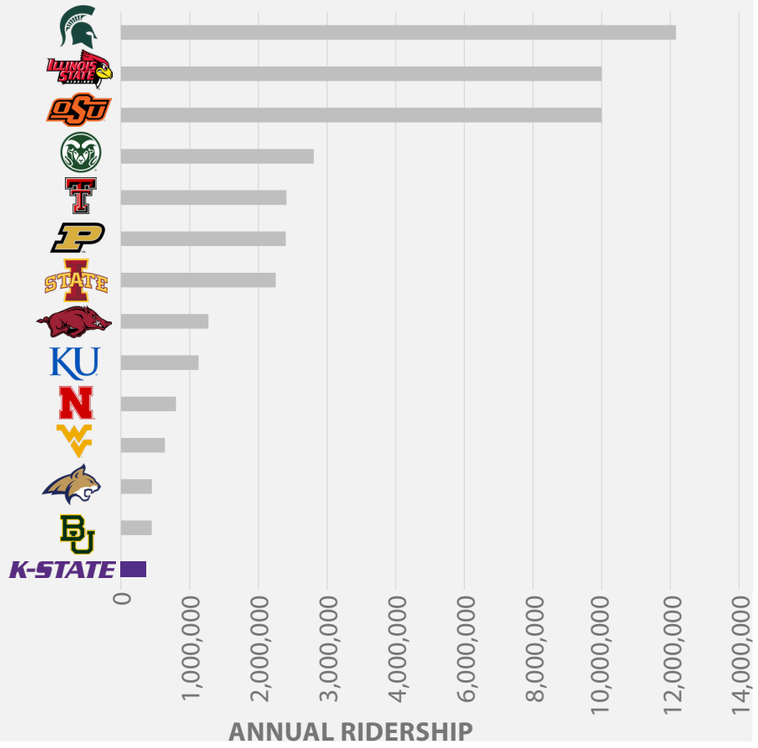
Peer Institutions are operating 17 hours, 5 hours more than K-State's existing operation hours.

TRANSIT HOURS OF OPERATION COMPARISON



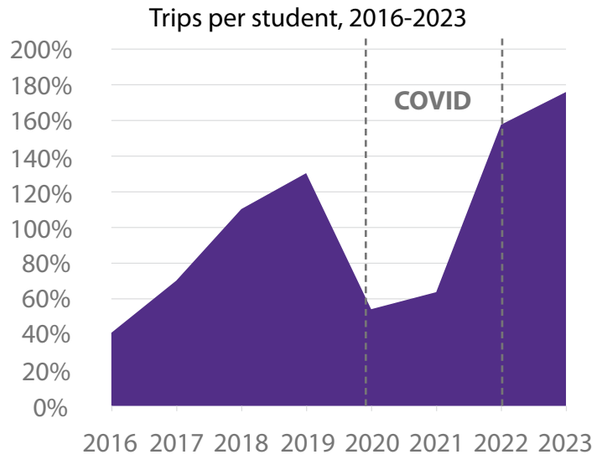
Bus ridership at K-State is 77% lower than peers.

TRANSIT RIDERSHIP COMPARISON



TRANSIT TRENDS & CHALLENGES

Despite the low hours of operation and frequency of K-State's bus service, ridership has recovered from pre-pandemic levels, seeing a 20% increase in rides per student between 2022 and 2023, indicating interest from students. Furthermore, the share of students using the SafeRide (late night ride program at K-State) has also increased from 21% in 2023 to 31% in 2024, further indicating interest in night-time service.



Survey Summary

While the ATA Bus presents challenges regarding reliability, funding, frequency and communication, the 2024 parking survey received over 350 comments related to transit improvements. Many were related to the desire for an improved bus system that was more reliable, predictable or more like what they have seen or experienced at other campuses or institutions.

The majority of similarly-sized universities that I have attended or visited have a reliable, fast method of public transport that can take students from one side of the campus to the other within 10 minutes.

Other institutions offer free buses or park-and-ride shuttles.

Other colleges and cities work together and provide free bus pases to students that don't live on campus. I wish K-State did this or the city at least provided discounted bus passes for the school year.

I have been at Universities with real, well thought public transportation and bicycle lanes, and it really makes a difference on campus. I wish I could ride my bicycle to campus, but when I was able to at a real bike friendly town, it made a huge difference. I think able bodied students would benefit if our campus and town put more effort into bicycle lanes and public transportation.

The ATA bus is slowly gaining popularity and we hope the services continue! It would be nice if the campus bus route continued past 7 pm. I feel safer on the ATA bus than walking on campus.

I would love to take public transportation, but public transportation is severely lacking in Manhattan. It's a very car-dependent city.

Instead of investing in more parking spaces, we should have smoother public transportation or another means of transportation.

If there were better ATA bus transportation, I would love to take it, then I wouldn't need to worry about parking at all.

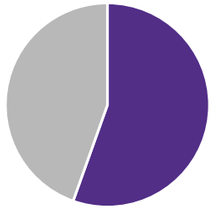
I wish K-State would reinvest in public transit.

Reliable and clearer public transportation around main and north campus to surrounding areas.

RIDERSHIP TRENDS & FUNDING CHALLENGES

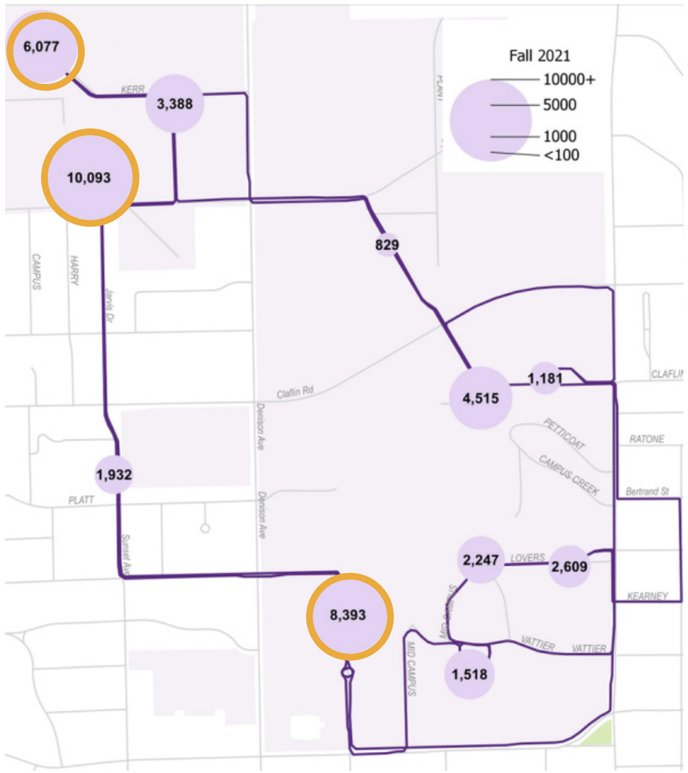
Recent funding challenges have limited ATA Bus services, including a $150,000 shortfall in contributions from K-State. This gap prevents ATA Bus from accessing $650,000 in available federal funds to enhance and promote the service. Feedback from open houses and stakeholder meetings highlighted staffing shortages—particularly in hiring and retaining drivers—as a major barrier to service reliability. This concern is echoed in survey results, which show that only 0.5% of respondents use transit to travel to and from campus.

Despite low-frequency, funding gaps, limited communications and lower enrollment, ridership has recovered from pre-pandemic levels, indicating interest and demand from students. Furthermore, ridership trends indicate that 55% of ridership occurs at three stops: Jardine, Student Union and East Stadium.



55% of ridership occurs at three stops: Jardine, Student Union, East Stadium

ATA BUS STOP FREQUENCY MAP

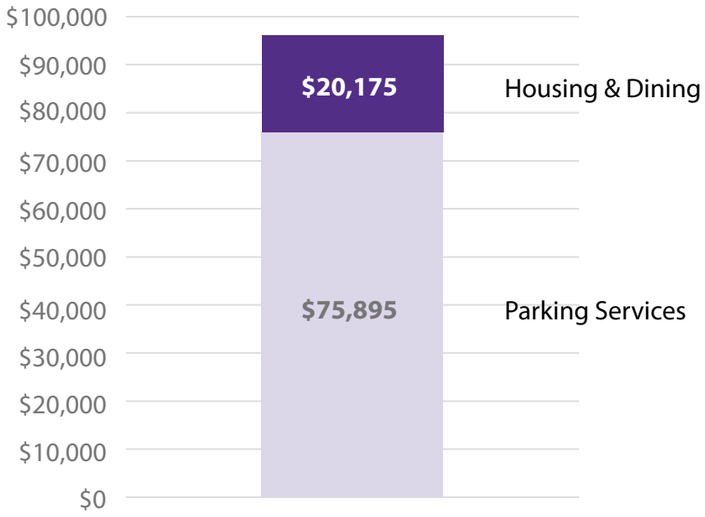


Funding Challenges

There is a **$150,000 funding gap** from K-State to ATA Bus to provide free service to students, staff and faculty.

Without the $150,000 in funding from K-State, ATA Bus cannot leverage $650,000 in federal funds

ATA BUS FUNDING

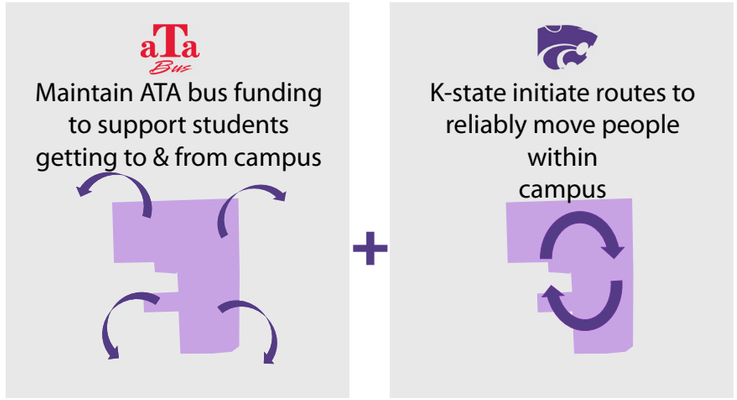


NOTE: DATA 2024

IMPLEMENTATION

Opportunities & Strategies:

To promote a frequent, reliable transit service, K-State can introduce their own transit system to move people within campus. By owning and operating their own transit service, K-State can create their own routes, determine hours of operation, make staffing decisions, utilize larger passenger capacity buses and more. The establishment of a new K-State transit system is an opportunity to re-brand, increase visibility and give riders a transit experience that they may find at a peer university without oversight or association with ATA Bus.



Recommendations & Additional Studies

It is critical that students, faculty and staff have reliable transportation options when traveling to, from and within campus, which includes the presence of transit on campus. To promote a frequent, reliable transit service, K-State can introduce a K-State run shuttle system to move people within campus. By owning and operating their own transit service, K-State can create their own routes, determine hours of operation, make staffing decisions, utilize larger passenger capacity buses and more.

The establishment of a new K-State transit system is an opportunity to re-brand and increase visibility without oversight or association with ATA Bus. K-State can have the opportunity to scale incrementally. No matter how large the system is, linking K-State transit stops with ATA Bus stops can provide seamless transfers to riders between the two services, connecting campus to shopping, services and other city destinations.

	IMMEDIATE	NEAR-TERM	MID-TERM	LONG-TERM
Routing	Survey students to understand transit preferences and interest at K-State	Complete ridership forecast assessment to identify potential preferred routes	Pilot identified route for K-State per study recommendations	Introduce new routes, increasing service area as ridership user confidence grow
Funding	Continue current funding with ATA Bus	Complete study to determine costs associated with pursuing K-State bus service vs. ATA Bus service. Identify funding gaps	Determine if K-State will pursue separate/additional bus service. Determine ongoing ATA Bus funding, if applicable	Hold ongoing steering committee meetings to discuss bus opportunities. Begin to market a 'mobility fund' to achieve enhancements identified
Communication	Include and feature transit during student orientation	Update/upgrade bus information on campus and on K-State website	Establish smart phone application to inform students of real time bus information, maps, trip planning and notifications	Launch transit ambassadors program to advocate for transit at K-State
Physical	Enhance/upgrade bus stop signs to be more eye-catching and legible, consider established branding guidelines	Enhance bus stops to include benches and route information	Identify potential bike/ pedestrian/transit-only roadways	Dedicate key roadways as 'transit only' (i.e., transit malls)

B

SPACE NEEDS ANALYSIS

B1 SPACE NEEDS ANALYSIS
B2 SPACE UTILIZATION ANALYSIS
B3 SPACE GUIDELINES

B1 SPACE NEEDS ANALYSIS

Establishing a realistic space need is an essential component of campus planning, focusing on understanding and evaluating the spatial requirements of an institution. The primary goals of a space assessment in the context of campus planning are to:

- *Identify current and future space.*
- *Optimize space utilization and functionality.*
- *Support informed decision making.*

PROCESS

The space analysis for the Manhattan Campus was established through a process that included:

- Gathering facilities, enrollment, course, research expenditure and staffing data for the Fall 2023 term from the university.
- Preparing space utilization analyses for classrooms and teaching labs.
- Establishing space guidelines with the university for the various space categories on campus based on typical metrics for campuses like K-State with similar academic missions.
- Preparing two space need analyses: (1) using Fall 2023 actual data and (2) incorporating projected changes.

PLANNING ASSUMPTIONS

Enrollment & Personnel

The space analysis assumes that student enrollment will increase from 15,679 on campus students in Fall 2023 to 18,250 students, an increase of 16.4%. Undergraduate enrollment is projected to increase from 12,967 to 15,438, an increase of 19% and graduate enrollment is projected to increase from 2,712 to 2,812, or 3.7%. Total campus personnel are projected to increase from 9,430 to 10,844, approximately 15%. Increases are projected in faculty, administrative staff and support staff.

Research Expenditures

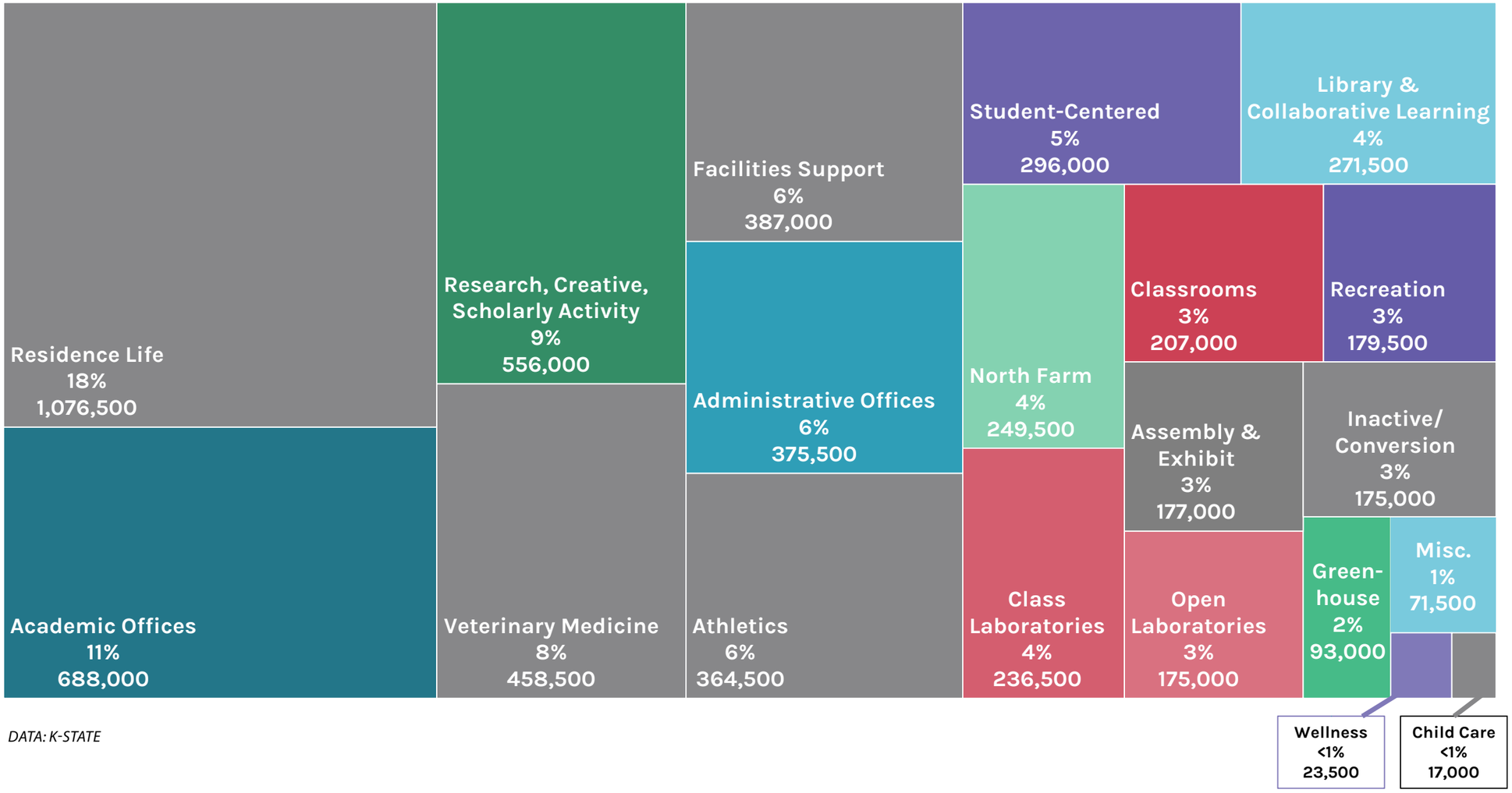
The space analysis assumes that research expenditures will increase from approximately $213 million currently to $300 million. This will be a combination of interdisciplinary research and discipline specific research.

	Fall 2023	Target Enrollment
Enrollment	**15,679**	**18,250**
Undergraduate Students	12,967	15,438
Graduate Students	2,712	2,812
Personnel	**9,430**	**10,844**
Faculty	1,653	1,934
Staff	7,777	8,910

Existing Space

In Fall 2023, the campus had 6,078,000 assignable square feet (ASF) across 20 categories. This ASF is assumed to decrease to 6,046,500 ASF with current and planned projects. The graphic to the right indicates the quantity and percentage of space in each of the 20 categories in the analysis. As is typical on most residential campuses, residence life space is the largest. Classrooms are 3% of the space on campus.

Existing Space by Category (FALL 2023)



DATA: K-STATE

SPACE NEED SUMMARY

In Fall 2023, there was 945,500 ASF more space on campus than required when utilization expectations and space guidelines developed with the university are applied. This was primarily in academic space (classrooms and open labs) and academic support space (offices and libraries). Incorporating the projected increase in enrollment and personnel, the increased research expenditures goal and anticipated facilities changes, the analysis indicates that this will be reduced to 451,500 ASF in the target enrollment scenario.

	FALL 2023 ENROLLMENT Student Headcount = 15,679			**TARGET ENROLLMENT** Student Headcount = 18,250		
	Existing ASF	Guideline ASF	Net	Planned ASF	Guideline ASF	Net
Academic Space	618,500	377,000	241,500	617,000	430,500	186,500
Academic Support Space	1,406,500	1,003,500	403,000	1,417,000	1,139,500	267,500
Research Space	898,500	875,000	23,500	892,000	1,092,500	(200,500)
Student Space	499,000	376,500	122,500	499,000	438,500	60,500
Other Space	2,655,500	2,500,500	155,000	2,631,500	2,494,000	137,500
TOTAL	**6,078,000**	**5,132,500**	**945,500**	**6,046,500**	**5,595,000**	**451,500**

B2 SPACE UTILIZATION ANALYSIS

In order to establish space need guidelines for classrooms and teaching labs, the utilization of these scheduled teaching spaces in Fall 2023 was evaluated.

CLASSROOM UTILIZATION

There were 201 classrooms on the Manhattan Campus in the Fall 2023 term. Classroom utilization is a function of the number of scheduled courses, class time duration and course enrollment compared to the number of student stations in the room. A benchmark for institutions similar to K-State would be 32 to 35 weekly rooms hours with 70% seat fill, on average.

CLASSROOM USE BY DAY & TIME

Classrooms were most heavily scheduled Tuesday through Thursday. On Tuesday and Thursday at 2:00 and Wednesday from 10:00 to noon over 80% of the rooms were scheduled.

Time of Day	*Monday*		*Tuesday*		*Wednesday*		*Thursday*		*Friday*		*Average*	
	Rooms In Use	% In Use	Rooms In Use	% In Use	Rooms In Use	% In Use	Rooms In Use	% In Use	Rooms In Use	% In Use	Rooms In Use	% In Use
8:00 AM	60	30%	66	33%	68	34%	66	33%	53	26%	63	31%
9:00 AM	137	68%	155	77%	139	69%	156	78%	128	64%	143	71%
10:00 AM	159	79%	152	76%	164	82%	155	77%	146	73%	155	77%
11:00 AM	153	76%	140	70%	161	80%	151	75%	145	72%	150	75%
12:00 PM	142	71%	139	69%	145	72%	145	72%	127	63%	140	69%
1:00 PM	126	63%	143	71%	128	64%	143	71%	106	53%	129	64%
2:00 PM	122	61%	168	84%	124	62%	165	82%	94	47%	135	67%
3:00 PM	92	46%	126	63%	92	46%	130	65%	54	27%	99	49%
4:00 PM	60	30%	49	24%	57	28%	62	31%	21	10%	50	25%
5:00 PM	42	21%	39	19%	29	14%	49	24%	9	4%	34	17%
6:00 PM	22	11%	16	8%	15	7%	19	9%	1	0%	15	7%
7:00 PM	16	8%	13	6%	19	9%	12	6%	1	0%	12	6%

Total classrooms = 201

Classroom Utilization by Building

The average weekly hours a classroom was scheduled is 21.3, with 52% of the seats filled. The average student station size of 17.6 ASF is significantly below the 25 ASF typical for good educational environments.

Building Name and ID		No. of Rooms	Average ASF per Seat	Weekly Student Contact Hours	Average Weekly Room Hours	Seat Fill Rate
ACKERT/CHALMERS HALL	00136	3	12.7	3,938	24	51%
BLUEMONT HALL	00158	13	17.4	9,254	23.3	46%
BURT HALL	00009	1	11.9	578	17	46%
CALL HALL	00072	4	20.7	1,821	20.4	47%
CALVIN HALL	00013	11	19.2	4,391	21.5	42%
CARDWELL HALL	00091	12	13.9	12,023	24.3	52%
CHEM-BIOCHEM BUILDING	00165	1	26.7	131	13	42%
COLLEGE OF BUSINESS BUILDING	00284	19	22.9	27,058	27.6	76%
DICKENS HALL	00018	4	21	1,236	16.3	47%
DOLE HALL	00168	1	20.5	51	5.5	42%
DURLAND/RATHBONE/FIEDLER/ENGINEERING HALL	00153	21	17.2	18,917	26.8	49%
EISENHOWER HALL	00022	19	19.9	5,500	18.2	60%
ENGLISH	00108	2	20.6	742	21.8	52%
GENERAL RICHARD B. MYERS HALL	00079	3	17.4	455	9	38%
JUSTIN HALL	00041	12	17.4	10,711	26.1	48%
KEDZIE HALL	00071	5	13.6	3,600	18.4	48%
KING HALL	00020	2	16.8	1,410	25.5	39%
LAFENE STUDENT HEALTH CENTER	00575	1	23.5	252	6	88%

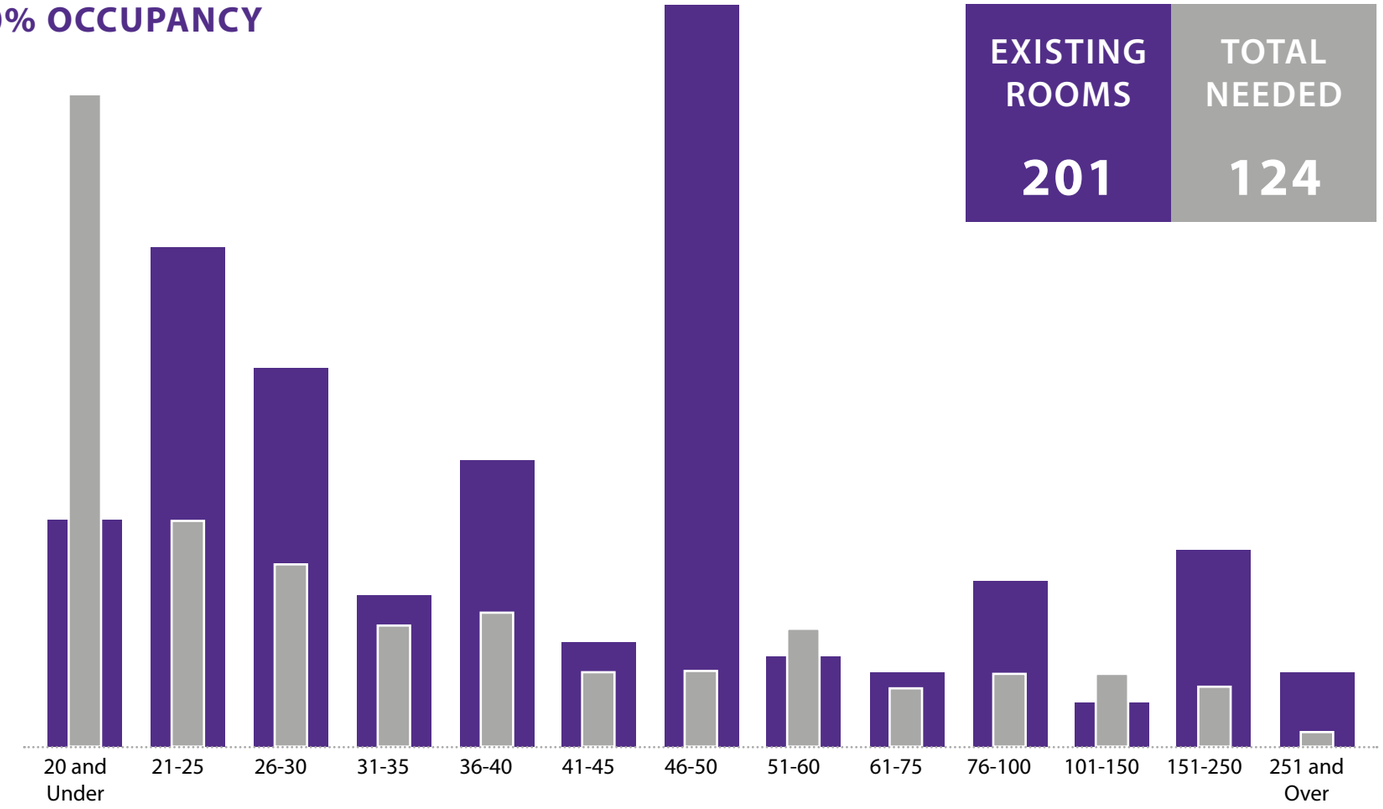
Building Name and ID		No. of Rooms	Average ASF per Seat	Weekly Student Contact Hours	Average Weekly Room Hours	Seat Fill Rate
LEADERSHIP STUDIES & PROGRAMS BUILDING	00195	7	20.3	2,681	14.6	45%
LEASURE HALL	00112	4	22.9	2,346	21	53%
MCCAIN AUDITORIUM	00133	3	21.1	929	22.4	34%
NICHOLS HALL	00082	5	25.4	1,744	17.2	64%
SEATON / REGNIER HALL	00102	9	16.4	5,113	15	57%
SHELLENBERGER HALL	00080	2	22.8	486	18.4	24%
THOMPSON HALL	00106	2	14.2	886	20	30%
THROCKMORTON HALL	00161	10	18.5	3,394	13.6	40%
UMBERGER HALL	00109	3	11	5,702	17.7	49%
WARD HALL	00085	1	20.1	97	14	15%
WATERS HALL	00120	9	17.6	6,868	24.1	47%
WATERS HALL ANNEX	00117	2	20.5	874	25	38%
WEBER HALL	00004	3	12	3,619	21.8	33%
WILLARD HALL	00116	7	16.6	5,144	20.3	56%
		201	**17.6**	**141,950**	**21.3**	**52%**

Classroom Mix Analysis

A classroom mix analysis compares the number and size of existing classrooms with course enrollments. A course is assigned to the smallest room that will accommodate it with 90% of the seats filled. In Fall 2023 there were 201 classrooms on campus. If scheduled 33 hours per week on average, K-State would have required 124 rooms during the Fall term. There was a significant deficit in small classrooms. However, these courses could be consolidated into larger available rooms. Deficits in rooms with 51 to 60 seats and 101 to 150 were also able to be accommodated in larger rooms.

33 WRH @ 90% OCCUPANCY

EXISTING ROOMS	TOTAL NEEDED
201	124



	20 and Under	21-25	26-30	31-35	36-40	41-45	46-50	51-60	61-75	76-100	101-150	151-250	251 and Over
EXISTING ROOMS	15	33	25	10	19	7	49	6	5	11	3	13	5
TOTAL NEEDED	43	15	12	8	9	5	5	8	4	5	5	4	1

Teaching Lab Utilization

There were 161 scheduled teaching labs on the Manhattan Campus in Fall 2023. Teaching lab utilization is a function of the number of scheduled courses, class time duration and course enrollment compared to the number of student stations in the room. A benchmark for institutions similar to K-State would be 24 to 28 weekly rooms hours with 80% seat fill, on average.

Teaching Lab Use by Day & Time

Of the 161 teaching labs on campus, the greatest number in use at one time was 98, or 61%, at 2:00 PM on Tuesday.

Time of Day	*Monday*		*Tuesday*		*Wednesday*		*Thursday*		*Friday*		*Average*	
	Rooms In Use	**% In Use**	**Rooms In Use**	**% In Use**	**Rooms In Use**	**% In Use**	**Rooms In Use**	**% In Use**	**Rooms In Use**	**% In Use**	**Rooms In Use**	**% In Use**
8:00 AM	39	24%	51	32%	43	27%	49	30%	29	18%	42	26%
9:00 AM	59	37%	82	51%	67	42%	78	48%	47	29%	67	41%
10:00 AM	66	41%	80	50%	72	45%	79	49%	53	33%	70	43%
11:00 AM	71	44%	83	52%	87	54%	83	52%	59	37%	77	48%
12:00 PM	64	40%	77	48%	81	50%	71	44%	57	35%	70	43%
1:00 PM	79	49%	84	52%	93	58%	79	49%	60	37%	79	49%
2:00 PM	85	53%	98	61%	91	57%	95	59%	55	34%	85	53%
3:00 PM	70	43%	76	47%	77	48%	73	45%	46	29%	68	42%
4:00 PM	63	39%	62	39%	66	41%	60	37%	34	21%	57	35%
5:00 PM	48	30%	43	27%	54	34%	43	27%	25	16%	43	26%
6:00 PM	8	5%	20	12%	7	4%	10	6%	0	0%	9	6%
7:00 PM	6	4%	17	11%	5	3%	8	5%	0	0%	7	4%

Teaching Lab Utilization by Building

The campus-wide lab utilization was 16.7 hours per week, with 62% of the student stations occupied. Average station size is dependent on the academic discipline.

Building Name and ID		No. of Rooms	Average ASF per Seat	Weekly Student Contact Hours	Average Weekly Room Hours	Seat Fill Rate
ACKERT/CHALMERS HALL	00136	12	39	21	12.7	5,351
BLUEMONT HALL	00158	3	38.5	14	9.3	606
CALL HALL	00072	1	34.3	13	3	93
CALVIN HALL	00013	1	30.3	82	4.1	164
CAMPUS CREEK COMPLEX	00027	2	23.1	13	9.1	447
CARDWELL HALL	00091	8	31.2	18	8.4	2,654
CHEM-BIOCHEM BUILDING	00165	5	66.8	11	14.2	1,224
COLLEGE OF BUSINESS BUILDING	00284	5	34.2	28	16.2	3,117
DICKENS HALL	00018	1	23.9	35	36.1	1,444
DURLAND/RATHBONE/FIEDLER/ENGINEERING HALL	00153	19	35.7	14	8.8	4,978
EISENHOWER HALL	00022	2	26.9	11	13.9	597
FAIRCHILD HALL	00030	1	37.4	6	2.7	108
GENERAL RICHARD B. MYERS HALL	00079	2	25.2	11	2.8	267
JUSTIN HALL	00041	8	44.8	17	19.9	4,207
KEDZIE HALL	00071	2	34.3	17	6	324
KING HALL	00020	9	46.2	16	24.2	3,918
LAFENE STUDENT HEALTH CENTER	00575	1	36.3	15	10	300

Building Name and ID		No. of Rooms	Average ASF per Seat	Weekly Student Contact Hours	Average Weekly Room Hours	Seat Fill Rate
MARY & CARL ICE HALL	00283	1	20.2	41	27.2	1,470
MCCAIN AUDITORIUM	00133	3	29.8	13	12.2	1,388
NICHOLS HALL	00082	8	33.1	9	2.7	839
SEATON / REGNIER HALL	00102	39	50.9	22	8.7	12,692
TECHNOLOGY DEVELOPMENT INSTITUTE (TDI)	00652	1	98	0	0	0
THOMPSON HALL	00106	2	24.3	12	9.2	624
THROCKMORTON HALL	00161	8	34.9	16	5.9	1,454
WATERS HALL	00120	1	21.3	9	6.1	140
WATERS HALL ANNEX	00117	1	51.4	7	0.9	21
WEBER HALL	00004	1	19.7	23	11.1	668
WEST STADIUM	00105	1	14.7	8	1.1	164
WILLARD HALL	00116	13	47.5	13	10.3	3,082
		161	39.9	52,341	16.7	62%

B3 SPACE GUIDELINES

GUIDELINES BY SPACE CATEGORY

Space guidelines were developed and applied to provide an understanding of the Fall 2023 campus space need and the Target enrollment space need in 20 Space categories.

Classrooms

Classrooms are defined as any room primarily used for scheduled instruction requiring no special equipment. The rooms are generally referred to as "general purpose" classrooms, seminar rooms or lecture halls. A typical metric for large R1 universities is 30 to 40 hours of scheduled use per week with 67% to 75% of the seats filled. For K-State, a formula that combines expected utilization of 33 hours per week with 67% of the seats filled and 25 ASF per student station was used.

Class Labs

Class labs are defined as rooms used primarily for regularly scheduled classes that require special purpose equipment to serve the needs of a particular discipline for group instruction, participation, observation, experimentation or practice. Space requirements are calculated using a formula that is similar to that used to determine classroom space with the exception that the ASF per student station varies by discipline.

A typical utilization expectation for large R1 universities is 24 to 28 weekly rooms hours and 80% student station occupancy. For K-State, 24 hours and 80% occupancy was combined with the following factors for teaching lab and support space per student station.

- Aerospace & Aeronautical Engineering 140 ASF
- Agricultural Engineering 125 ASF
- Agriculture 80 ASF
- Agronomy 70 ASF
- Animal Sciences 90 ASF
- Anthropology 60 ASF
- Architecture 80 ASF
- Art 80 ASF
- Biological Sciences 65 ASF
- Business & Management 40 ASF
- Chemical Engineering 120 ASF
- Chemistry 75 ASF
- Civil Engineering 120 ASF
- Communications 50 ASF
- Computer & Information Science 60 ASF
- Computer Based Laboratory 40 ASF
- Dance 150 ASF
- Economics 40 ASF
- Education 40 ASF
- Electrical Engineering 100 ASF
- Engineering 120 ASF
- Exercise Physiology & Kinesiology 80 ASF
- Food Science & Technology 80 ASF
- Foreign Languages 40 ASF
- Geography 60 ASF
- Geology 60 ASF
- Health Professions 80 ASF
- Horticulture 65 ASF
- Industrial & Management Engineering 120 ASF
- Mathematics 30 ASF
- Mechanical Engineering 140 ASF
- Music 60 ASF
- Physical Sciences 75 ASF
- Psychology 50 ASF
- Social Sciences 50 ASF
- Sociology 40 ASF
- Veterinary Medicine 90 ASF

Open Labs

Open labs are rooms that are available for unscheduled or informally scheduled instruction and student use in a particular discipline. Types of rooms in this category typically include computer labs with specialized software, language labs, architecture studios, nursing and other health care education labs, music practice rooms, maker space and tutorial and testing facilities.

The guideline for open labs varies by campus. Based upon SmithGroup experience, the guideline for K-State was established at 5 ASF per student.

Academic & Administrative Offices

The guideline for office space is based on an allocation per employee type for private offices and workstations plus additional space for conference space, workrooms and office storage. The individual allocation varies from 30 to 300 ASF. The conference, workroom and storage allocations vary from 15 to 120 ASF. These space factors are being incorporated into K-State space guidelines.

Library & Collaborative Learning

This category recognizes that the tradition of all campus study space being located in the library has been superseded by distributed informal learning and collaborative study space across campus.

The contemporary academic library is best defined as a blend of the traditions of the past integrated with digital media. Space such as stack areas, individual study space, group study rooms, staff offices and processing or technical areas comprise the library.

Collaborative learning space is informal study space located outside of the library. It is typically adjacent to scheduled teaching space to facilitate group and individual study prior to class and as a place to continue class discussions outside of the classroom. The guideline for this category includes a factor for the library collection, library service space and study space across campus. The space factors for K-State include 0.07 ASF each for the 875,995 volume equivalent items in the collection and a study space allocation for 25% of the undergraduate population and 10% of the graduate student population. SmithGroup experience indicates that approximately 60% of the study/collaboration space should be located in the library and 40% distributed across campus.

Miscellaneous

Miscellaneous space consists of spaces that are not included in other space categories, such as media production, instructional clinics, demonstration space, field buildings, non-assigned meeting rooms and animal facilities. The guideline of 5 ASF per student is based on SmithGroup experience with similar institutions to K-State's type and enrollment.

Research, Creative, Scholarly Activity

Research space needs at research-intensive institutions are often determined by applying a factor per square foot to research expenditures. This establishes the total amount of space required, which is then allocated by the institution for individual faculty research, scholarly and creative endeavors. The following factors, developed by SmithGroup through research specific space studies and workshops with R1 institutions similar to K-State, were used to project research, creative and scholarly activity space needs.

College/Department	Expenditures per ASF
College of Agriculture	$400
College of Arts and Sciences	
A.Q. Miller School of Media & Communication	$1,200
Aerospace Studies	$400
Art	$400
Biology	$375
Chemistry	$375
Economics	$1,200
Geology	$375
Mathematics	$1,200
Other non-science Fields	$1,200
Other Sciences	$525
Political Science	$1,200
Psychological Sciences	$400
Physics	$375
Sociology, Anthropology, & Social Work	$1,200
College of Business Administration	$1,200
College of Education	$1,200
College of Engineering	
Engineering	$375
Computer Science	$525
College of Human Ecology	$375

Recreation

To establish recreation space need, NIRSA: Leaders in College Recreation (formerly the National Intramural-Recreational Sports Association) guideline recommendations were applied to the 2023 and potential enrollments. Swimming pool space was deleted from the guideline.

Student Centered

Examples of the various functions that are typically found in the student-centered space category include food service, bookstore, lounge, meeting space, student government and student organization space, irrespective of where the space is located on campus. An allocation of 12 ASF per student is recommended by the Association of College Unions International (ACUI) for campuses with robust on-campus housing. This metric was used for the K-State analysis.

Wellness

A space factor of 2 ASF per student headcount was applied to establish the space requirement for student health care facilities, based on the 2017 K-State Health and Wellness Master Plan.

Assembly & Exhibit

A Council of Educational Facilities Planners International (CEFPI) standard guideline was used as a basis for the K-State analysis. This guideline establishes a core of 27,450 ASF and an additional 6 ASF per student over 5,000 for institutions with active fine arts and music programs. The existing Rodeo Arena and Beach Art Museum space were added to the guideline as spaces unique to K-State.

Athletics

K-State has more athletics space than peer institutions. Existing space quantity was used as the guideline.

Veterinary Medicine

Existing space quantity was used as the guideline.

Child Care

Existing space quantity was used as the guideline.

Facilities Support

Plant operations space typically includes shops, central storage and central services, but can also include other space types assigned to the physical plant. The factors considered when determining the appropriate guideline include purchasing practices that affect warehousing needs, storage space adjustments due to climate, extent of grounds maintenance and the types of facilities being maintained. A typical range is 4 to 7% of the campus ASF being maintained. A factor of 7% was used for K-State.

Inactive/Conversion Space

Inactive/conversion space is space that has been taken off-line by the university due to renovations in progress, non-applicability for academic or support functions, space that is being held in reserve as swing space during campus renovations, etc. The guideline is established based on unique needs of the individual campus. A factor of 4 ASF per student was used for K-State.

Residence Life

Residence life space need is typically established per bed, not by ASF. The goal for the percentage of students living on-campus at R1 institutions varies depending on location, housing available in the community and the desired campus culture. With more than 5,000 beds in a variety of types available on the Manhattan Campus and a target enrollment of 18,250 students, the percentage is within the typical 20 to 30% goal. The existing ASF is included in the analysis to acknowledge it as space the campus maintains.

UNIVERSITY SPACE NEED

Total campus space need increases from 5,132,500 to 5,595,000 ASF in the target enrollment scenario. The greatest additional need is space for research, creative and scholarly activity.

There is excess capacity in teaching space when utilization expectations are applied. The analysis incorporates a campus-wide guideline of 25-square-feet per classroom student station, significantly larger than the current 17.6-square-feet.

The office space analysis indicates a mismatch between office guidelines and existing office size, not in the number of offices. Hale Library is larger than K-State needs, particularly when considering that collaborative learning/study space should be distributed across campus, not consolidated in the library.

Research, creative and scholarly activity space campus-wide is balanced in the Fall 2023 analysis. With the projected increase in research activity, additional space will be needed.

Other space categories where guidelines have been applied are essentially in balance, with the exception of inactive/conversion space. Ahearn Field House accounts for 74,500 ASF in this category.

	Fall 2023 Enrollment Student Headcount = 15,679				Target Enrollment Student Headcount = 18,250			
Space Category	**Existing ASF**	**Guideline ASF**	**Net**	**Percent**	**Projected Existing ASF**	**Guideline ASF**	**Net**	**Percent**
Academic Space								
Classrooms	207,000	115,000	92,000	44%	209,500	132,500	77,000	37%
Class Labs	236,500	183,500	53,000	22%	236,500	207,000	29,500	12%
Open Labs	175,000	78,500	96,500	55%	171,000	91,000	80,000	47%
Academic Space Subtotal	***618,500***	***377,000***	***241,500***	***39%***	***617,000***	***430,500***	***186,500***	***30%***
Academic Support Space								
Academic Offices	688,000	537,000	151,000	22%	688,500	618,000	70,500	10%
Administrative Offices	375,500	220,500	155,000	41%	375,500	246,500	129,000	34%
Library & Collaborative Learning	271,500	167,500	104,000	38%	271,500	184,000	87,500	32%
Miscellaneous	71,500	78,500	(7,000)	(10%)	71,500	91,000	(19,500)	(27%)
Academic Support Space Subtotal	***1,406,500***	***1,003,500***	***403,000***	***29%***	***1,407,000***	***1,139,500***	***267,500***	***19%***
Research Space								
Research, Creative, Scholarly Activity	556,000	532,500	23,500	4%	549,500	750,000	(200,500)	(36%)
Greenhouse	93,000	93,000	0	0%	93,000	93,000	0	0%
North Farm	249,500	249,500	0	0%	249,500	249,500	0	0%
Research Space Subtotal	***898,500***	***875,000***	***23,500***	***3%***	***892,000***	***1,092,500***	***(200,500)***	***(22%)***
Student Space								
Recreation	179,500	157,000	22,500	13%	179,500	183,000	(3,500)	(2%)
Student-Centered Space	296,000	188,000	108,000	36%	296,000	219,000	77,000	26%
Wellness	23,500	31,500	(8,000)	(34%)	23,500	36,500	(13,000)	(55%)
Student Space Subtotal	***499,000***	***376,500***	***122,500***	***25%***	***499,000***	***438,500***	***60,500***	***12%***
Other Space								
Assembly & Exhibit	177,000	152,500	24,500	14%	177,000	168,000	9,000	5%
Athletics	364,500	364,500	0	0%	364,500	364,500	0	0%
Veterinary Medicine	458,500	458,500	0	0%	458,500	458,500	0	0%
Child Care	17,000	17,000	0	0%	17,000	17,000	0	0%
Facilities Support	387,000	369,000	18,000	5%	387,000	336,500	50,500	13%
Inactive/Conversion	175,000	62,500	112,500	64%	151,000	73,000	78,000	52%
Residence Life	1,076,500	1,076,500	0	0%	1,076,500	1,076,500	0	0%
Other Space Subtotal	***2,655,500***	***2,500,500***	***155,000***	***6%***	***2,631,500***	***2,494,000***	***137,500***	***5%***
TOTAL	**6,078,000**	**5,132,500**	**945,500**	**16%**	**6,046,500**	**5,595,000**	**451,500**	**7%**

C

SUSTAINABILITY IMPACT STUDY

C1 STARS REPORTING
C2 SUSTAINABILITY AUDIT
C3 PEER BENCHMARKING
C4 BUILDING ENERGY CONSUMPTION

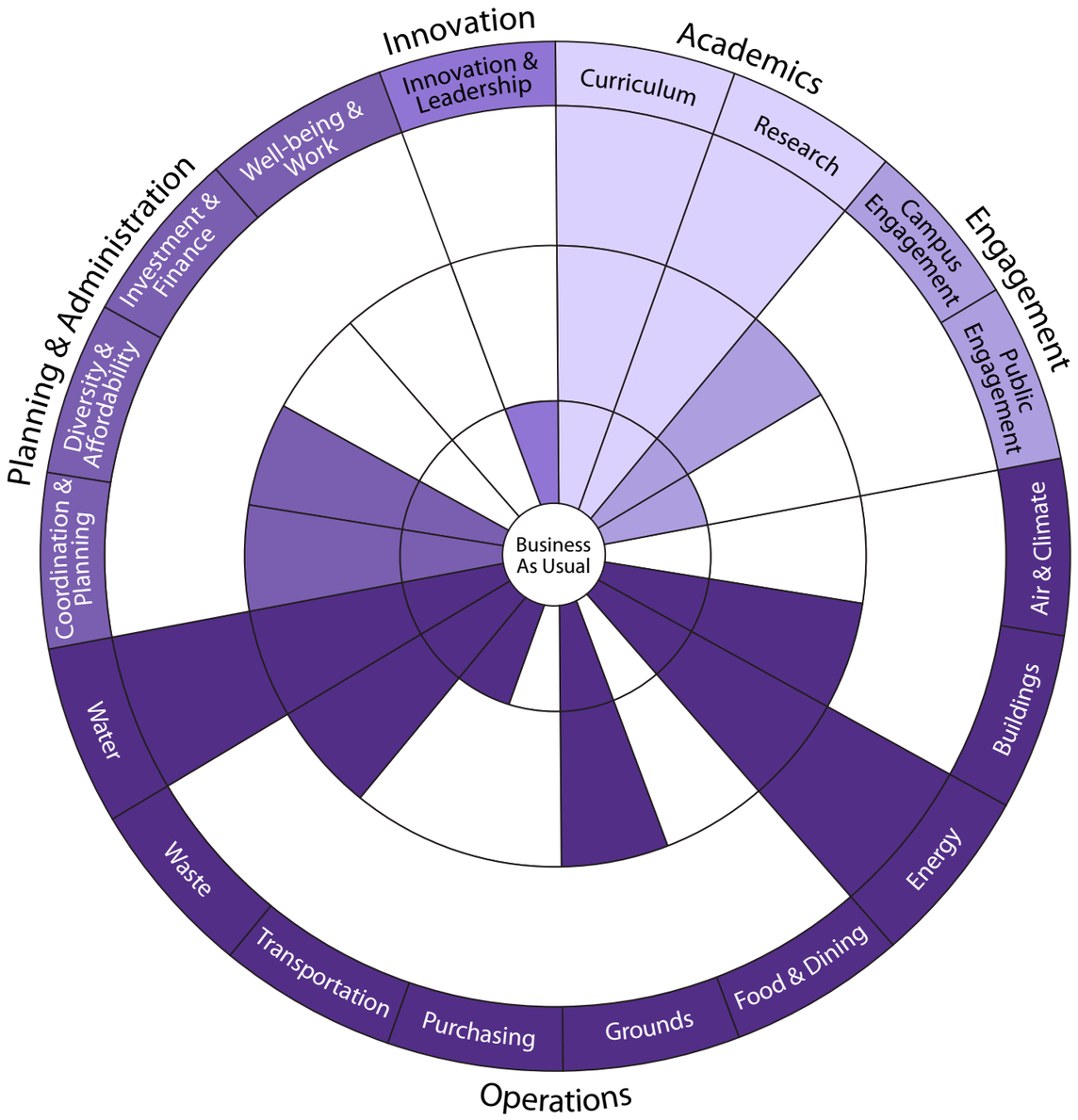
C1 STARS REPORTING

The AASHE STARS framework was used to identify priorities in academics and operations focusing on energy and water, while highlighting the urgent need for leadership, coordination and investment to turn momentum into measurable progress.

The AASHE STARS framework is a widely used tool for assessing and reporting sustainability performance in higher education. While K-State does not currently participate, the planning team reviewed the framework with the university during early planning to evaluate its current efforts and identify priority areas, with a particular focus on operations for this plan.

K-State identified academics as a central pillar of sustainability, with opportunities to strengthen programs like Environmental Science, the Kansas Water Institute and the Feed the Future Innovation Lab. There was strong interest in using the campus as a "living lab" to integrate sustainability into education and research. However, current efforts were often siloed, highlighting the need for better communication and campus-wide engagement.

Operationally, water and energy were top priorities, with Kansas's water risk positioning the university for leadership through the Kansas Water Institute. Energy efficiency and renewable energy were also emphasized, though cost remains a challenge. Waste, food and dining initiatives showed promise, while areas like transportation and purchasing received less attention. In planning and administration, the need for dedicated sustainability staff was clear to provide structure, leadership and momentum for future efforts.



Data: 2024 AASHE STARS Audit

C2 SUSTAINABILITY AUDIT

K-State's land-grant mission positions the university as a statewide leader in sustainability-focused education, research and outreach. With a presence across the state of Kansas, K-State is uniquely equipped to scale impactful sustainability solutions and climate resilience initiatives throughout the Manhattan, Olathe and Salina Campuses as part of this planning effort.

An audit of K-State's existing sustainability initiatives was conducted in the fall of 2024. The foundation for sustainability at K-State was established in the 2014 K-State 2025 Sustainability Strategic Action Plan, which outlined goals across academics, campus and public engagement, operations and leadership. K-State continues to demonstrate leadership in several areas, including five LEED-certified buildings, a wind energy agreement with Evergy, a strong bike network and the Kansas Water Institute.

However, the analysis also highlighted key gaps, particularly the absence of published sustainability goals and consistent data tracking. These insights, coupled with the university's broader strategic repositioning through the Next-Gen K-State Strategic Plan, reaffirmed sustainability as a critical institutional priority.

ACADEMICS	ENGAGEMENT	OPERATIONS	PLANNING & ADMINISTRATION	LEADERSHIP & INNOVATION
CESAS Consortium for Environmental Stewardship and Sustainability KCARE Kansas Water Institute NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES SECONDARY MAJOR EDUCATIONAL FUEL FOR A SUSTAINABLE FUTURE. **Climate Change & Mitigation REU**	SEA	U.S. GREEN BUILDING COUNCIL LEED CERTIFIED USGBC TREE CAMPUS USA evergy **Wind Agreement**	**K-State 2025 Sustainability Strategic Action Plan** **Energy & Environment Program In Division of Facilities** **Access and Opportunity**	BICYCLE FRIENDLY COMMUNITY Spring 2020 BRONZE THE LEAGUE OF AMERICAN BICYCLISTS S Alliance G K-State Food Pantry CATS' CUPBOARD

C3 PEER BENCHMARKING

As part of the early planning process, a peer benchmarking exercise was conducted to evaluate K-State's sustainability performance in comparison to similar institutions.

Eight universities were selected based on key criteria, including land-grant status, comparable enrollment size and membership in the Big 12 Conference. The group also includes a mix of aspirational and assumed peer institutions, offering a well-rounded perspective to assess K-State's current standing and identify areas for growth in sustainability.

All eight peer institutions selected for benchmarking publicly report their sustainability data through the AASHE STARS framework, which served as the primary data source for comparison. Since K-State does not currently participate in STARS, its metrics were estimated using available utility data. The utility data for K-State reflects the 2023 calendar year, while the peer institution data corresponds to the data tracking year specified in each institution's most recent STARS report. Given K-State's operational focus on water and energy, the benchmarking effort concentrated on key metrics related to energy use, water consumption and carbon emissions.

	Data Reference Year
Kansas State	2023
Colorado State University	2022
Iowa State University	2022
Oklahoma State University	2022
University of Kansas	2014
University of Nebraska - Lincoln	2020
University of Colorado - Boulder	2019
University of Illinois	2020

BETTER

WORSE

TOTAL ENERGY CONSUMPTION PER UNIT FLOOR (MMBTU/SFT)

Oklahoma State University	0.08
University of Nebraska Lincoln	0.09
University of Colorado Boulder	0.11
Colorado State University	0.12
North Carolina State	0.16
University of Kansas University	0.16
Kansas State (Manhattan)	0.17
University of Illinois	0.19
Iowa State University	0.26

PERCENT OF TOTAL ENERGY CONSUMPTION FROM CLEAN SOURCES

University of Kansas	54%
Oklahoma State University	34%
Kansas State (Manhattan)	17%
Iowa State University	10%
University of Illinois	3%
Colorado State University	1%
University of Colorado Boulder	0%
University of Nebraska Lincoln	0%
NC State	0%

WATER USE PER SQUARE FOOT (GAL/SFT)

University of Colorado Boulder	20
NC State	21
University of Nebraska Lincoln	21
Colorado State University	23
University of Kansas	25
Iowa State University	28
University of Illinois	29
Oklahoma State University	30
Kansas State (Manhattan)	31

WATER USE PER WEIGHTED USER (GAL/USER)

University of Kansas	6300
University of Colorado Boulder	7700
NC State	10500
Kansas State (Total)	11900
Colorado State University	12300
Iowa State University	13400
University of Illinois	14100
University of Nebraska Lincoln	14400
Oklahoma State University	16700

TOTAL LEED BUILDINGS

Colorado State University	44
University of Illinois	32
University of Colorado Boulder	31
Iowa State University	25
NC State	18
University of Nebraska Lincoln	15
Kansas State (Total)	5
University of Kansas	3
Oklahoma State University	1

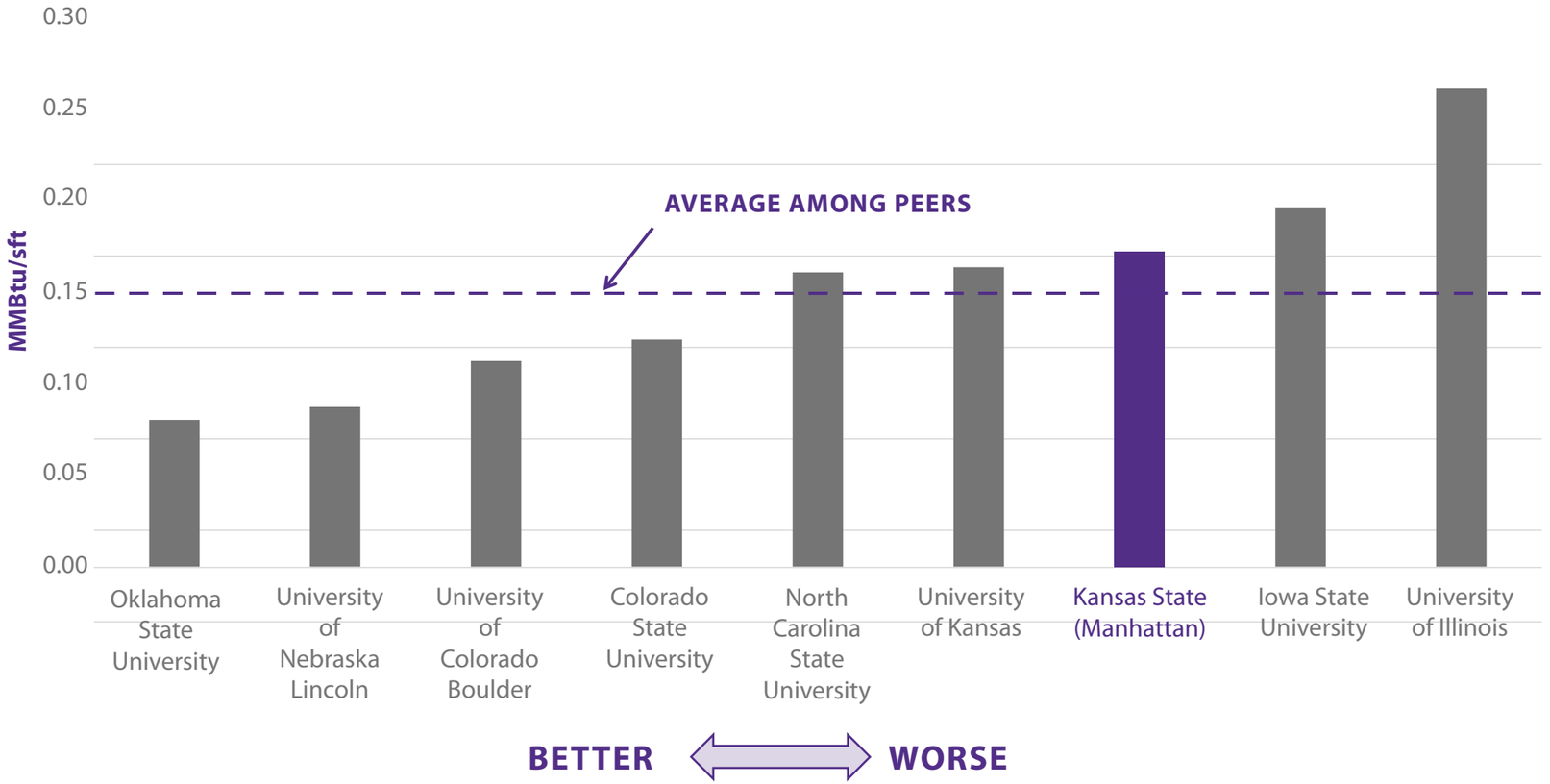
CARBON REDUCTION GOALS

Iowa State University	50% reduction by 2025
Colorado State University	Carbon neutral by 2040
University of Colorado Boulder	50% 2030 & neutral 2050
University of Nebraska Lincoln	Net zero by 2050
University of Illinois	Carbon neutral by 2050
NC State	Climate neutral by 2050
Oklahoma State University	Not published
University of Kansas	Not published
Kansas State (Manhattan)	Not published

K-State data is 2023 facilities data. Peer institution data is based on the data tracking year noted in each institution's most recent STARS Report.

TOTAL ENERGY CONSUMPTION PER UNIT FLOOR

When comparing energy consumption per square foot (measured in MMBtu), K-State used slightly more energy than the peer average. Among the universities studied, Oklahoma State University had the lowest energy use, consuming approximately 53% less energy per square foot than K-State. These findings highlight a significant opportunity for K-State to reduce energy use and operational costs through enhanced energy efficiency measures.

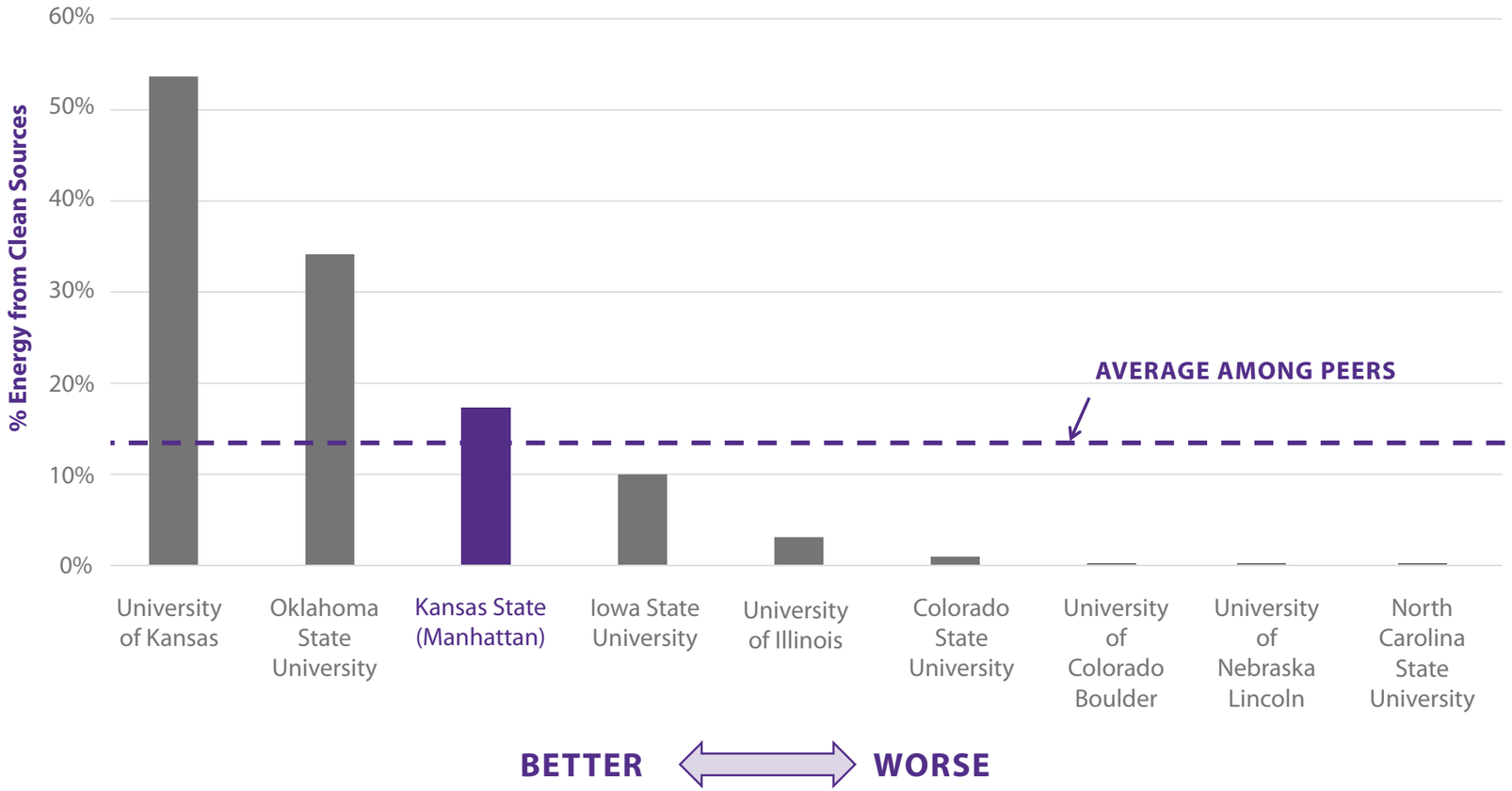


2023 Facilities Data

% TOTAL ENERGY FROM CLEAN SOURCES

Clean energy use among peer institutions varied significantly, with K-State performing just above the peer average. The main contributor to K-State's clean energy portfolio is its long-term wind energy agreement with Evergy, initiated in 2018. This agreement supplies up to 50% of the Manhattan Campus's electricity from wind power and is set to continue for 20 years. As of 2024, the university had retired 187,444 megawatt-hours (MWh) of Renewable Energy Credits (RECs), with annual energy savings ranging between $350,000 and $400,000.

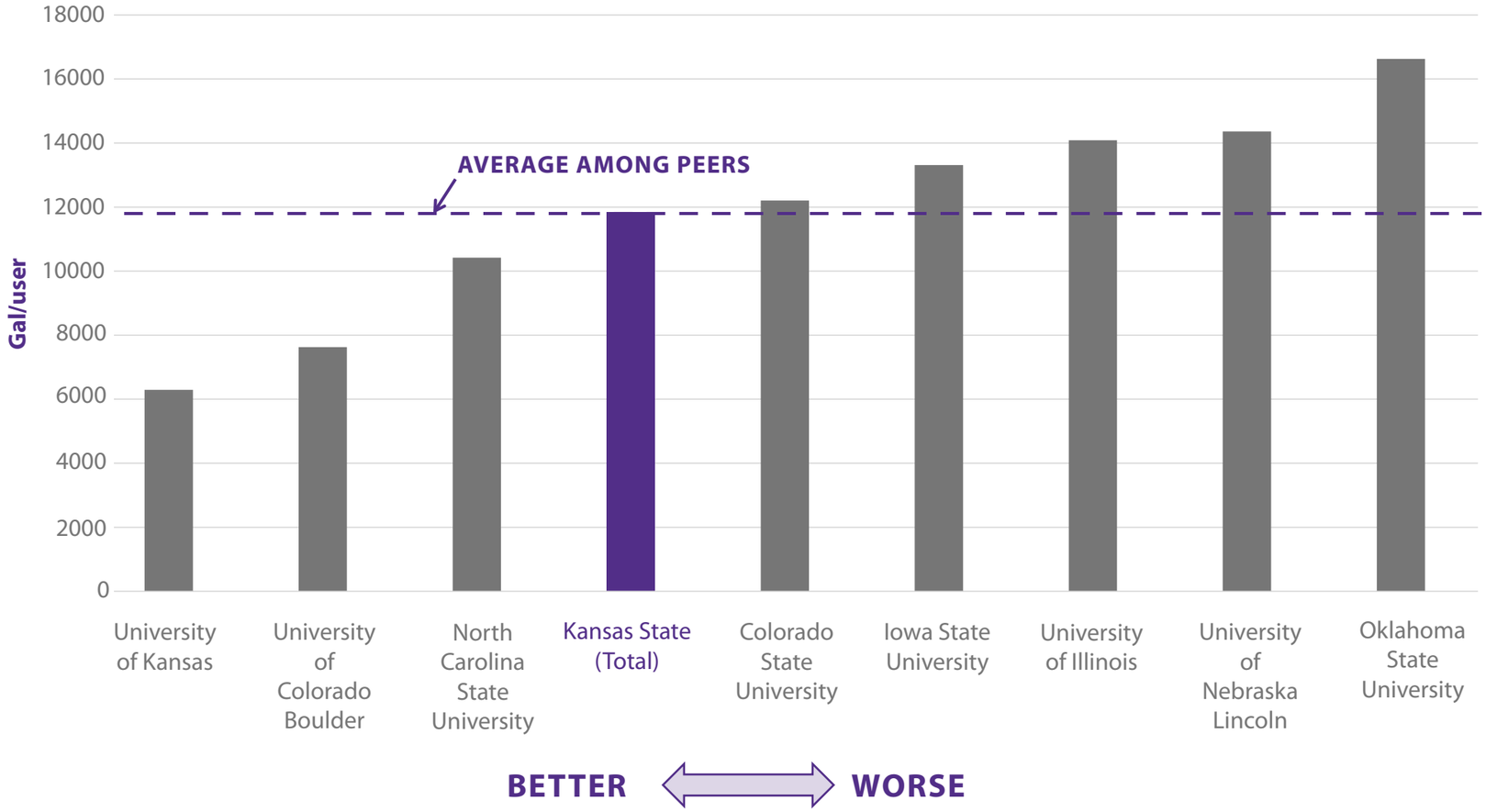
These achievements reflect meaningful progress, but also highlight the potential for K-State to further distinguish itself in clean energy leadership. Formalizing data reporting and sharing progress more transparently could strengthen the university's position among peers and help identify additional opportunities for innovation and investment in renewable energy.



2023 Facilities Data

WATER USE PER WEIGHTED FLOOR

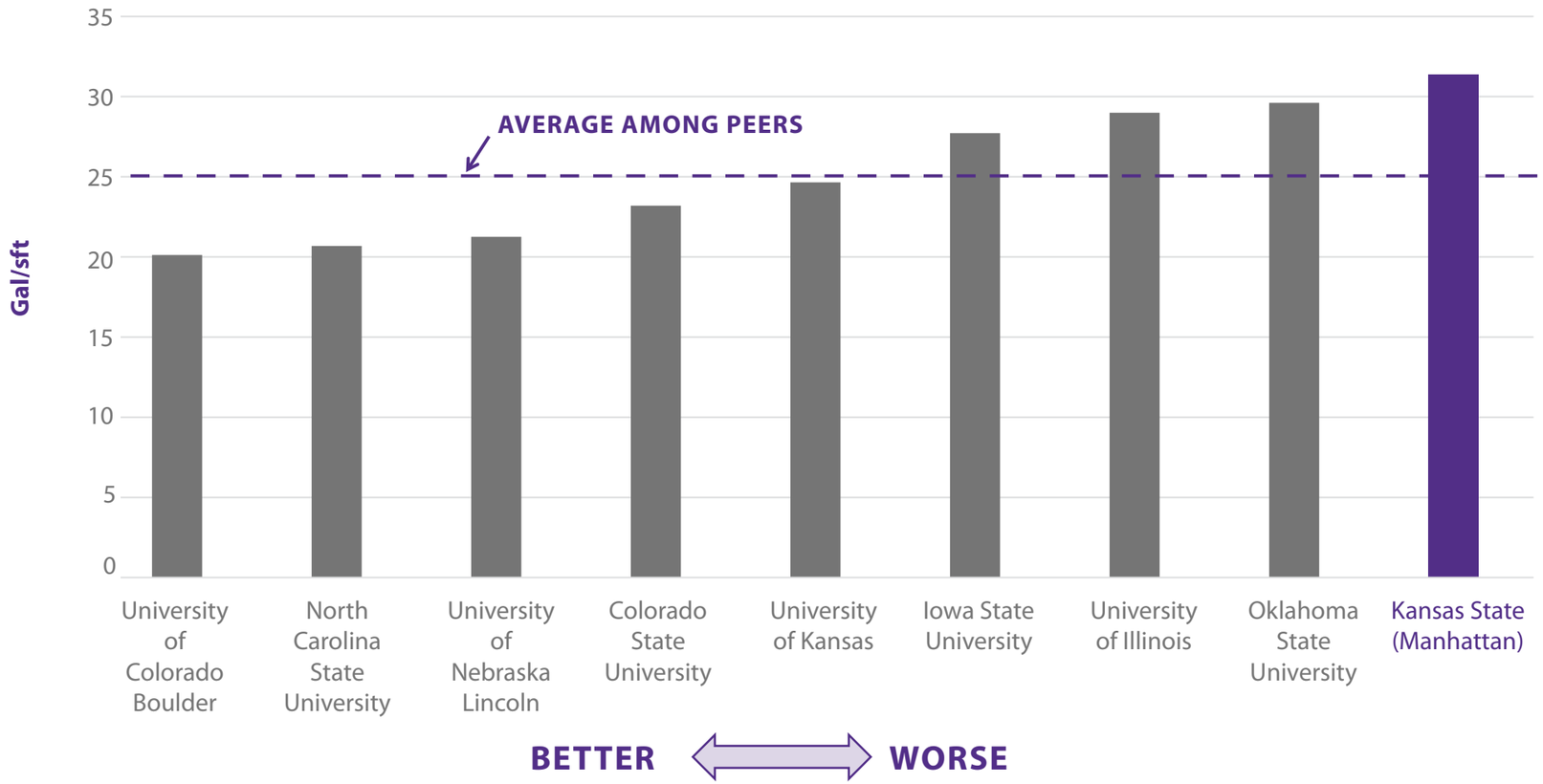
K-State's water use per weighted campus user was higher than many of its peers. Notably, the University of Kansas had the lowest water consumption among peers, using nearly 50% less water per campus user than K-State. This gap presents a clear opportunity for K-State to enhance water efficiency and demonstrate leadership within the state. Because weighted campus user data had to be estimated, formal participation in STARS reporting would help validate these findings and support more accurate benchmarking.



2023 Facilities Data

WATER USE PER SQUARE FOOT

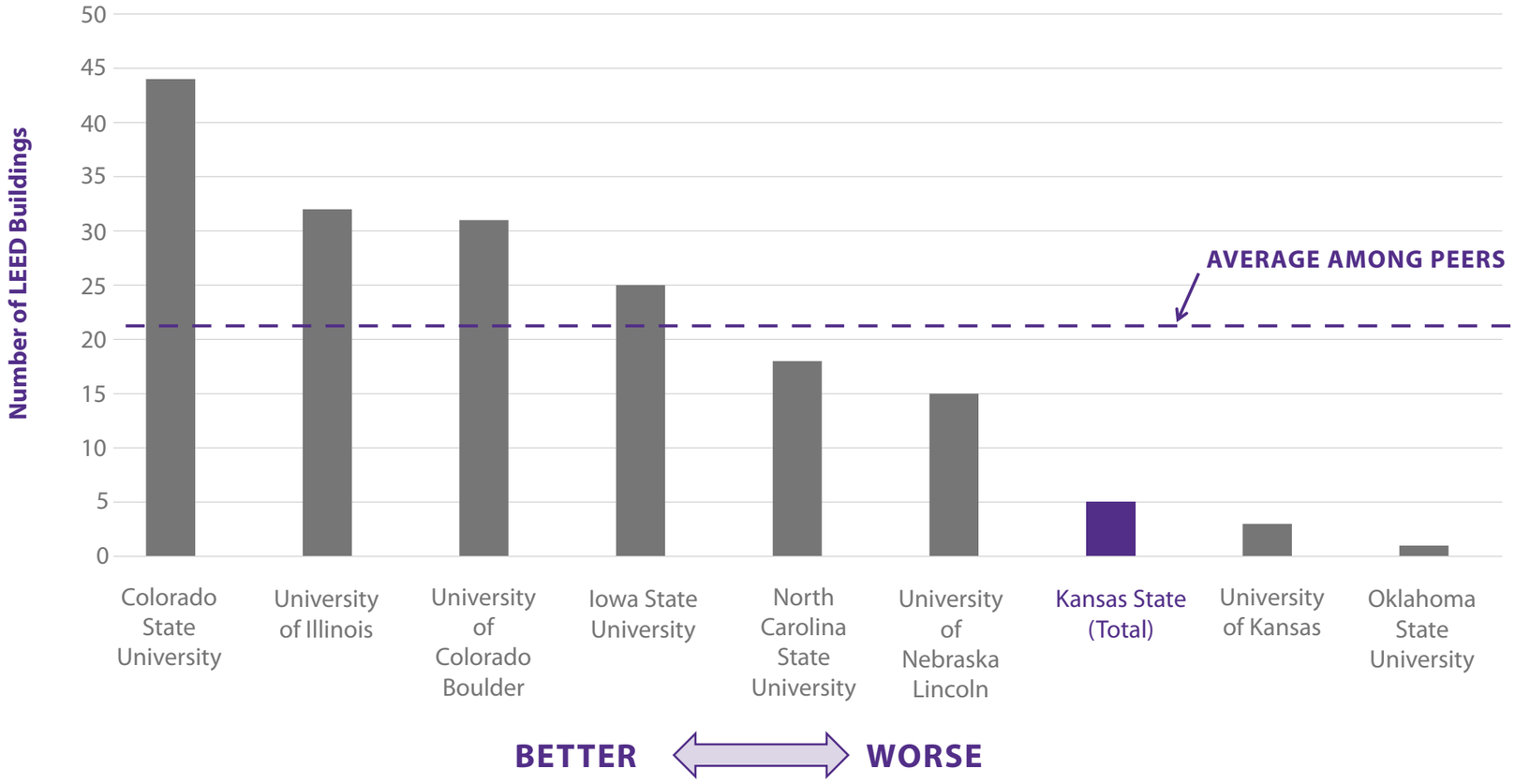
When measured by square footage, K-State had the highest water consumption among peer institutions. While further analysis is needed to confirm this intensity, the preliminary data suggests significant potential for improving water efficiency at the building level through targeted upgrades and operational changes.



2023 Facilities Data

TOTAL LEED BUILDINGS

K-State has five LEED buildings across the Manhattan (four) and Olathe (one) campuses. This falls 76% below the peer average of 21 LEED buildings. This discrepancy highlights an opportunity for K-State to better document sustainability on new construction and major renovations through LEED or other sustainability certifications.



2023 Facilities Data

CARBON REDUCTION GOALS

K-State was one of only three universities in the study without a publicly available carbon reduction goal. Most peer institutions committed to achieving carbon neutrality by 2050. The K-State 2025 Sustainability Strategic Action Plan, published in 2014, recommended an 80% emissions reduction by 2050 from a 2005 baseline. However, this target has not been formally adopted or publicly reaffirmed by the university.

University	Carbon Goal
Iowa State University	50% reduction by 2025
Colorado State University	Carbon neutral by 2040
University of Colorado Boulder	50% reduction by 2030 & carbon neutral by 2050
University of Nebraska - Lincoln	Net zero by 2050
University of Illinois	Carbon neutral by 2050
North Carolina State University	Climate neutral by 2050
Oklahoma State University	Not published
University of Kansas	Not published
Kansas State (Total) *	Not published

* **K-State 2025 Sustainability Strategic Action Plan recommends 80% reduction by 2050 from 2005 baseline**

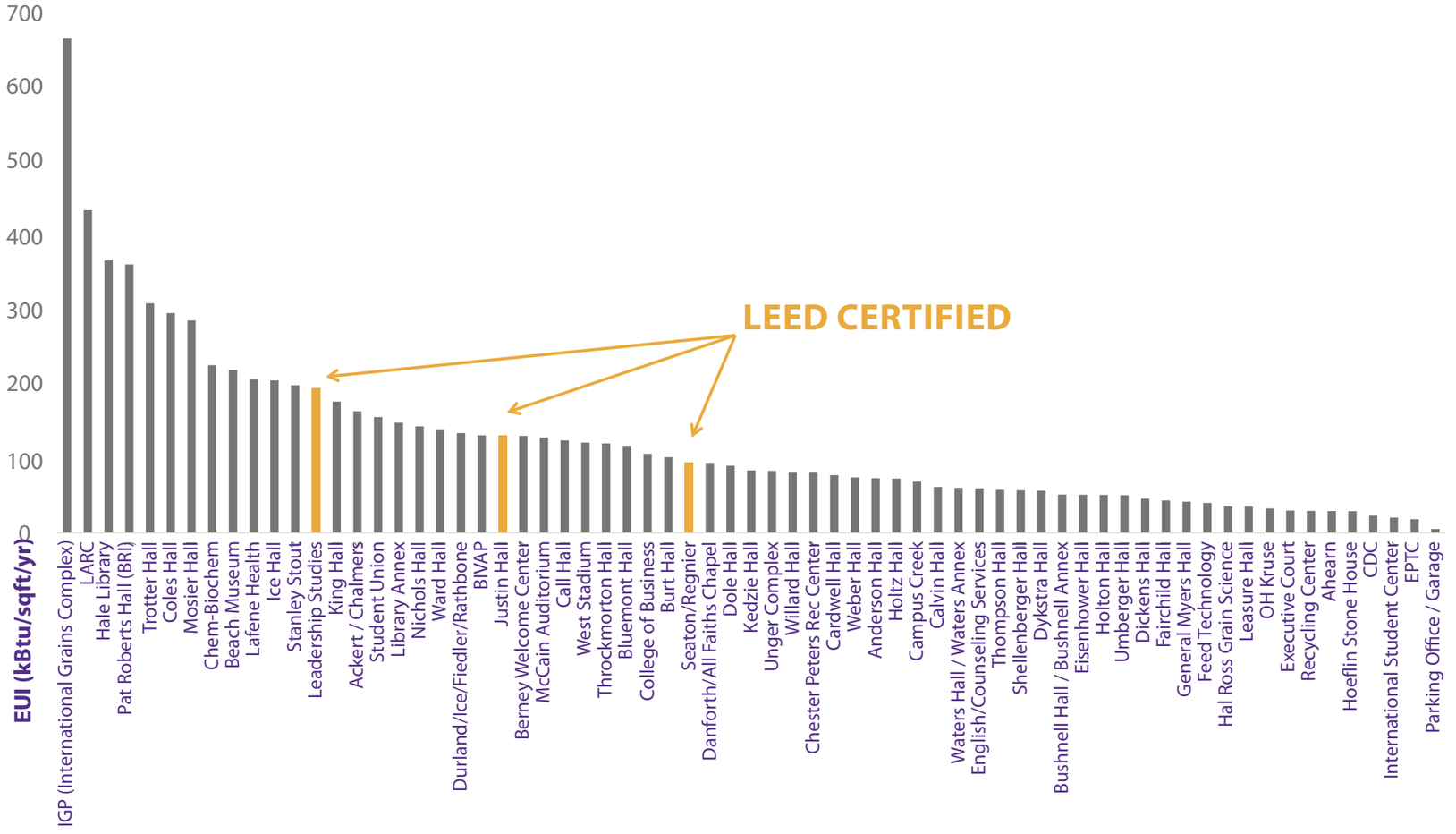
C4 BUILDING TOTAL ENERGY CONSUMPTION

The Energy Use Intensity (EUI) of 114 buildings across the Manhattan, Salina and Olathe Campuses was analyzed to assess both their EUI and their deviation from target values based on building use type.

On the Manhattan Campus, 89 buildings were studied and we found that 15 of them accounted for over 50% of the campus's total building energy use. The top three energy consumers, Bramlage Coliseum, Pat Roberts Hall and Bill Snyder Family Stadium, together made up more than 20% of the total energy use.

The energy performance of LEED-certified buildings varied when compared to other similar buildings on campus. Further study is needed to determine whether these buildings are performing better or worse than expected, based on their specific use types.

EUI BY BUILDING
89 BUILDINGS STUDIED ON MANHATTAN CAMPUS



EUI DEVIATION FROM TARGET VALUE BY BUILDING

EUI measures energy use per square foot, but without accounting for building type, it can be misleading—especially on technical campuses. Comparing EUI to benchmarks based on use type helps identify true under-performance and prioritize improvements. This project used EUI targets from ENERGY STAR Portfolio Manager U.S. National Median Reference Values, summarized in the table.

Energy efficiency investments should be prioritized for buildings with high total energy use and an EUI significantly above target levels. Several of the top energy-consuming buildings are already recommended for demolition or major renovation, as noted. Additional ASHRAE energy audits are recommended for the seven highest energy-consuming buildings to better understand the reasons behind their elevated EUI and identify energy-saving measures with the greatest potential impact on overall campus energy consumption.

Rank	Building Name	Total Energy Use MMBTU	% of Total Energy Use	EUI kBTU ft2	Deviation from Target
1	Bramlage Coliseum	52,800	8.8%	296	426%
2	Pat Roberts Hall	41,200	6.8%	358	212%
3	Bill Snyder Family Stadium - West Stadium	27,500	4.6%	150	167%
4	Vanier Football Complex	22,500	3.7%	143	182%
5	Durland/Rathbone/Fiedler/Engineering Hall	21,200	3.5%	55	13%
6	Chester E. Peters Recreation Complex	20,900	3.5%	83	62%
7	Mosier Hall	19,700	3.3%	71	77%
8	Seaton/Regnier Hall	19,500	3.2%	51	6%
9	Lafene Student Health at Mercy Health Center	18,800	3.1%	205	412%
10	Hale-Farrell Library	18,300	3.0%	45	-38%
11	Ackert/Chalmers Hall	18,000	3.0%	85	113%
12	Coles Hall	17,600	2.9%	162	41%
13	Throckmorton Hall	16,100	2.7%	40	-1%
14	Grain Science Center - International Grains Program	13,000	2.2%	659	N/A
15	Derby Dining Center	12,000	2.0%	130	-52%
	TOTAL	**339,100**	**56.3%**		

ASHRAE Audit Recommended

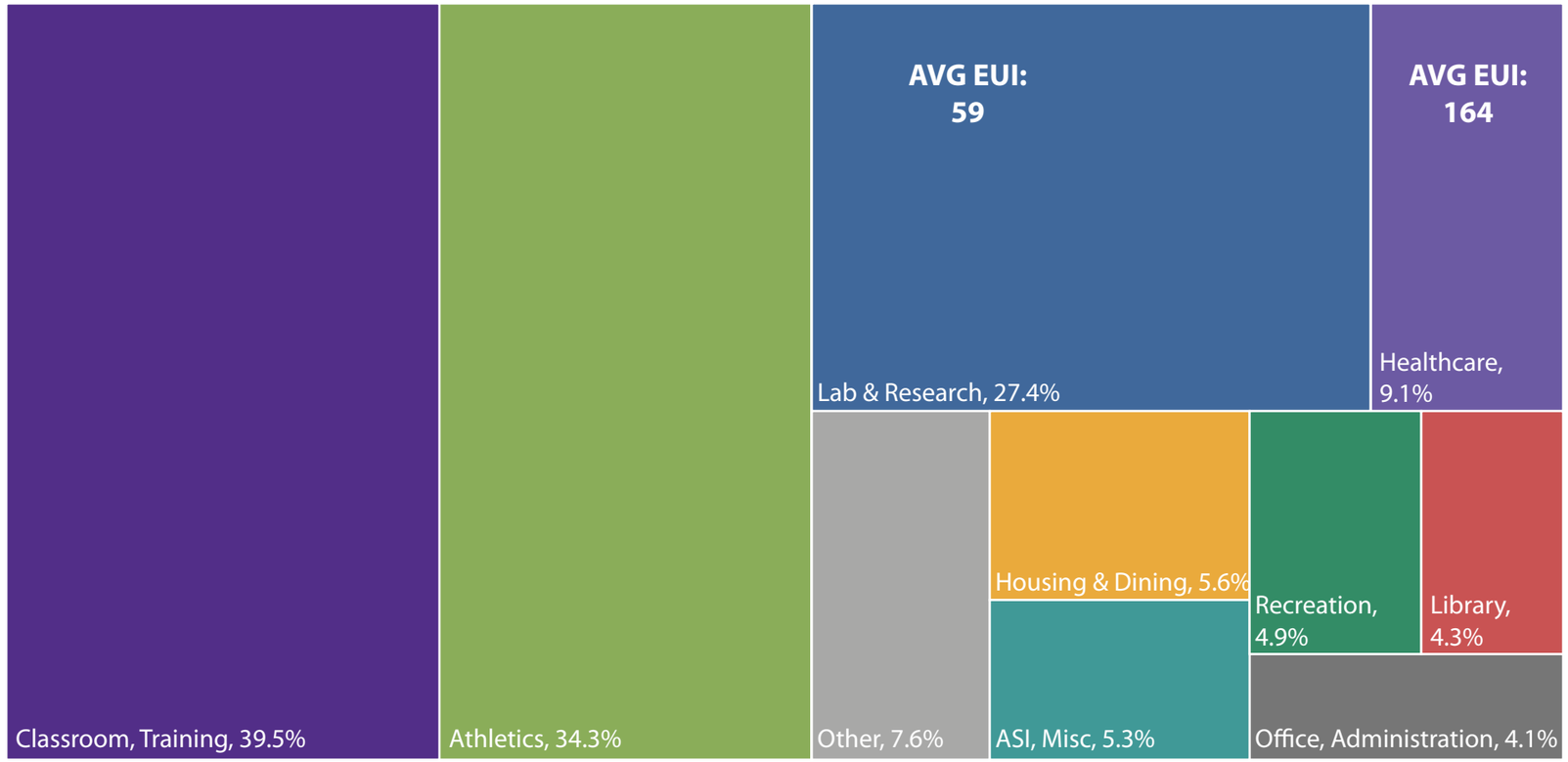
Renovation Recommended

Demolition Recommended

Building energy use data was from 2024 Energy Audit provided by K-State facilities leadership.

MANHATTAN ENERGY USE BY BUILDING TYPE

Building energy use was also aggregated by use type to better understand which areas consumed the most energy on campus. Classrooms, athletics and research buildings were the highest consumers, with athletics and research buildings having the highest average EUI. Prioritizing interventions in these two categories appears to be the most effective approach for reducing overall campus energy use.



BUILDING TOTAL WATER CONSUMPTION

Domestic water use was analyzed for 65 buildings on the Manhattan Campus using data provided by the university. The top 15 highest-consuming buildings accounted for over 15% of total water use among those studied. Throckmorton, Weber and Pat Roberts Halls were the top three consumers, together responsible for more than 35% of total usage. The dataset did not include housing and dining, athletics, the Manufacturing Learning Center, or ASI Swine facilities; further studies are recommended to assess water use in these areas.

67 BUILDINGS STUDIED ON MANHATTAN CAMPUS

Rank	Building Name	Domestic Water Use	% of Total Water Use	WUI gal/ft2
1	Throckmonton Hall	11000	13.4%	20.1
2	Weber Hall	9600	11.7%	48.6
3	Pat Roberts Hall(BRI)	8500	10.4%	55.2
4	Mosier Hall	7800	9.5%	20.0
5	Coles Hall	6700	8.2%	46.2
6	Trotter Hall	5300	6.4%	50.5
7	Chester Peters Rec Center	4000	4.8%	11.2
8	Ackert/Chalmers	2700	3.2%	9.4
9	Seaton/Regnier	2300	2.7%	4.5
10	LARC	2200	2.6%	85.5
11	Call Hall	2000	2.4%	23.5
12	Hale Library	1700	2.1%	3.1
13	Student Union	1700	2.0%	4.8
14	Durland/Ice/Fiedler/Rathbone	1600	1.9%	3.0
15	Beach Museum	1500	1.8%	26.0
	TOTAL	**68,000**	**83.2%**	

Percentage of total water use of buildings studies. This makes up 25% of total campus water use.

D

SPACE GUIDELINES

D1 SPACE PLANNING GUIDELINES

Space guidelines have been developed to serve as an aid in planning, design and space management. These guidelines are meant to assist K-State in establishing consistent, flexible and efficient space planning parameters. The intent of the guidelines are to promote the optimum use of space in new, existing and renovated buildings. Space planning is about using standards and guiding principles to measure how well space is being used and plan for future needs. As the space planning guidelines are applied over time it will be continually reviewed and adapted to represent K-State's needs.

GUIDELINES

- Space is owned by the Board of Regents, thus the Vice President for Administration and Finance and the Provost retain ultimate responsibility for allocating and re-allocating space.
- The University operates in a dynamic environment. To be successful, it must be able to use its resources flexibly to not only create change, but also adapt to it. It is recognized that space, particularly research and office space, cannot be assigned permanently, or for an indefinite period of time to any one individual, program, unit, or college. Space may require reallocation based on need, productivity, or when the priorities of the unit, college, and/or university change.
- Ownership of space is not implied by occupancy, nor should it be inferred.
- Units should not stockpile unused or underutilized space, nor may they lease it to another department. Space will be relinquished to the Office of Space Management and be reassigned in order to optimize space utilization on campus.
- Units that receive new or different space shall vacate existing space. Units may submit a backfill plan as part of the space request process but space will be reassigned in accordance with the strategic needs of the university.
- Space allocations that satisfy long-range plans take precedence over more temporary requests.
- The use or lease of university space by a non-university entity must be approved by the Vice President for Administration and Finance, Office of Financial Services, Office of Space Management, Provost, and Vice President for Research (where applicable) prior to development of any space use agreements or lease documents.
- Space requests or assignments that demonstrate higher research and scholarly productivity, are cost-effective, enhance revenues, or encourage interdisciplinary interaction will be given priority.
- Synergistic or like activities should be housed in proximity.
- To support accurate reporting of space, organizational units are required to report changes to assigned spaces as a part of the annual space survey. Changes may include floor plan updates, room use changes, changes in occupancy or vacated space.
- All vacated space shall be reported to the office of Space management for reassignment to best support the strategic needs of the University.

D2 SPACE STANDARDS

CLASSROOM FACILITIES - 100

Classroom - 01.100.10

- Classrooms include:
  - *A room or space used for scheduled instruction that is not tied to a specific subject or discipline, and does not require special or restrictive equipment or configuration.*
  - *Rooms may be called: lecture rooms, seminar rooms, demonstration rooms and general-purpose classrooms.*
  - *A classroom may contain special equipment such as pianos, maps, computers and other items appropriate to a specific area of study if this equipment does not render the space unsuitable for use by classes in other areas of study.*

Classroom 01.100.10 - Assignable Station Size per Student (minimum NASF)

ROOM CATEGORY	Movable Chairs w/ Tablet Arm	Movable Tables and Chairs	Fixed Tables w/ Movable Chairs	Fixed Seating
Traditional Lecture	20-22	25-30	20-25	17-20
Active Learning	25-30	30-35	-	-

Classroom Service - 01.100.15

- A room or space that directly serves one or more classrooms as an extension of the activities in that space.
- Classroom services include: telecommunications control booths, coat rooms, projection rooms or storage areas, if such rooms serve classrooms.

LAB FACILITIES - 200

Class Lab - 01.200.10

- A space used primarily for formally or regularly scheduled instruction (including associated mandatory, but non-credit-earning labs) that require special purpose equipment or a specific space configuration for student participation, experimentation, observation or practice in an academic discipline.
- Class labs include:
  - *Space designed for or furnished with equipment to serve the needs of a particular discipline for group instruction in formally or regularly scheduled classes. This special equipment normally limits or precludes the use of the spaces by other disciplines.*
  - *Included in this category are spaces generally called teaching labs, instructional shops, computer labs, drafting rooms, band rooms, choral rooms, (group) music practice rooms, language labs, (group) studios, theater stage areas used primarily for instruction, instructional health labs and similar specially designed or equipped rooms, if they are used primarily for group instruction in formally or regularly scheduled classes.*
  - *Computer rooms used primarily to instruct students in the use of computers are classified as class labs if that instruction is conducted primarily in formally or regularly scheduled classes.*

Classroom Lab Service - 01.200.15

- A space that directly serves one or more class labs as an extension of the activities in those spaces.
- Class labs service include: storage areas, preparation rooms, projection rooms, telecom rooms and coat rooms.

Total space required for class lab facilities is determined by considering a number of factors: average station utilization and student contact hours; number of students; assignable square feet (ASF) per station requirements; and number of stations required. The space guidelines listed in the class lab - 210/215 Table include lab support within the per station ASF.

Of note, the total class lab space for campus should not equal the combined total of class lab space for each department as there are additional open labs for tutoring, academic support and other campus-wide needs that do not fit neatly into the departmental buckets.

Class Lab 01.200.10 & 01.200.15 ASF per Student

PROGRAM	*ASF*
Agricultural Engineering	125
Agriculture	80
Agronomy	70
Animal Sciences	90
Anthropology	60
Architecture	80
Art	80
Biological Sciences	65
Business & Management	40
Chemical Engineering	120
Chemistry	75
Civil Engineering	120
Communications	50
Computer & Information Science	60
Computer Based Lab	40
Dance	150
Economics	40
Education	40

PROGRAM	*ASF*
Electrical Engineering	100
Engineering	120
Exercise Physiology & Kinesiology	80
Food Science & Technology	80
Foreign Languages	40
Geography	60
Geology	60
Health Professions	80
Horticulture	65
Industrial Engineering	120
Mathematics	30
Mechanical Engineering	140
Music	60
Physical Sciences	75
Psychology	50
Social Sciences	50
Sociology	40
Veterinary Medicine	90

OFFICE FACILITIES - 300

Office - 01.300.10

Optimizing the allocation of building space ensures that, as an institution, we use our physical resources effectively.These guidelines are intended to help departments and units manage their office space in an efficient and effective manner, providing guidance for space planning in both current and future buildings. Office spaces are determined by an employees position FTE designation and the amount of time spent working on campus. These standards will continue to evolve to best support the needs of the University.

Office 01.300.10 ASF per Position

GROUP	POSITION TYPE	ROOM TYPE	ASF
Executive	President	Office	450
	Provost / Vice President	Office	300
Administration	Dean / Assistant Vice President	Office	240
	Director	Office	200
	Associate or Assistant Director	Office	160
Staff	Full Time	Office or Workstation	120
	Part Time	Workstation	80
	Administrative Assistant	Workstation	64
	Student Worker	Workstation	36
Faculty	Tenure Track, Full Time	Office	130
	Tenure Track, Part Time	Shared Office or Workstation	80
Other	Grad Student	Workstation	50
	Post Docs	Shared Office or Workstation	100
	Research Associates	Shared Office or Workstation	80
	Lecturers / Adjunct	Shared Office or Workstation	80

SPACE ALLOCATION PROCEDURES

The Vice President for Administration and Finance and the Provost oversee space management to ensure the university maximizes its resources, delivering high-quality academic services to students and fostering a positive, productive environment for faculty and staff. The following procedures have been developed to provide consistency and understanding of the space management process.

1. Requests for space (new or reallocation) must be submitted by a Dean or Vice President. The requestor must submit a Space Request Form to the Office of Space Management. The form can be found on the Office of Space Management website. When submitting forms, allow for a minimum of two (2) weeks for review and consideration of each request.

2. Requests must include an internal Space Evaluation that verifies that adequate space does not exist within the resources already available to the department, college or program. This evaluation must include a total of all space associated with the department(s) requesting space. This should include shared space, storage space, etc. If you require help completing the evaluation, contact the Office of Space Management.

3. When new space is allocated to a college, department or program a review of the existing space must be completed by the Office of Space Management to determine the future use of that space.

4. Justification for the space requested must be included with the Space Evaluation. It should include information about the new or expanded program that requires the space, the schedule, whether the requested space is temporary or permanent and funding for additional space.

5. Periodic reviews of space will be made to ensure the best possible use of space.

6. With respect to requests for office space:
   - Employees working four (4) or more days in the office, as required by their contract, will receive a dedicated office or work space. Those working three (3) days or fewer in person will have a shared office or workspace.
   - Faculty with a research appointment who complete research within their offices and have no lab space may have differing space needs from faculty with no research appointment. Office space for these faculty will be evaluated on a case-by-case basis.

SPACE EVALUATION

A Space Evaluation is a comprehensive review of currently assigned space for a college, department or major administrative unit. The evaluation will compare space utilization and distribution based upon departmental personnel lists, space inventory data and nationally used formulas and standards, which measure adequacy and effectiveness of space use in colleges and universities. The Space Evaluation process is intended to serve as a planning tool for the individual colleges and for the university.

1. A detailed inventory of the department or division's space may be requested from the Office of Space Management. This will include room use and the type of activity associated with the room, as well as net square feet totals and occupants.

2. The department or division should perform a physical walk through of its space to make sure all current space is being fully utilized.

3. If the department or division needs assistance in performing the space audit, please contact the Office of Space Management who will arrange for a physical review of the space.

4. Forward the results of the space audit with a detailed description of the department/division's space needs to the department/division's dean or vice president for approval prior to the request being forwarded to the Office of Space Management.

5. A college, department or program is expected to make corrections to inappropriate uses of space before new space will be recommended for assignment. Examples of inappropriate space use include: vacancies, multiple offices assigned to a faculty or staff member, labs used for office space or offices used for storage space.

E

ARCHITECTURAL DESIGN GUIDELINES

E1 ARCHITECTURAL DESIGN

These high-level design considerations are intended to preserve and enhance the unique and cohesive aesthetic character of the university. More detailed technical specifications are found on the K-State Campus Planning & Facilities Management (CP&FM) website. CP&FM will direct future campus development in accordance with these considerations and state statutes. The Campus Planning and Development Advisory Committee shall use these considerations in their review of proposed campus developments.

K-State buildings in the campus core reflect a collegiate campus setting with a limited palette of building materials, which are primarily of limestone. Many of these buildings are facing quads, forming a series of interconnected informal open lawns with shade trees that define the campus. Historic Anderson Hall, facing the "Oval," establishes a protected lawn and our campus image, and thus the height of other buildings within the academic core should be no taller than Anderson Hall's primary roof line. The Manhattan Campus is architecturally eclectic but unified through materials, scale and open space

E2 GUIDING PRINCIPLES

ENVIRONMENTAL STEWARDSHIP

The University's goal is to be energy efficient and environmentally responsible in our buildings and operations. Building construction and renovation must comply with code requirements for energy efficiency and include sustainable features similar to those required for LEED Silver. Actual certification is optional and will be determined on an individual project basis.

MATERIALS

Buildings should incorporate materials with long life and minimal maintenance needs.

TRANSPARENCY

Buildings should avoid blank walls. To make the building more inviting and reduce the need for artificial lighting, design it with a high level of transparency to allow ample daylight to enter.

LANDSCAPE DESIGN

The design quality of space between buildings is equally important to the design of the buildings themselves. Buildings should not be considered only as objects but as collective forms creating and defining outdoor rooms and spaces.

CAMPUS ZONES

The Manhattan Campus is comprised of three distinct zones: Lower Campus, Mid-Campus and Upper Campus, as depicted in the zone map to the right.

Lower Campus

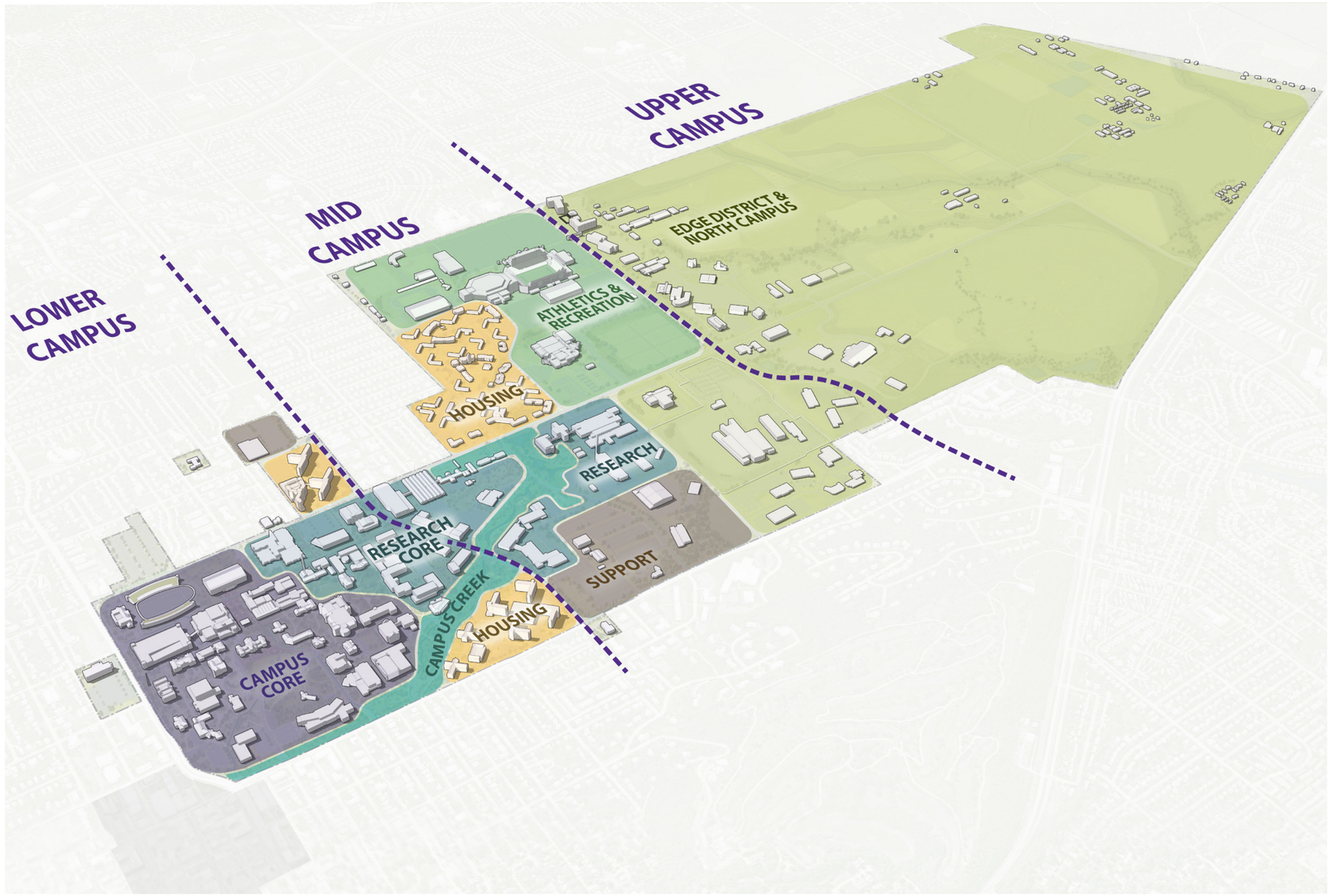
Most of the area south of Claflin Road. This area is defined by limestone buildings of three stories or fewer within a park-like, pedestrian-oriented campus setting. Building masses define a variety of outdoor spaces. The edges of the Lower Campus are often defined by stone walls and gateways.

Mid-Campus

The area north of Claflin Road and south of Kimball Avenue has a lower density of buildings and lacks the spatial qualities of the Lower Campus. The intent of the plan is for future buildings to create more defined outdoor spaces, similar to the character of the Lower Campus. Architectural styles are more varied, but limestone and glass are the predominant exterior finish materials. This zone includes two areas with exceptions from standard guidelines, Athletics and Jardine.

Upper Campus

The area north of Kimball Avenue. Buildings in this zone are used for agricultural purposes. They are constructed of a broader range of exterior finish materials rather unified by selective use of color.



	LOWER CAMPUS	MID-CAMPUS	UPPER CAMPUS
CHARACTERISTICS			
PREDOMINANT LAND USE	Teaching, research and student life	Teaching, research and student life	Agricultural teaching and research
INTENDED LOOK & FEEL	Park-like campus	Park-like campus	Rural
EDGE DISTRICT			
MASSING & SPATIAL ORGANIZATION			
ALLOWABLE HEIGHT	Most buildings should be four stories or less, but taller buildings may be permitted near the perimeter of the Lower Campus. Buildings in the environs of Anderson Hall shall be shorter than the primary roof line of Anderson Hall.	Taller buildings (over four stories) are permissible in this zone. Jardine: Taller buildings allowed Athletics: No height limit. Object buildings within open landscape.	No height limit
SPATIAL ORGANIZATION			
OPEN SPACE	Create a hierarchy of formal and informal open spaces including larger parks (such as Anderson Lawn), quads, courtyards and malls. Create figurative outdoor rooms within the academic core that are framed by buildings. Provide a variety of environments such as woods, prairie and gardens.	Future development: Define formal and informal figurative open spaces, similar to the Lower Campus. Jardine: Create a hierarchy of formal and informal open spaces which build community by establishing residential neighborhoods, offering opportunities for gathering and recreation and accommodating special events. Remove internal road networks to establish open spaces. Athletics: Create logical and clear circulation paths to major venue entrances from parking areas and adjacent zones.	Establish or maintain refined agricultural or natural settings for barns, research facilities and out buildings.

	LOWER CAMPUS	MID-CAMPUS	UPPER CAMPUS
PLACEMENT & ORIENTATION	Locate new buildings to maintain the pedestrian experience of transitioning through a sequence of outdoor spaces or quads. Preserve view corridors to Anderson Hall. Consider building orientation to optimize solar lighting and solar gain for energy efficient design and solar gain.	Locate new buildings in such a manner that the pedestrian experience of transitioning through a sequence of outdoor spaces or quads in the Lower Campus is dispersed throughout the Mid-Campus Zone. Consider building orientation to optimize solar lighting and solar gain for energy efficient design and solar gain.	Cluster buildings as functionally appropriate to create wind breaks, service yards and needed adjacencies. Consider building orientation to optimize solar lighting and solar gain for energy efficient design and solar gain.
SPATIAL PLANNING CONCEPTS	Preserve the quads and Anderson "Oval" by not constructing any structures within them. Remove historically insignificant buildings that are inappropriately sited to create new quads and enhance the spatial quality of the campus. Noisy and unattractive cooling towers, fuel tanks, generators, etc. currently located along major pedestrian circulation paths should be relocated to more appropriate locations at the end of their serviceable lives.	Enhance the spatial and pedestrian quality of the campus by relocating parking lots to the campus perimeters, removing internal streets and strategically placing new buildings. Create quads with thoughtful placement of buildings and removal of parking and streets.	Prioritize agricultural zone for agricultural programs which incorporate interdisciplinary education, research or outreach in agriculture.
GENERAL BUILDING DESIGN			
CHARACTER & IMAGE	Honor historic context; employ compatible architectural styles, material palette, texture, fenestration patterns and scale. New construction within a 500-foot radius of buildings on the historic register shall comply with State Historical Society requirements.	Future development should replicate the density, spatial organization and park-like pedestrian quality of the Lower Campus to the greatest extent feasible. Architectural styles may vary but the university's aesthetic continuity should be preserved with limestone and glass exterior wall finishes and comparably colored roofing materials.	Institutional quality development with a limited palette of exterior finish materials and colors will extend the university's identity and image, while preserving and enhancing the natural beauty and rural character of the area.
ACCESSIBILITY	All new construction must comply with ADA requirements, other applicable accessibility codes and should strive to use universal design principles. Consider placing classrooms and labs with high utilization on lower levels to accommodate class changes.	All new construction must comply with ADA, other applicable accessibility codes and should strive to use universal design principles. Consider placing classrooms and labs with high utilization on lower levels to accommodate class changes.	All new construction must comply with ADA, other applicable accessibility codes and should strive to use universal design principles. Provide accessible parking and unloading spaces at all new agricultural facilities.

	LOWER CAMPUS	MID-CAMPUS	UPPER CAMPUS
BUILDING MASSING	Typically simple, complete, multistory volumes of formal rectangular in plan and frequently with steep hipped or gabled roofs.	Typically simple, complete, multistory volumes of formal and informal rectangular plans, often with low sloped roofs and occasionally with steep hipped or gabled roofs.	Apply traditional agricultural settings to the arrangement of buildings.
EXTERIOR FINISH, MATERIALS & COLORS			
EXTERIOR WALLS	Exterior walls in the Lower Campus are predominately pitched face, coursed ashlar limestone with smooth limestone accents. Exterior walls of new buildings in the Lower Campus should be contextually appropriate and constructed predominately of natural limestone and glass. For the Goodnow/Marlatt area, new construction may include elements to interface with the existing red brick buildings.	Natural limestone is the preferred exterior wall finish material in the Mid-Campus Zone. A limited use of limestone-colored cast and pre-cast concrete, masonry, EFIS and limestone or warm medium gray metal panels is permitted with CP&FM approval. For Jardine housing, it is permissible to use durable engineered wood, concrete or composite siding in a broader range of approved colors.	A broader range of exterior wall finishes is permitted in the Upper Campus zone, but exterior finish colors are limited to maintain aesthetic continuity. Acceptable exterior finish materials include natural limestone, limestone colored cast and pre-cast concrete, limestone or warm medium gray metal panels, masonry, stucco or exterior finish insulation system (EFIS) with CP&FM approval.
ROOFING	Many of the Lower Campus buildings have steep roofs with campus standard "Oxford Gray" architectural textured composition shingles. Other roofing materials such as slate, synthetic slate or standing seam metal roofing in a similar warm medium gray color range may be used on sloping roofs with CP&FM approval. Low sloping roofs visible from other buildings should be light gray or vegetated. Strive to incorporate RoofPoint principles including durability, thermal discontinuity, energy efficiency, air barriers, daylighting, traffic protection, etc.	Visible sloping roofs should be a warm, medium gray color similar to the campus standard "Oxford Gray" architectural textured composition shingles. Campus standard MBCI "Ash Gray" color is preferred for standing seam metal roofs on utilitarian buildings and metal sided mechanical penthouse screen walls. Strive to incorporate RoofPoint principles including durability, thermal discontinuity, energy efficiency, air barriers, daylighting, traffic protection, etc.	Visible sloping roofs should be a warm medium gray color similar to campus standard "Oxford Gray" architectural textured composition shingles. Campus standard MBCI "Ash Gray" color should be used for metal roofs on agricultural buildings . Strive to incorporate RoofPoint principles including durability, thermal discontinuity, energy efficiency, air barriers, daylighting, traffic protection, etc.

	LOWER CAMPUS	MID-CAMPUS	UPPER CAMPUS
GLAZING AND DOOR & WINDOW FRAMES	Glass may range from clear to medium gray or medium bronze tones. Mirrored, dark tinted or colored glass is prohibited. Door and window frames may be clear anodized aluminum or gray/bronze tones.	Glass may range from clear to dark gray or bronze tones. Mirrored or colored glass is prohibited. Door and window frames may be clear anodized aluminum or gray/bronze tones.	Glass may range from clear to dark gray or bronze tones. Mirrored or colored glass is prohibited. Door and window frames may be clear anodized aluminum or gray/bronze tones.
SITE & GROUNDS			
CAMPUS EDGE SETBACKS	Maintain 100-foot green space along Anderson Avenue and 50-feet along Manhattan and Denison Avenues.	Maintain 100-foot green space along Kimball Avenue and 50-feet along Denison Avenue.	Maintain 100-foot green space along Kimball and 150-feet along Denison, College and Marlatt Avenues.
OUTDOOR SPACES	New construction and renovations shall include places for people to gather in plazas with benches, trash receptacles bike parking and lighting. Optional furniture may include tables, canopies or shade structures. In addition to pedestrian accommodations, bike parking facilities shall be provided in approved locations.	New construction and renovations shall include places for people to gather in plazas with include benches, trash receptacles bike parking and lighting. Optional furniture may include tables, canopies or shade structures. In addition to pedestrian accommodations, bike parking facilities shall be provided in approved locations.	Establish quality Kansas typical environments in a range of primary and out buildings. Cluster buildings as functionally appropriate to create wind breaks and service yards. In addition to pedestrian accommodations, bike parking facilities shall be provided in approved locations where desired.
LANDSCAPING	Provide thoughtful selection of trees, shrubs, perennial and annual materials to enhance the campus aesthetic and climatic environment. Consult Landscape Guidelines.	Provide thoughtful selection of trees, shrubs, perennial and annual materials to enhance the campus aesthetic and climatic environment. Consult Landscape Guidelines.	Consult Landscape Guidelines.

	LOWER CAMPUS	MID-CAMPUS	UPPER CAMPUS
DUMPSTERS, GROUND-MOUNTED INFRASTRUCTURE & EQUIPMENT	Placement and design of service areas, waste dumpsters, recycling receptacles and ground mounted equipment such as transformers, generators, cooling towers, condensing units, etc. must be coordinated and approved by the University Landscape Architect. No overhead utilities permitted. Every effort shall be made to screen these elements with plant materials and fencing. Relocate unattractive and noisy ground-mounted infrastructure and equipment currently located along major pedestrian paths at the end of serviceable equipment life to less prominent locations.	Placement and design of service areas, waste dumpsters, recycling receptacles and ground mounted equipment such as transformers, generators, cooling towers, condensing units, etc. must be coordinated and approved by the University Landscape Architect. No overhead utilities permitted. Every effort shall be made to screen these elements with plant materials and fencing.	Placement and design of service areas, waste dumpsters, recycling receptacles and ground mounted equipment such as transformers, generators, cooling towers, condensing units, etc. must be coordinated and approved by the University Landscape Architect. No overhead utilities permitted.
SITE FURNITURE	Provide a consistency in color and materials for benches and waste receptacles. Current standards call for black metal site furniture.	Provide a consistency in color and materials for benches, waste receptacles. Current standards call for black metal site furniture.	
WALL & FENCING	Preserve existing stone walls around Lower Campus. Continue stone walls along Denison Avenue. Provide contextually appropriate limestone walls with vertical black steel picket fencing to secure and screen dumpsters and mechanical equipment. Chain link fencing is not permitted.	Limestone walls with vertical black steel picket fencing should be provided to define or secure outdoor areas when required and to screen dumpsters and mechanical equipment. Chain link fencing is permitted in limited applications such as for recreation or security.	Develop attractive multi-species design standard for animal containment fencing along city and county streets. Functionally appropriate fencing of any type is permitted in remote rural areas.

	LOWER CAMPUS	MID-CAMPUS	UPPER CAMPUS
EXTERIOR LIGHTING	Pedestrian walk and street lighting shall be illuminated to EIS standards and conform to adjacent fixture and pole styles. Parking lot and other security lighting shall be illuminated according to EIS standards and incorporate night sky and cutoff features. Banners may be incorporated with light poles. LED fixtures preferred. No high pressure sodium fixtures permitted. Wall pack lighting is discouraged. Poles shall be of historic character.	Pedestrian walk and street lighting shall be illuminated to EIS standards and conform to adjacent fixture and pole styles. Parking lot and other security lighting shall be illuminated according to EIS standards and incorporate night sky and cutoff features. LED fixtures preferred. No high pressure sodium fixtures permitted.	Security lighting to incorporate night sky and cutoff features. No high pressure sodium fixtures permitted. Parking lot and walk lights to conform to mid-Campus lighting standards.
GATEWAYS & ENTRY FEATURES	Defined by limestone walls, columns and black steel picket fencing/gates to include scale appropriate "K-State" sign. Kiosk directories placed near pedestrian entries. Placement as defined by Signage and Wayfinding Guidelines.	Defined by limestone walls and black steel picket fencing/gates to include scale appropriate "K-State Sign." Kiosk directories placed near pedestrian entries.	Gateways at entrances to remote buildings or complexes should be similar to the Large Animal Research Center Gateway. In the The Upper Campus zone, signs for buildings or complexes of buildings may often include departmental or complex name with "K-State" sign.
SIGNAGE	Refer to Signage and Wayfinding Guidelines available from CP&FM for identification, directional and directory signs. Powercat or similar logos are not permitted. All signage must be approved by CP&FM.	Core campus sign applications apply. Exception: the use of the Powercat (only on athletics buildings and signage) or Rec Center logo (only on Recreation Center building and signage) is permitted. All signage must be approved by CP&FM.	Signage at entrances to remote buildings or complexes should be integrated into gateway/entry features (similar to Large Animal Research Center). Signage is at a larger scale to permit readability from greater distances in faster moving vehicles. All signage must be approved by CP&FM.
STORMWATER MANAGEMENT	Campus stormwater management is seen as an interconnected system which accommodates the quantity and quality of runoff such that there is no increase in stormwater runoff from the campus. The system may include green roofs, rainwater gardens, cisterns, permeable pavement, etc developed in support of the Campus Stormwater Management Study.	In addition to the core campus applications, storm water control practices may include detention basins.	In addition to the core campus applications, storm water control practices may include detention basins.

	LOWER CAMPUS	MID-CAMPUS	UPPER CAMPUS
CAMPUS CIRCULATION			
MULTI-MODAL TRANSPORTATION	Primarily pedestrian-oriented, with provisions for bike traffic. Bike parking facilities shall be provided in approved locations and coordinated with bike routes. Incorporate plan concepts for routes, minimizing conflicts with pedestrians. Bus and automobile traffic accommodated on perimeter streets, with some access roads into campus. Most on-campus vehicular traffic limited to service vehicles. Always make limited access accommodations for emergency, accessibility transportation, service and delivery vehicles such that private vehicle access is limited.	Provide sidewalk and bike infrastructures to encourage walking and riding bikes. Bike parking facilities shall be provided in approved locations and coordinated with bike routes. Incorporate plan concepts for routes, minimizing conflicts with pedestrians. Bus and automobile traffic accommodated on perimeter streets, with some access roads into campus. Most on-campus vehicular traffic limited to service vehicles. Always provide limited access accommodations for emergency, accessibility transportation, service and delivery vehicles such that private vehicle access is limited.	Provide sidewalk and bike infrastructures to encourage walking and riding bikes along primary transportation corridors. Bike parking facilities shall be provided in approved locations and coordinated with bike routes. Incorporate master plan concepts for routes, minimizing conflicts with pedestrians. Bus and automobile traffic accommodated on perimeter streets, with some access roads into campus.
PARKING	Relocate private and state vehicle parking from the Lower Campus Zone as to the campus edges. Screen parking with plant materials according to the Landscape Guidelines.	Screen parking with plant materials according to the Landscape Guidelines.	Screen parking with plant materials according to the Landscape Guidelines.
PERIMETERS STREETS	Provide consistent concrete sidewalks and appropriate, consistent lighting for pedestrian and automobile safety. Provide bike lanes, paths or routes as appropriate. Street trees at regular spacing approved by the University Landscape Architect, and, where applicable, City of Manhattan standards.	Campus edge streets with sidewalks, bike lanes or paths and appropriate fencing as needed, clear gateways and entrances as needed, with appropriate level of security and signage and street trees at campus gateways.	Rural street with appropriate and consistent fencing as needed, clear gateways and entrances with appropriate level of security and signage, street trees and campus gateways.

F

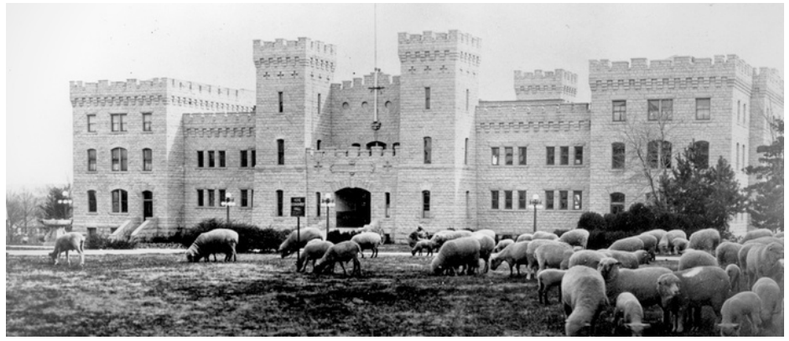
LANDSCAPE & OPEN SPACE

F1 OVERVIEW

The campus landscape of K-State expresses a diverse land grant mission that includes education, research and service. From its founding as an institution in the flint hills native prairie, the campus has evolved to become a living lab with a variety of beautiful places, functions and character which address the history of the campus, location and mission. Future campus improvements should strive to honor this diversity and variety in a sustainable manner.

HISTORY OF CAMPUS LANDSCAPE

K-State, formerly Bluemont College, was founded in 1858. In 1863, the institution became a land grant college whose primary purpose was to research and determine which plants could be cultivated and grown in the Kansas Prairie landscape and provide the information to the general public. As a primary feature of the campus landscape, shelterbelts, also referred to as windbreaks, provided an essential function for the landscape of the campus by protecting human habitat, agricultural lands and livestock from winter and summer winds. Shelterbelts consisted of native and common varieties that would give protection for more select tree species in future plantings. Among the research conducted on campus, a central focus was horticulture. The primary objective of campus research at the time was to test the adaptability of eastern tree species in the Kansas landscape. Other important research included: grain, fertilizer, tilling, feeding animal and milk production. Much of the historic tree canopy was planted not as a part of an organized landscape plan, but incrementally as an experimental nursery of trees and shrubs. As a result, the landscape evolved gradually, seizing opportunities to improve the campus as they emerged. Today, the campus is an arboretum with a wide variety of well-established tree species, shrubs, perennials and grasses that is to be replicated, adapted and preserved where appropriate. The campus has an established "tree walk" that should be maintained and enhanced.



F2 PRINCIPLES

These themes are carried throughout the Landscape Guidelines and serve as the guide to physical development of the open and green spaces on campus. Any improvement to the campus landscape should:

STRENGTHEN IDENTITY

- Provide active open spaces that are beautiful, comfortable, navigable and part of an identifiable hierarchy transitioning from formal to semi-formal to informal, reflecting the university's identity and pride.
- Ensure enhancements are historically respectful, presently relevant and forward-thinking.
- Unify the campus through the use of materials, plant selection and space design.

LEVERAGE PROGRAM ADJACENCIES

- Foster educational environments by incorporating living labs that serve as functional landscapes for use by faculty, staff and students.
- Cultivate landscapes for learning, research and recreation in proximity to buildings with related programs.
- Enhance visibility of the campus arboretum resources; pursue Tree Campus USA designation.

PROMOTE SUSTAINABILITY

- Preserve or enhance natural systems and promote sustainable landscapes, as reflected in the K-State 2025 and Campus Master Plan Update 2012.
- Consider multi-seasonal use and aesthetics in any campus landscape design.

Certain standards apply across the entire campus and must be reviewed for any project taking place on campus grounds. Please refer to the Campus Zones and Land Uses chapter for guidance, including the campus zone map.

PLANT SELECTION

Plants for the campus landscape should be selected to enhance the beauty of the campus, as well as supporting a sustainable landscape. Selecting native, low-maintenance plants is preferred. Occasionally there will be opportunity for selecting non-native plant material to expand diversity and educational exploration. For the most up-to-date lists of appropriate plants, refer to the Kansas State Horticulture, Forestry and Recreation Resources online references (www.hfrr.ksu.edu). Select plants based on microclimate and use.

IRRIGATION RECOMMENDATIONS

Irrigation is an important functional component of the campus landscape and can greatly impact the success of plant material. To improve efficiency of irrigation systems on campus recommendations are as follows:

- Connect isolated systems.
- Install more efficient systems as existing facilities age or are damaged.
- Consider the use of alternative water sources such as:
  - Rainwater capture through cisterns, rain barrels, sub-surface
  - Greywater from adjacent buildings and/or
  - Condensation from chillers and coolers.

  These represent only a few options available, new technologies and practices should be considered.
- Consider the use of drought tolerant/low water use plants (where appropriate) into the landscape and irrigate only in times of severe drought.

MEMORIALS & ART

Campus features including memorials and art can add to the landscape and are encouraged on campus. Art installations require review by the Sculpture Committee, as well as an endowment for maintenance and care for the piece.

WAYFINDING & SIGNAGE

Provide signage in campus spaces to promote campus brand, identity and aid in wayfinding through the campus for visitors. Refer to the Wayfinding & Signage standards of the Campus Master Plan Update 2012.

SIDEWALK & PATHWAYS

Provide adequate lighting levels for pedestrians (in compliance with IES Standards), particularly in the Lower Campus and Mid-Campus Zones. Provide universally accessible routes through campus, per most current ADA Standards. Path design and size to be appropriate to level of use, providing a hierarchy of connections through the campus.

SITE FURNISHINGS

Site furnishings should provide uniformity and are appropriate to the context/use of space. For the most up-to-date recommendations for site furnishings including tables, benches, trash receptacles, light fixtures and bike racks contact the University Landscape Architect at CP&FM.

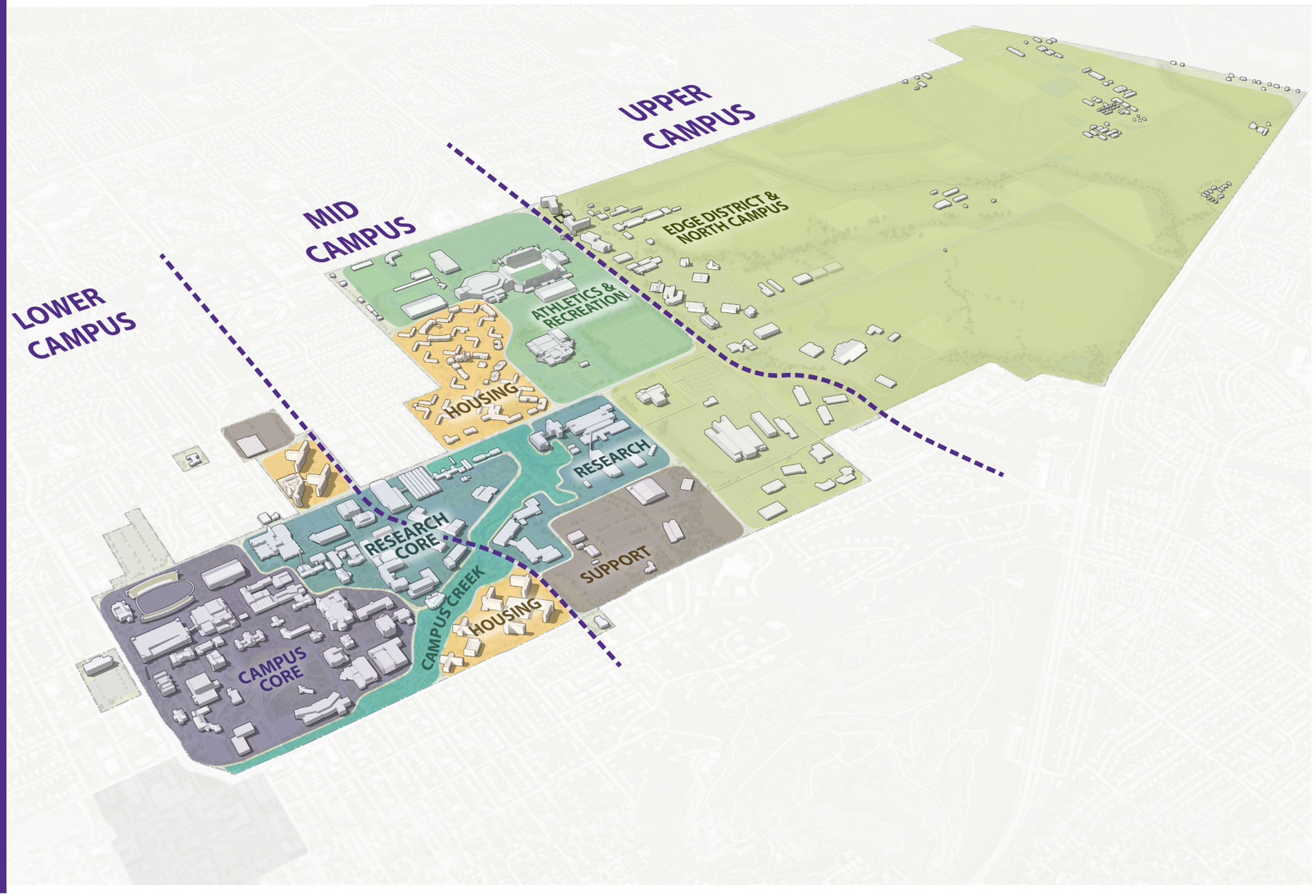
F3 ZONES & USES

The Manhattan Campus is made up of three distinctive zones: the Lower Campus, Mid-Campus and Upper Campus. The Lower Campus Zone was the area first developed for academic use and includes the oldest buildings on campus. On the west side of the Lower Campus Zone, the Kramer Complex consists of traditional residence halls and a dining center. On the east side, the Derby and Strong complexes comprise traditional residence halls and suites, as well as two dining centers. This zone also comprises the majority of the academic undergraduate experience.

The Mid-Campus Zone is located between the Lower Campus Zone and Kimball Avenue. This area is home to the College of Veterinary Medicine and is immediately adjacent to the 25-acre K-State Research Park and the National Bio and Agro-Defense Facility. Jardine Apartments are located west of Denison Avenue in this zone. An area of athletics and recreation use between Denison and College Avenues and south of Kimball Avenue provides facilities for the more active aspects of campus life.

North of Kimball Avenue is the Upper Campus Zone. This zone of the campus is mostly used for agricultural, veterinary and research activities.

The guidelines included in this appendix apply to landscapes in all three of zones. More detailed guidelines specific to individual campus zones can be found in the Landscape Design Guidelines.



F4 LANDSCAPE GUIDELINES

LANDSCAPE TYPOLOGIES

The following landscape typologies help shape the campus environment while contributing to the quality of life on campus. Following the guidance provided for each typology will significantly increase the chances of success. The design team, in collaboration with a supportive institutional client, will bring more to a specific project than can be expressed in this set of guidelines.

EDGES & ENTRANCES

The edges and entrances define the boundary and transition between the campus and the surrounding community, creating visually inviting spaces that offer a positive, welcoming first impression to visitors.

QUADS

A typical campus quad is characterized by large open green spaces that are iconic and enhance the identity of the institution. These spaces provide gathering opportunities for both ceremonial and impromptu events. Pedestrian routes provide direct routes to, through and/or around the green space.

PEDESTRIAN MALLS

A pedestrian mall is typically a street that has been converted from vehicular to pedestrian/bike-only circulation (as well as emergency access and ADA shuttle). It provides important connections from one area of the campus to another, flexible arrangement of space and serves as an iconic experience for the campus.

PLAZAS

Plazas are characterized by a large expanse of hardscape that supports pedestrian traffic into building entrances, outdoor dining and/or event spaces. It is important to maintain flexible programming opportunities to promote a sense of community for the space, incorporating a mix of fixed and movable seating. The use of art, sculpture, temporary exhibits and/or water features is encouraged as is appropriate to site context.

COURTYARDS

Courtyards are generally smaller, more intimate gathering areas that are at least partially enclosed by buildings and primarily serve the adjacent structures. These spaces are often planted with a more diverse range of plant species that cannot be planted in more open areas.

CAMPUS GREEN SPACE

Campus green spaces are quality landscapes that may be preserved as the campus is developed. It also includes undeveloped areas with minimal landscaping.

WOODLAND HABITATS & RIPARIAN CORRIDORS

Woodland and riparian habitats are typically within or adjacent to streams and creeks and provide a natural setting among more developed areas of campus. These areas also provide natural stormwater management and wildlife habitat, serving as a functional amenity for the campus.

PLAYING FIELDS

Large areas of artificial turf used for intramural sports, each demanding specific maintenance requirements. Playing fields may also occur as open spaces adjacent to or within the Lower Campus.

AGRICULTURAL RESEARCH LANDS

The lands to the north provide hands-on learning opportunities near the Lower Campus. These lands are a valuable resource for the University and are being used for departmental research, remaining true to the land grant mission.

SURFACE PARKING

Typically, surface parking in the Lower Campus and Mid-Campus Zones consists of smaller parking lots, adjacent to buildings, that are used primarily for ADA accessible parking or loading/unloading.

EDGES & ENTRANCES

DESCRIPTION		GUIDANCE		PRIMARY ACADEMIC	VETERINARY	RESIDENTIAL	ATHLETICS	THE EDGE & NORTHCAMPUS
• Define physical boundary • Identify transition from community • Inviting, positive first impression • Landscape forms identity and sense of place for university	ENTRANCES	**PRIMARY**	**SECONDARY**					
		Appropriate materials:	**Appropriate materials:**					
		Kansas native limestone gate	Kansas native limestone gate	●	●	●	●	
		Kansas native limestone wall	Kansas native limestone wall	●	●	●	●	
		Kansas native limestone posts/accents	Kansas native limestone posts				●	●
		Cast stone accents	Cast stone accents	●	●	●	●	
		Black wrought iron	Black wrought iron	●	●	●	●	●
		White rail fence	White rail fence					●
		Formal entry plantings of shrubs, perennials and trees	Accent plantings of shrubs and perennials	●	●	●	●	
		Informal plantings of shade trees	Naturalized plantings of shrubs and perennials					●
		Simple plant palette in formal arrangements					●	
		Identify entry to campus	Identify use/area of research facilities	●	●	●	●	●
		Scale of entrances appropriate to enlarged scale of buildings and facilities					●	
		Primary entrances to be well-designed and monumental in scale		●	●	●	●	●
	EDGES	Rural-like, but uniform edges						●
		Consistent shade tree canopy along edges		●	●	●		
		Intermittent shade tree canopy along edges, where appropriate					●	●
		Shelterbelts along edges, where appropriate					●	●
		Consider use of warm season turf grasses along edges					●	●
		Signage consistent with Signage and Wayfinding Guidelines		●	●	●	●	●
		Provide appropriate level lighting for multi-purpose (signing, safety and circulation)		●	●	●	●	●

DESCRIPTION	GUIDANCE	PRIMARY ACADEMIC	VETERINARY	RESIDENTIAL	ATHLETICS	THE EDGE & NORTHCAMPUS
QUADS						
• Large open green space • Iconic, enhancing identity of the institution • Direct pedestrian routes through and/or around • Provide ceremonial and impromptu gathering opportunities	Traditional turf as lawn	●	●	●		
	Formal foundation plantings of shrubs and perennials	●	●	●		
	Formal plantings of shrubs and perennials at focal points	●	●	●		
	Plant shade trees	●	●	●		
	Minimal stormwater management (rain gardens, ornamental bio-swales) where appropriate	●	●	●		
	Provide appropriate level lighting for multi-purpose (signage, safety and circulation)	●	●	●		
	Consistent site furnishings (re: CP&FM Office Standards)	●	●	●		
	Consider pedestrian safety in selection and placement of plant material	●	●	●		
PEDESTRIAN MALLS						
• Typically a street converted to pedestrian/bike-only traffic • Maintain accessible/ emergency access • Transitional spaces providing important connection • Iconic • Flexible arrangement of space for special events	Construct with pedestrian-scale permeable pavements	●	●	●		
	Include site furnishings (benches, trash, lighting, bike racks, etc.) ref. CP&FM Office Standards	●	●	●		
	Street trees spaced evenly	●	●	●		
	Wayfinding and signage consistent with guidelines	●	●	●		
	Improvements allow for handicap/emergency access	●	●	●		
	Provide appropriate level lighting for multi-purpose use (signage, safety and circulation)	●	●	●		
	Consider pedestrian safety in selection and placement of plant material	●	●	●		

DESCRIPTION	GUIDANCE	PRIMARY ACADEMIC	VETERINARY	RESIDENTIAL	ATHLETICS	THE EDGE & NORTHCAMPUS
PLAZAS						
• Large expanse of hardscape • Flexible programming; promote sense of campus community • Fixed or movable seating • Temporary art exhibit	Edge plantings of shrubs, perennials and trees around perimeter of plazas; consider the use of complimentary rain gardens where appropriate	●	●	●		
	Provide occasional breaks in pavement to soften with shade trees, shrubs/perennial beds or rain gardens as appropriate	●	●	●		
	Entrances to buildings/venues to be "high design" consisting of simple plant palette in formal arrangements	●	●	●	●	
	Provide fixed and movable seating opportunities	●	●	●	●	
	Design plazas to support adjacent programs/department activities	●	●	●	●	
	Design and site elements (such as sculptures and water features) to promote university branding and identity	●	●	●	●	
	Provide opportunities for sculpture displays.	●	●	●	●	
	Construct using permeable pavements appropriate to use	●	●	●	●	
	Incorporate human comfort considerations (i.e. water features and shade)	●	●	●	●	
	Consider pedestrian safety in selection and placement of plant material	●	●	●	●	
	Site lighting and furnishings to match Campus Standards (re: CP&FM Office Standards)	●	●	●	●	
COURTYARDS						
• Small, intimate gathering spaces • Typically enclosed at least partially by buildings • Fixed or movable seating • Used for outdoor classroom space • Use of diverse plantings	Provide seating arrangements designed for intimate gatherings	●	●	●		
	Extend adjacent academic uses in to the space	●	●			
	Consider rain gardens, cisterns, rain barrels, etc. as appropriate	●	●	●		
	Construct using permeable pavements appropriate to use	●	●	●		
	Consider pedestrian safety in selection and placement of plant material	●	●	●		
	Site lighting and furnishings to match Campus Standards (re: CP&FM Office Standards)	●	●	●		

DESCRIPTION	GUIDANCE	PRIMARY ACADEMIC	VETERINARY	RESIDENTIAL	ATHLETICS	THE EDGE & NORTHCAMPUS
PLAZAS						
• Typically within or adjacent to streams and creeks • Natural setting among developed land uses • Provides natural stormwater management and wildlife habitat • Serves as a functional amenity	Remove structures that inhibit Campus Creek's ability to function hydrologically	●	●	●		
	Provide space for outdoor classrooms	●	●	●		
	Reduce invasive plant species	●	●	●		
	Daylight Campus Creek where possible	●	●	●		
	Incorporate in- and off-line stormwater detention areas	●	●	●		
	Provide pedestrian access paths along the creek corridor	●	●	●		
	Provide site lighting and furnishings to match Campus Standards (re: CP&FM Office Standards)	●	●	●		
	Provide appropriate lighting levels along paths	●	●	●		
AGRICULTURAL/RESEARCH LANDS						
• Provides hands-on learning opportunities • Land or areas for departmental research	Maintain research activity near the Lower Campus					●
	Continue sustainable initiatives concerning land management, rotational grazing, composting and stormwater					●
	Reduce invasive plant species					●
	Site lighting and furnishings to match Campus Standards (re: CP&FM Office Standards)					●

DESCRIPTION	GUIDANCE	PRIMARY ACADEMIC	VETERINARY	RESIDENTIAL	ATHLETICS	THE EDGE & NORTH CAMPUS
SURFACE PARKING						
	Perimeter landscape buffer strip (min. 15-feet wide, 20-feet when sidewalk is present)	●	●	●	●	●
	Fescue turf	●	●	●		
	Native turf				●	●
	Shade trees	●	●	●	●	
	Stormwater features (curb cuts, rain gardens, bio-swales)	●	●	●	●	
	Sidewalks	●	●	●	●	
	Interior landscape islands (min. 8-feet wide) equal to at least X% of total parking lot area	10%	10%	10%	4%	NA
	Native or fescue turf				●	
	Shrubs/perennials	●	●	●	●	
	Shade trees	●	●	●	●	
	Stormwater features (curb cuts, rain gardens, bio-swales)	●	●	●	●	
	Construct using permeable pavements as appropriate	●	●	●	●	●
	Construct temporary lots using edged gravel					●
	Consider under-pavement storage of rain water (used for irrigation or infiltration), where appropriate	●	●	●	●	
	Consider pedestrian safety in selection and placement of plant material	●	●	●	●	●
	Site lighting and furnishings to match Campus Standards (re: CP&FM Office Standards)	●	●	●	●	●
PLAYING FIELDS						
• Large areas of artificial or natural turf used by campus sports • Open spaces adjacent to or within the Lower Campus	Incorporate under-field storage of rain water to be used for supplemental irrigation					
	Investigate innovative methods/technologies to reduce the need for potable water in irrigation	●			●	
	Install quality artificial turf where appropriate	●			●	

G

SIGNAGE & WAYFINDING GUIDELINES

G1 WAYFINDING METHODOLOGY

The Signage and Wayfinding Master Plan guides the addition of directional signs on the Manhattan Campus. The system complements existing campus signage. The following is a brief summary of the guideline. For a complete description refer to the Signage and Wayfinding Master Plan (Fall 2012). This document outlines the criteria and methods for designing, organizing and placing sign messages and programming.

The system of wayfinding signage reinforces the brand by delivering clear and simple navigational guidance. A consistent message hierarchy meets current and future wayfinding needs.

ADVANCE AND SUPPLEMENTAL WAYFINDING

Advance Wayfinding begins prior to arrival. It is the policy of K-State to provide effective advance wayfinding information to facilitate the visitor experience and reduce the navigational burden on the signage system. The University provides printed and online maps and brochures for prospective visitors.

SIGN MESSAGING HIERARCHY

On-campus wayfinding information is designed for infrequent visitors. Signs cannot and should not list all possible destinations. This would result in confusion for visitors looking for the highest level of information only. A hierarchy of destinations is applied to the University's wayfinding program based on importance to visitors, new students and people unfamiliar with campus. The following methods apply to the implementation of wayfinding messages.

VEHICULAR MESSAGES

The objective of vehicular signage is to direct motorists first to the appropriate campus districts then to more specific destinations within campus. Vehicular districts include Main Campus, Athletics Complex, Veterinary Medicine and The Edge & North Campus. The "Regional Secondary Destinations" within each district are limited to those identified by the Task Force as most relevant for visitors and where parking, additional information or designated drop-offs are available. Districts and Regional Secondary Destinations are listed on the next page.

Vehicular signage is organized by direction and listed on the following page. For example, all destinations requiring a left turn are grouped together. This is the left "directional group" and it is preceded by a left arrow. Directional groups always occur in a specific order–left, right and straight ahead. Consistently listing directional groups in the same order from sign to sign improves wayfinding and reduces the amount of time required for a motorist to read and react to the sign. Likewise, turns are listed before straight-ahead destinations since turns require a more immediate action.

PEDESTRIAN DIRECTIONAL MESSAGES

Similar priorities are established for pedestrian directional signage; these signs give guidance to key destinations that are also organized into three primary directional groups – left, right and straight. As with vehicular messages, the groups are consistently listed in this order and preceded by the appropriate arrow.

The destinations on pedestrian directional signs are limited to those most relevant to visitors and people who are new to campus. The goal is not to list every building on each sign; rather, it is to help those unfamiliar with campus navigate preferred routes to key destinations. Pedestrian directional signage is concentrated in the Lower Campus Zone. The destinations listed on a sign shall not exceed a 10-minute walking duration from that location.

ORIENTATION MAPS

Map kiosk signs contain a campus map and directory. The pedestrian wayfinding system depends on kiosk signs to provide visitors a way to find all campus facilities, not just those on directional signs. Campus kiosk maps are placed at transition points from vehicular to pedestrian travel (such as parking lots, bus stops and drop-off areas), near major public facilities and along designated paths of pedestrian travel signs. They include a "You Are Here" marker–an important orientation tool.

DESTINATION MESSAGES

Identification signs are destination markers. They indicate arrival. Messages include the name of the facility, field or lot and should not include additional directional information

G2 VEHICULAR SIGNAGE

The vehicular sign family has been designed to accommodate driving speeds and distances. Vehicular signs influence first impressions and contribute to a sense of arrival.

CONTENT

Vehicular directional signs provide direction for vehicular traffic through the use of text, arrows and perform the following functions:

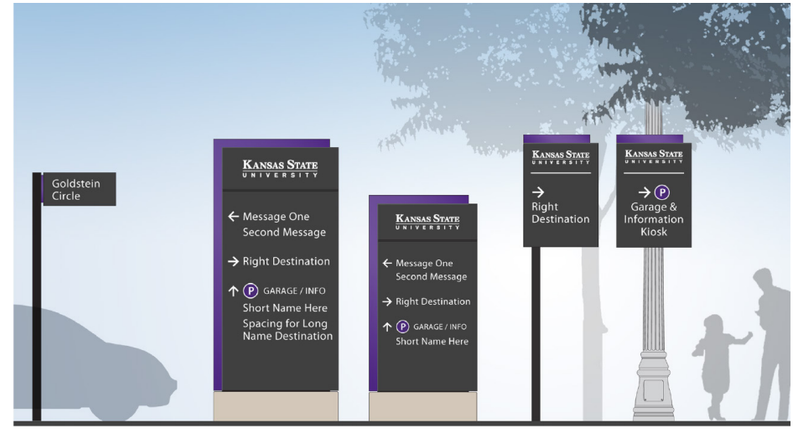
- Identify route and required turns
- Encourage preferred routes to destinations
- Provide guidance to primary campus districts and the key "regional" or nearby destinations as appropriate within each district

It is not possible to list every destination; rather, a sign should carry a mix of relevant nearby and more distant destinations. Refer to Signage and Wayfinding Master Plan (Fall 2012)for an explanation.

The goal of vehicular signage is to guide motorists to appropriate destinations. For example, vehicular signs do not list Hale Library since it is not accessible to motorists. They are directed instead to the parking garage and information kiosk where pedestrian wayfinding takes over.

Vehicular messages are organized by directional groups and destinations within each group are listed in alphabetical order. There is one exception. The parking garage and information kiosk is listed at the top of the directional group in which it occurs. This destination is prioritized since it is an important source of additional parking and permit information for visitors.

The family of exterior campus signs conveys clear directional messages and reinforces the university brand. Each sign type serves a unique function to deliver a clear hierarchy of information. Signs are designed for use on campus.



STREET SIGN

LARGE VEHICULAR DIRECTIONAL

SMALL VEHICULAR DIRECTIONAL

VEHICULAR TRAILBLAZER [FREESTANDING]

VEHICULAR TRAILBLAZER [EXISTING POST MOUNTED]

DESIGN & LEGIBILITY

Vehicular directional signs display the university logo and utilize the university's colors. Letter heights and color contrast requirements were determined by a review of roadway conditions.

FLEXIBILITY

Vehicular directional signs provide the university flexibility in updating and maintaining message panels. Updates can be made with minimal disturbance to the sign structure and foundation.

STREET SIGNS

Inter-campus street signs identify the various roads within the campus. They also help regulate vehicular traffic movement, orient drivers and are part of the overall wayfinding system. The design retains the existing sign structure and updates the message panel.

LARGE VEHICULAR DIRECTIONAL

Large vehicular directional signs are located on university property along the campus perimeter (where space and sightlines permit) and outside of the City of Manhattan public right-of-way. They provide a strong sense of arrival and give guidance to primary campus destinations such as the Athletics Complex, parking garage and the College of Veterinary Medicine.

SMALL VEHICULAR DIRECTIONAL

Small vehicular directional signs are located on University property along the inter-campus roadway network where travel speeds and road complexity is reduced. They also may be used in the southern portion of campus perimeter, where traffic patterns permit. Signs must be placed outside of the City of Manhattan public right-of-way.

VEHICULAR TRAILBLAZERS

Trailblazers announce immediate turns to major destinations and confirm motorist routes. They also support the wayfinding system in areas with minimal space for signs. They may be installed as freestanding signs or mounted on existing posts.

G3 PEDESTRIAN SIGNAGE

The Signage and Wayfinding Master Plan guides the addition of directional signs on the Manhattan Campus. The system complements existing campus signage. The following is a brief summary of the guideline. For a complete description refer to the Signage and Wayfinding Master Plan (Fall 2012). This document outlines the criteria and methods for designing, organizing and placing sign messages and programming.

CONTENT

Pedestrian directional signs provide direction for pedestrian traffic through the use of text and arrows and perform the following functions:

- Provide clear direction to the most common destinations
- Compliment intuitive wayfinding
- Promote primary campus destinations
- Promote pedestrian navigation within a 10-minute walking radius
- Promote preferred paths to minimize conflicts with vehicular routes and capitalize on campus assets

DESIGN

Pedestrian directional signs utilize the university's colors. Signs should be double-sided where practical to maximize value.

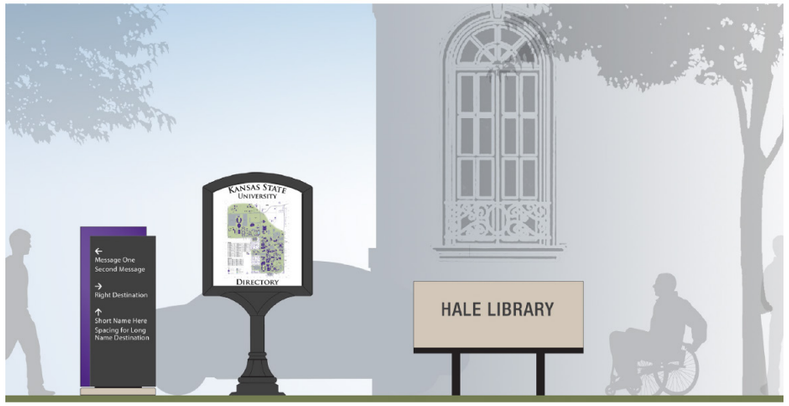
LEGIBILITY

Letter height requirements for the pedestrian signage family were determined by a review of the campus pedestrian pathway network and typical viewing distances.

FLEXIBILITY

Pedestrian directional signs have been designed to provide the university flexibility in updating the message content. Updates can be made with minimal disturbance to the sign structure and foundation.

The pedestrian signage family complements the natural and architectural campus setting and coordinates closely with vehicular signs. Signs shall accommodate pedestrian viewing distances and speeds.



PLACEMENT

Individual sign placements need to be evaluated for sightlines, legibility and proximity to relevant pathway intersections. Signs should be located periodically along straight routes (spaced as required by sightline conditions) to provide confirmation and reassurance. Additionally, signs should be located at campus thresholds and parking areas where visitors enter campus. Multiple signs along the same pathway should stay to the same side of the path and align, where practical.

PEDESTRIAN DIRECTIONAL

Pedestrian directional signs are generally placed within the main core of campus at major decision points along primary pedestrian routes. They direct to key pedestrian destinations such as the Student Union, McCain Auditorium, Hale Library, Anderson Hall and the parking garage.

MAP KIOSK

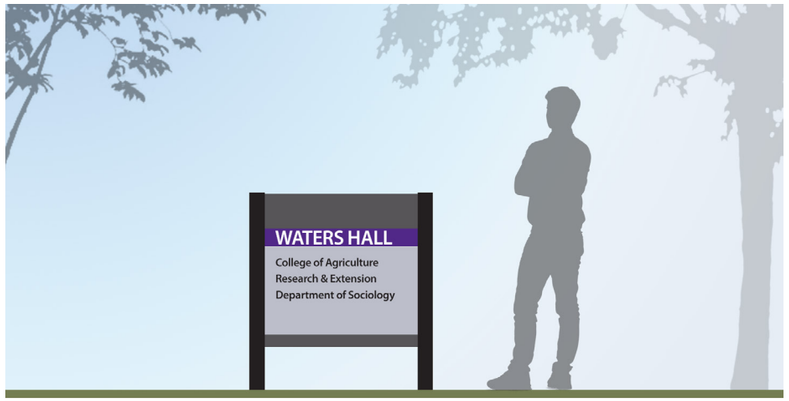
The pedestrian map kiosk signs are generally the first signs visitors will encounter after parking and leaving their vehicles. This sign type retains the existing sign structure. Contained within the unit are a "You Are Here" map of the campus, directory information and a contact number for the Security and Traffic Information desk. Kiosks should be placed at parking facilities, drop-off locations, transit stops, at key intersections and gathering places on campus, as well as along primary pedestrian routes to supplement directional signs.

BUILDING IDENTIFICATION

The building identification sign marks the entrance and arrival to all university buildings and facilities. Uniformly designed and consistently placed near entrances, these signs aid in wayfinding as pedestrians intuitively understand "where to look" for names of buildings.

BUILDING IDENTITY & DIRECTORY SIGN

This sign type is designed to support a flexible, evolving campus environment by avoiding permanent association with a single program or college. This approach ensures that buildings can adapt to changing academic and administrative needs without requiring costly or time-consuming signage updates.



H

OLSSON UTILITIES STUDY

H1 WATER SYSTEM
H2 STORMWATER SYSTEM
H3 CHILLED WATER SYTEM

KANSAS STATE UNIVERSITY

WATER SYSTEM

ACRONYMS AND ABBREVIATIONS

ADD ..... average day demand
Ave ..... Avenue
AWWA ..... American Water Works Association
BPS ..... booster pump station
CA ..... certificate of authorization
CIP ..... cast iron pipe
DIP ..... ductile iron pipe
Dr ..... Drive
EA ..... each
EPS ..... Extended Period Simulation
fps ..... feet per second
ft ..... feet
GIS ..... geograpical information system
gpd ..... gallons per day
gpm ..... gallons per minute
KDHE ..... Kansas Department of Health and Environment
KSU ..... Kansas Stat University
LF ..... linear feet
MDD ..... maximum day demand
MGD ..... million gallons per day
MLK ..... Martin Luther King
PHD ..... peak hour demand
psi ..... pounds per square inch
PVC ..... polyvinyl chloride
Rd ..... Road
St ..... Street
USGS ..... United States Geological Survey
VFD ..... variable frequency drive

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APPENDICES

EXECUTIVE SUMMARY

This report reviews the existing water distribution system for Kansas State University (KSU). Campus pipes were added to the City of Manhattan, Kansas (City) existing hydraulic model to analyze system pressures, velocities, and available fire flow. Demands for campus buildings were provided by KSU to populate the model with updated flows throughout the newly added campus pipes and determine a maximum day demand factor. Hydrant flow testing was performed to help calibrate the campus water mains.

The calibrated hydraulic model indicated that pressures on the campus are adequate, ranging from 64 to 126 pounds per square inch (psi) throughout the system at average day conditions, and 49 to 125 psi during maximum day conditions. Most of the campus is on a master meter, and all areas on the KSU master meter fall within or above the recommended 60 to 80 psi range. The areas lower than 60 psi at some points during maximum day demand are around the Kramer Dining Center and dormitories, which are served from the City of Manhattan, Kansas Low Pressure Zone.

The model showed that only 39 percent of nodes on campus can meet the recommended 1,500 gallons per minute (gpm) fire flow availability. 22 percent of nodes provide less than 1,000 gpm, which are the focus of improvement recommendations. 4-inch mains and other potential bottlenecks were identified to be upsized to maximize the benefit to the campus.

Overall, velocities are not an issue under maximum day demand, but some velocities exceed the recommended maximum of 10 feet per second (fps) during fire flow, especially smaller-diameter pipes.

Hydrant spacing was also evaluated, with a 400-foot buffer drawn around each hydrant to check adequate coverage. Overall, the campus coverage is good with six locations identified where hydrants are recommended.

A new City 24-inch main is being considered, crossing the campus along Jardine Drive near parking lot B17. A potential interconnection was also modeled, which the model indicates will improve the fire flow in the area directly to the south of the connection.

A priority ranking and budgetary cost estimate is provided for the potential projects to improve fire flow availability, reduce high velocities, improve hydrant spacing, and consider a new City interconnection.

1. INTRODUCTION

KSU owns, operates, and maintains a private water system that provides domestic water and fire protection to the campus, which is connected to the City's water system. The KSU water system is several decades old and comprised of a variety of pipe materials. The campus is planning several facility updates and expansions in the coming years. To support the planned future expansions, it is important to evaluate the existing water system to check that it can properly serve the planned facilities.

This report will include a summary of the existing system, a hydraulic model and analysis, identification of potential deficiencies in the water system, and proposed projects, plus budget cost estimates to address them.

2. EXISTING WATER SYSTEM

2.1 Distribution System

The KSU water distribution system includes approximately 13.5 miles of water main of a variety of sizes and materials. The previous (2013) KSU Water System Master Plan developed by BG Consultants indicated that the pipe materials in much of the system are unknown due to the age of the system, but there is a significant amount of ductile iron pipe (DIP), cast iron pipe (CIP), and polyvinyl chloride (PVC) in service.

Using the hydraulic model as a basis, described later in this report, the total lengths of water distribution main (not including services) for each pipe diameter are summarized in Table 1.

Table 1. Summary of Water System.

Pipe Size (inches)	Length (LF)	Length (miles)	% of Total
3	38	0	<1%
4	12,504	2.4	17.6%
6	22,574	4.3	31.8%
8	19,300	3.7	27.2%
10	11,974	2.3	16.8%
16	3,841	0.7	5.4%
24	835	0.2	1.2%
TOTAL	**71,066**	**13.5**	**100%**

Ten States Standards indicate that where fire protection is provided, water mains should be a minimum of 6 inches in diameter. While it is typically not feasible to upsize all mains that are less than 6 inches, the hydraulic model can be used to determine where water mains should be upsized, or where dead-end mains can be looped into other mains to increase capacity. It is noted that approximately 82 percent of the existing campus distribution mains are 6 inches or larger.

The campus water distribution system is bound by Denison Avenue or College Avenue on the west, Manhattan Avenue on the east, Anderson Avenue on the south, and Kimball Avenue on the north. The campus water mains and surrounding area is shown in Figure 1. It is noted that there are some additional KSU water mains north of this area, on College Ave and Marlatt Ave.

The master meter water system connects to the City of Manhattan water system at three primary locations, as shown in Figure 1:

1. 24-inch main at Kimball & Denison Avenue – Central Connection
2. 6-inch main on Kimball Avenue, north of the Intramural Field – Northwest Connection
3. 10-inch main west of Research Park Drive, near Mary and Carl Ice Hall – Northeast Connection

There is one additional connection point off the City main on Claflin Road near General Richard B. Myers Hall with a valve that is normally closed, but available for emergency situations.

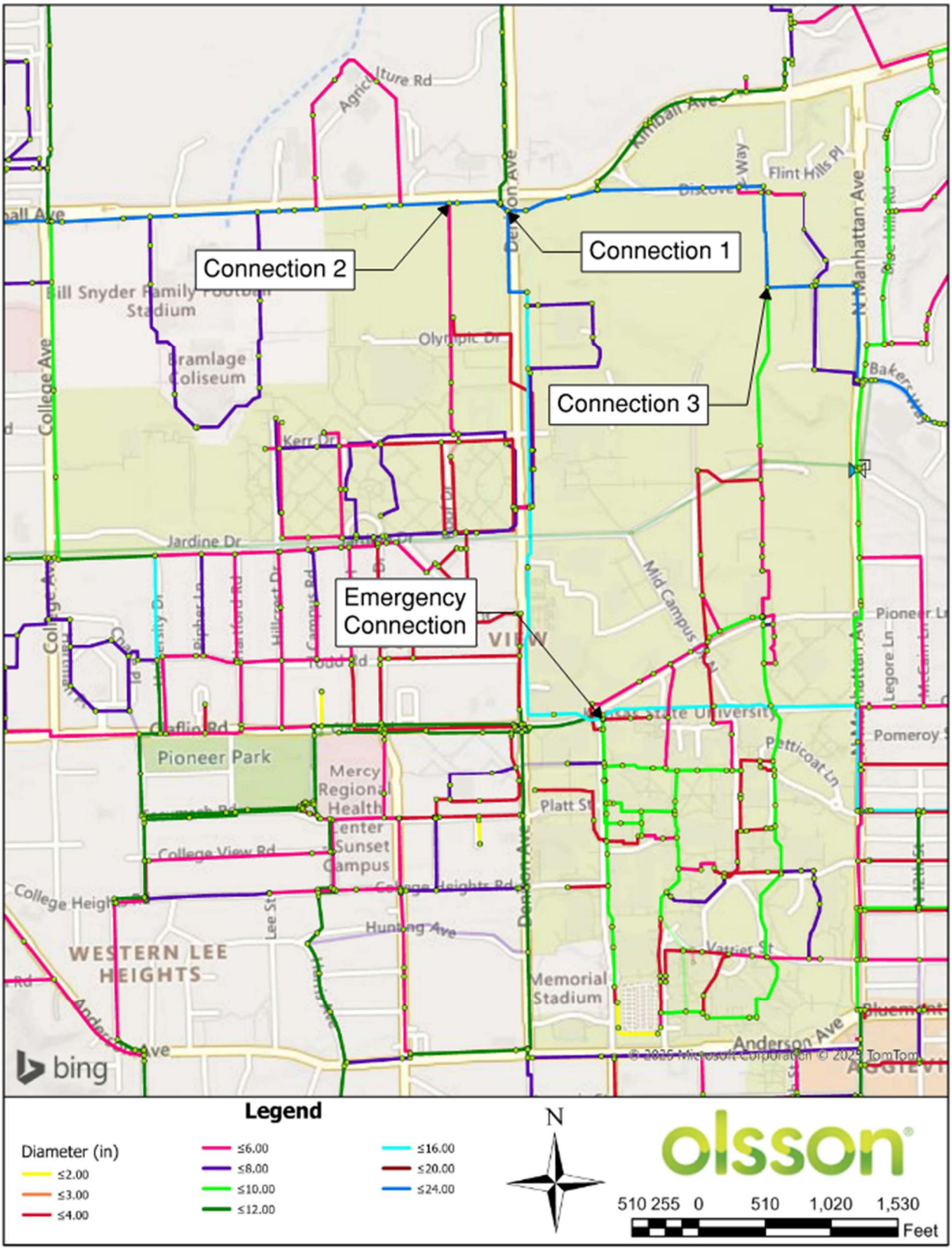

Figure 1. KSU Water Mains.

2.2 Booster Pump Station

The Central Connection at Kimball and Denison is a 24-inch main that reduces to a 16-inch and then a 10-inch main before entering a booster pump station (BPS) at the power plant. The BPS has a centrifugal pump rated for 1,500 gpm at 150-feet TDH, with its speed controlled via a variable frequency drive (VFD). Normal operation of the BPS is for the pump to operate when the suction pressure is at 75 psi or less and maintains 75 psi on the discharge side.

It is noted that after City pressure improvements since 2013, the pressure rarely falls below 75 psi, and the pump is not called to run to run. Water flows through the pump freely when it is not running. Campus operators report that typically a water main break on campus is one of the only events that would trigger the pump to turn on until the leak is isolated.

Figure 2. Power Plant BPS Nameplate.

3. DISTRIBUTION SYSTEM ANALYSIS

3.1 Water Model Development

Olsson developed a hydraulic model for the campus in WaterGEMs software by Bentley, Inc based on the existing City model. The private water system was digitized using existing system maps and previous reports as a basis, adding the campus water mains into the City's existing WaterGEMs model.

Nodes were added to the water model at each pipe junction and where hydrants were located. Elevations for the KSU campus were entered into the model using a United States Geological Survey (USGS) elevation file as a basis and further refined during calibration as described later in this report.

Water main sizes were added into the water model using maps, Riley County Geographic Information Services (GIS), and previously completed studies as a basis. Pipe lengths are automatically calculated within the model. The roughness values, referred to as C-factors, were initially input as 100 to represent aged pipe, and refined after reviewing the C-factors in the 2013 KSU master plan and updated based on current flow testing. New pipes are estimated to have a C-factor of 120.

The City's water model was last updated in 2020 as part of a master plan completed by Olsson. The City modeler has updated the model with water main changes since then. In the 2020 City master plan, demands scenario for average and peak day in 2024 were developed. The City recommended Olsson use these 2024 demand scenarios to represent a small amount of growth since the study was completed in 2020. This results in an overall City water demand of 7.2 million gallons per day (MGD) on average day and 18.0 MGD on maximum day. It is assumed the City model is calibrated for the purposes of this KSU addition.

3.2 Water Demands

3.2.1 Average Day Demands

Water demands were provided by KSU for use in the water model. Overall water usage was provided for 2019 through 2023, and daily water usage was provided for the individual campus buildings for 2023. The total average day KSU water use was 731,180 gallons per day (gpd), or 508 gpm over a 24-hour day.

Water demands are significantly lower in 2024 than in the previous study in 2013. Leaks in the chilled water system were previously leading to extremely high makeup water demands at the power plant. KSU maintenance staff has fixed these and other leaks in the system. They have

also reduced water demands at the power plant as well as the overall campus significantly in the past 11 years.

Table 2 summarizes the KSU buildings which are directly metered by the City of Manhattan and therefore are not analyzed in this report. Table 3 outlines the KSU buildings which are part of the master meters on the main campus. This table also includes average day water demands for each master meter building, which were calculated based on records provided by KSU. The total water use for buildings on the master meter is 621,303 gpd, or 431 gpm. Thus, approximately 85 percent of the total KSU water demand is on the master meter. Appendix A includes a map of buildings within the central campus and labels those on the KSU master meter and City meters.

Table 2. KSU Buildings on City Water Meters.

Building
Bill Snyder Family Stadium
Grain Science Center
Bramlage Coliseum
Brandeberry Indoor Complex
Edwards Hall
Engineering Building
Executive Court
Goodnow Hall
Hal Ross Grain Science
Hoeflin Stone House
Honors House
Ice Hall
Kramer Dining
KSU Foundation
Lafene Health

Building
Large Animal Research Center (LARC)
Library Annex
Martlatt Hall
Putnam Hall
Rowing Center
Sheep & Goat Meat Facility
Smurthwaite
Soccer Facility
Stanley Stout
UFM
Unger Complex
Van Zyle & Putnam Irrigation
Van Zyle Hall
Vanier Football Complex

Table 3. Water System Demands for Buildings on KSU Master Meter.

Building	Average Daily Demand (gpd)	Average Daily Demand (gpm)
Ackert Hall	3,636	2.52
Anderson Hall	647	0.45
Beach Museum	2,973	2.06
Berney Welcome Center	252	0.17
Bluemont Hall	60	0.04
Boyd Hall	18,511	12.85
Burt Hall	523	0.36
Bushnell Hall	73	0.05
Call Hall	4,095	2.84
Calvin Hall	1,159	0.80
Campus Creek	686	0.48
Cardwell Hall	3,475	2.41
Center for Child Development	1,012	0.70
Chalmers Hall	1,778	1.23
Chemistry/Biochemistry Building	695	0.48
Coles Hall	14,254	9.90
College of Business Administration	3,904	2.71
Danforth Chapel	710	0.49
Davenport Building	103	0.07
Derby Dining Center (includes Moore, Haymaker, and Ford Dorms)	82,693	57.43
Dickens Hall	553	0.38
Dole Hall	119	0.08
Durland Hall	1,795	1.25
Dykstra Hall	321	0.22
Eisenhower Hall	770	0.53
English & Counseling Services (ECS)	123	0.09
Equite Performance Testing Center (EPTC)	199	0.14
Fairchild Hall	452	0.31

Building	Average Daily Demand (gpd)	Average Daily Demand (gpm)
Feed Technology	111	0.08
Fielder Hall	111	0.08
Gen. Richard B. Myers Hall	102	0.07
Hale Library	3,454	2.40
Holton Hall	187	0.13
Holtz Hall	74	0.05
International Student Center	39	0.03
Jardine Apartments*	105,767	73.45
Justin Hall	1,383	0.96
Kedzie Hall	178	0.12
King Hall	385	0.27
KSU Chiller Plant (CP1)	2,297	1.6
KSU Chiller Plant (CP2)	231,592	160.83
Leadership Studies	212	0.15
Leasure Hall	637	0.44
McCain Auditorium	1,574	1.09
Mosier Hall	15,939	11.07
Nichols Hall	379	0.26
Parking Garage	66	0.05
Pat Roberts Hall	17,350	12.05
Pittman Building	144	0.1
Pittman Irrigation	326	0.23
President's House	167	0.12
Rathbone Hall	893	0.62
Rec Complex	4,100	2.85
Recycling Center	94	0.07
Seaton/Regnier	7,739	5.37
Shellenberger Hall	700	0.49
Student Union	3,380	2.35
Thompson Hall	610	0.42

Building	Average Daily Demand (gpd)	Average Daily Demand (gpm)
Throckmorton Hall	22,390	15.55
Trotter Hall	10,263	7.13
Umberger Hall	390	0.27
Ward Hall	1,688	1.17
Waters Hall	1,881	1.31
Weber Hall	33,174	23.04
West Hall	4,783	3.32
West Stadium	615	0.43
Willard Hall	530	0.37

*This demand was evenly split between 6 nodes in the Jardine Apartment area

3.2.2 Maximum Day Demands

Maximum Day Demands are defined as the maximum single-day water demand for the study period, determined by reviewing daily water demands provided by KSU. In 2023, the maximum day demand occurred on August 8, 2023 with a total demand of 2,325,115 gpd, or 1,615 gpm. This results in a maximum day peaking factor of 3.7 for the campus demands. In the model, a unit demand factor of 3.7 was input for all unit demands on the KSU master meter.

The remainder of the City demands, including campus demands on City meters, were adjusted for the maximum day alternative per the City model 2024 peak day scenario. The City Master Plan from 2021 found the maximum to average day ratio was 2.5. It is notable that this maximum day factor is lower than KSU, but that is to be expected since there are more seasonal users on the campus.

3.2.3 Diurnal Patterns

Diurnal patterns were applied to each node in the water model to simulate varying demands throughout an average day. Commercial, Residential, Residential High Irrigation, and Industrial diurnal patterns that were developed in the overall City model were utilized for this model are shown in Figure 3, Figure 4, Figure 5, and Figure 6, respectively.

Most nonresidential buildings on the campus were assigned to the Commercial pattern to represent higher daytime use and little to no use overnight when the buildings are unoccupied. Boyd Hall and West Hall, two dormitories on campus, Jardine Terrace Apartments, and the President’s House were assigned the Residential pattern to reflect highest water use in the morning and evenings. A meter specifically for irrigation at Pittman Building was assigned the Residential High Irrigation pattern, which has higher water use overnight, early morning, and in

the evening when lawns are most likely to be watered. The KSU Chiller plant was assigned an Industrial pattern which assumes constant use throughout the day.

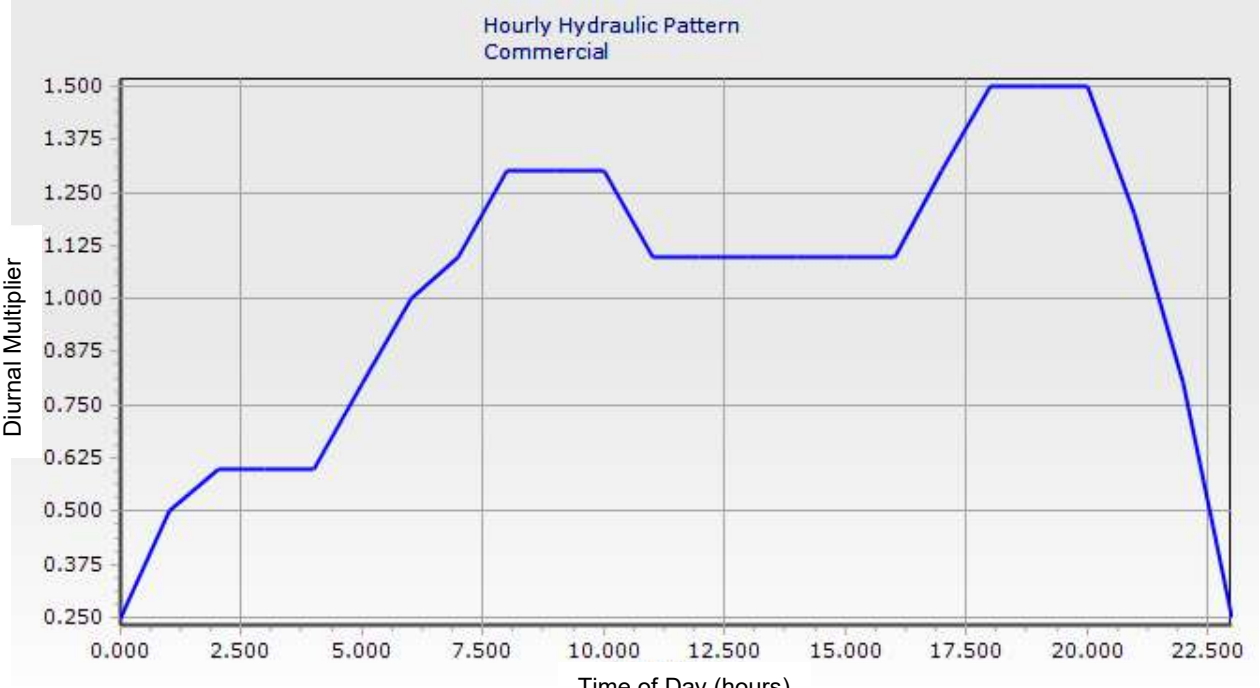

Figure 3. Commercial Diurnal Curve.

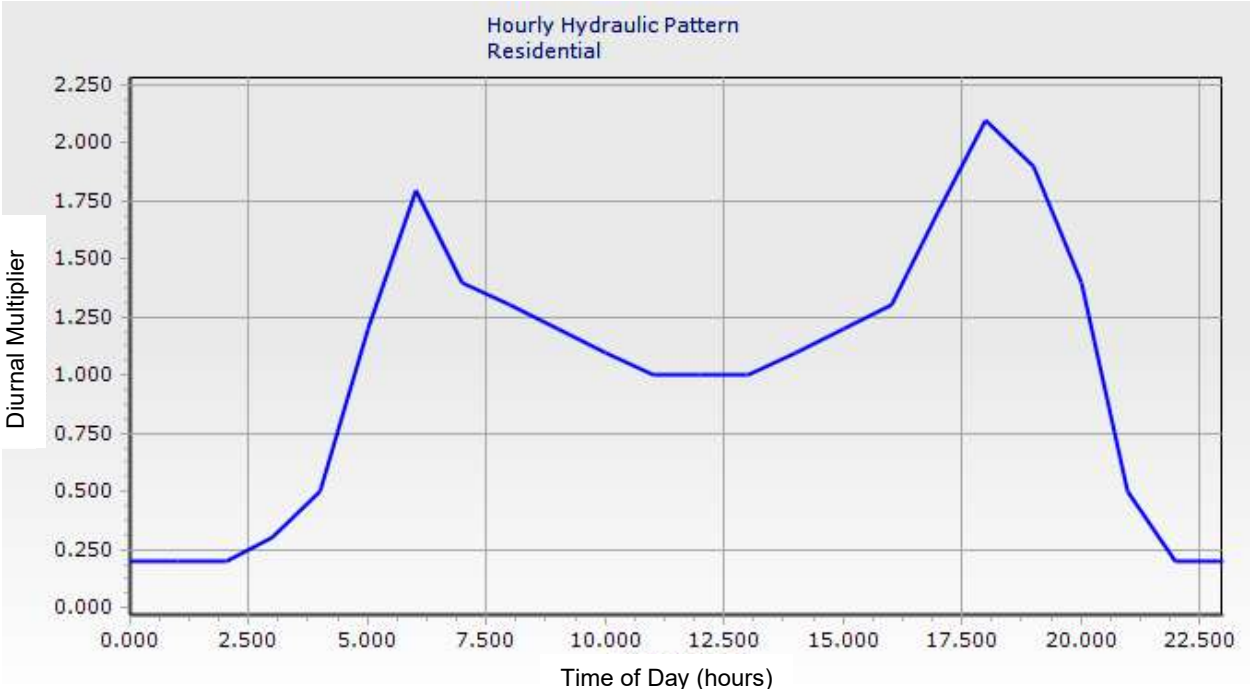

Figure 4. Residential Diurnal Curve.

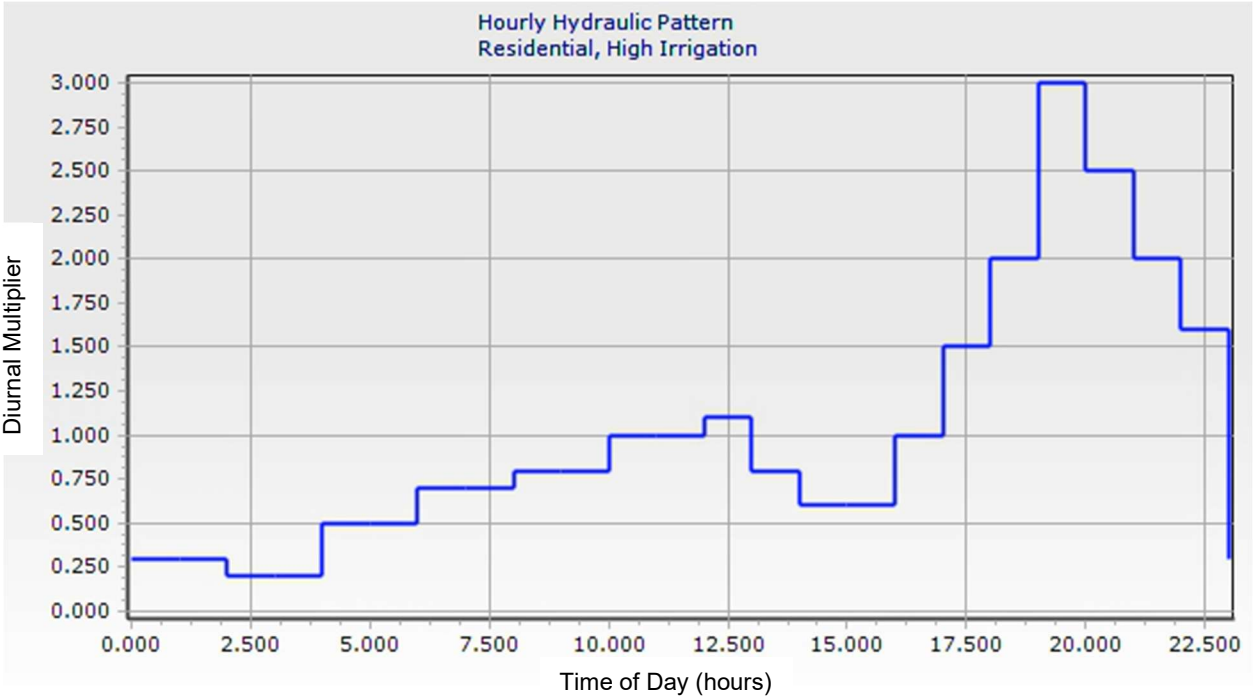

Figure 5. Residential High Irrigation Diurnal Curve.

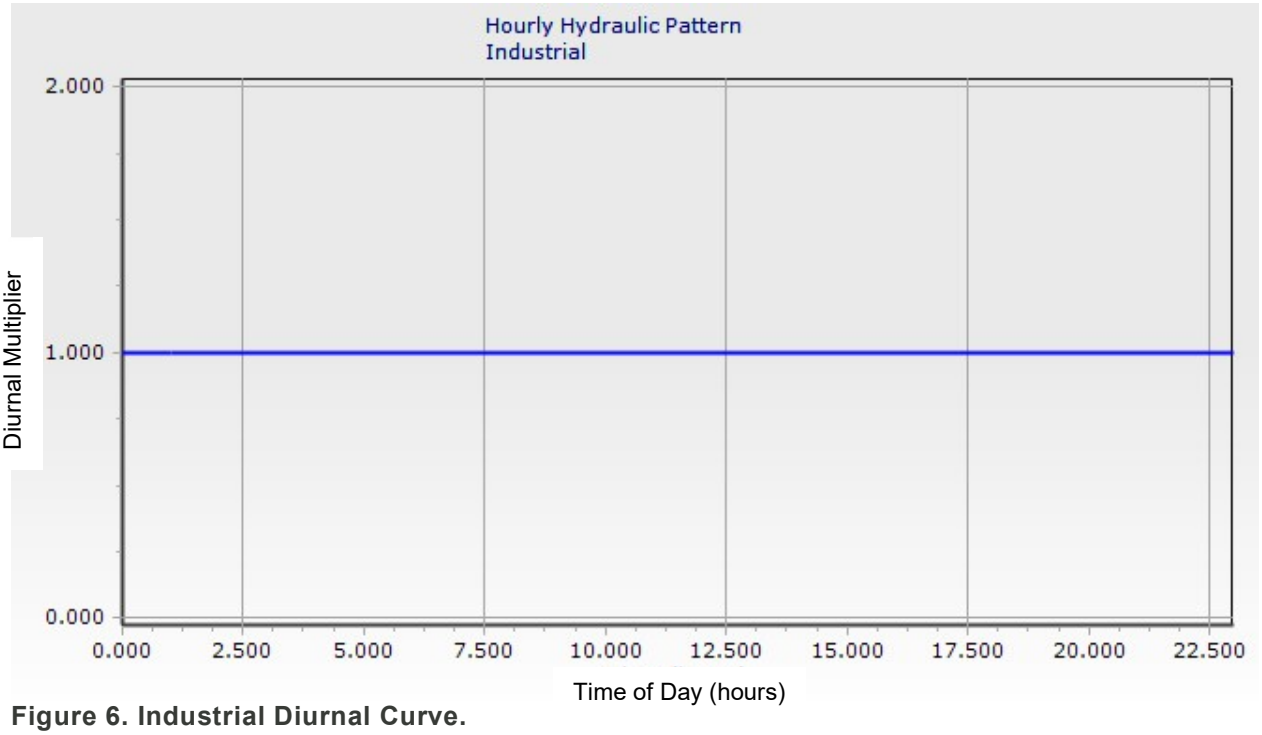

Figure 6. Industrial Diurnal Curve.

3.3 Flow Testing

Flow testing was completed throughout the campus water system on August 28, 2024. A representative sample of hydrants was identified, using the existing water system map as a basis. Flow testing consists of the following:

- Pairs of hydrants were identified throughout the KSU water system for flow testing.
- At each test location, one hydrant is identified as the “flow” hydrant, and one as the “residual” hydrant. It was attempted to sample two hydrants on the same water main line.
- A pressure gauge is installed on the fully opened residual hydrant. The static pressure at that hydrant is recorded.
- The flow hydrant is opened fully, and the pressure of the water leaving the hydrant is recorded using a pitot gauge.
- The pressure drop at the residual hydrant is recorded.

After the flow testing is complete, results are entered into a spreadsheet to document the results for use in calibrating the model. The pressure recorded from the flow hydrant (in psi) is converted to a flow rate (in gpm) using the following equation:

$$Q = 29.83 * CD^2\sqrt{P}$$

Where:
Q = Hydrant Flow (gpm)
C = Opening Coefficient (unitless), ranges from 0.7 to 0.9 depending on the shape of opening
D = Hydrant Opening Diameter (inches)
P = Pitot Tube Pressure (psi)

Maps of the flow testing locations are included in Figure 7, Figure 8, and Figure 9.

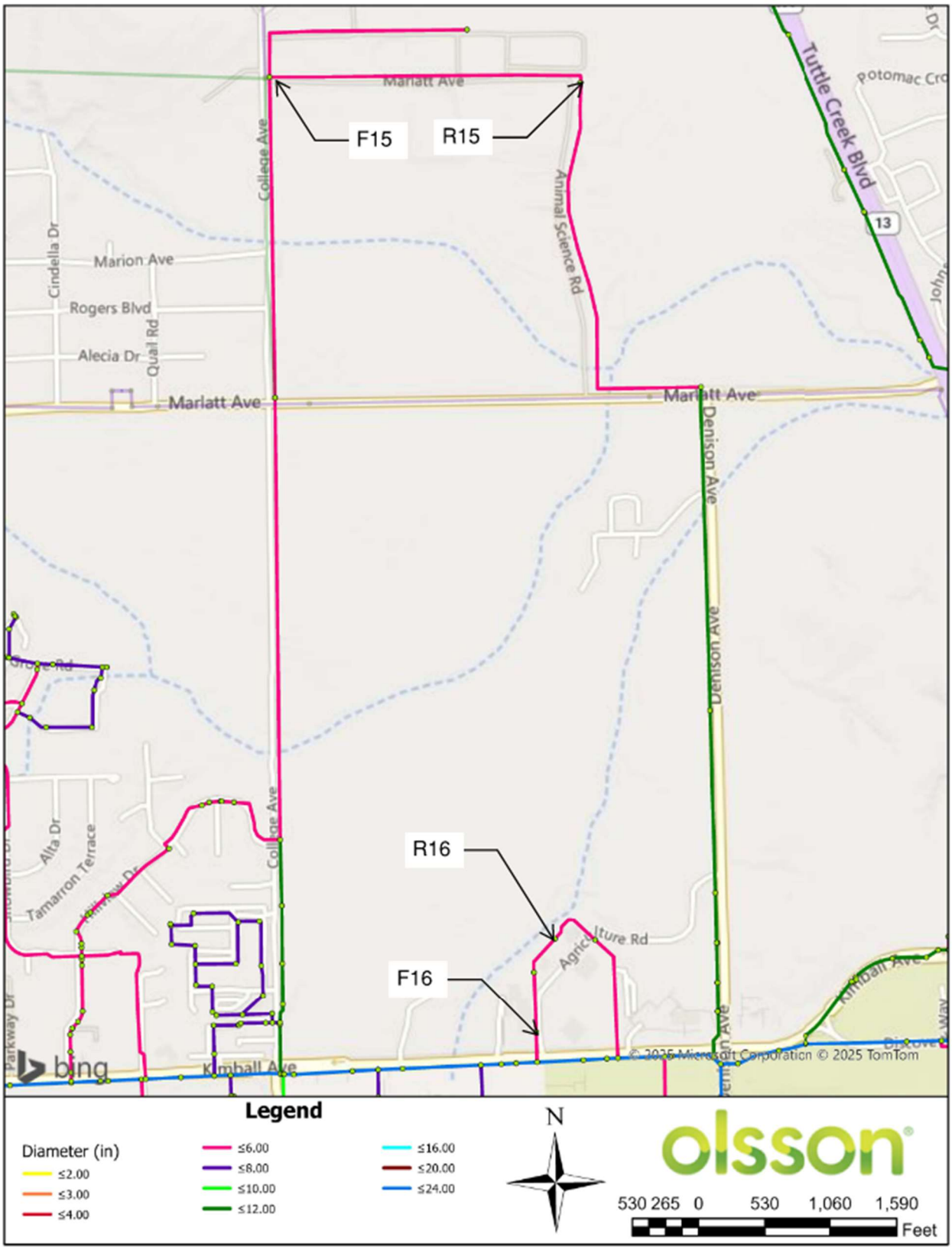

Figure 7. Flow Testing Map - North .

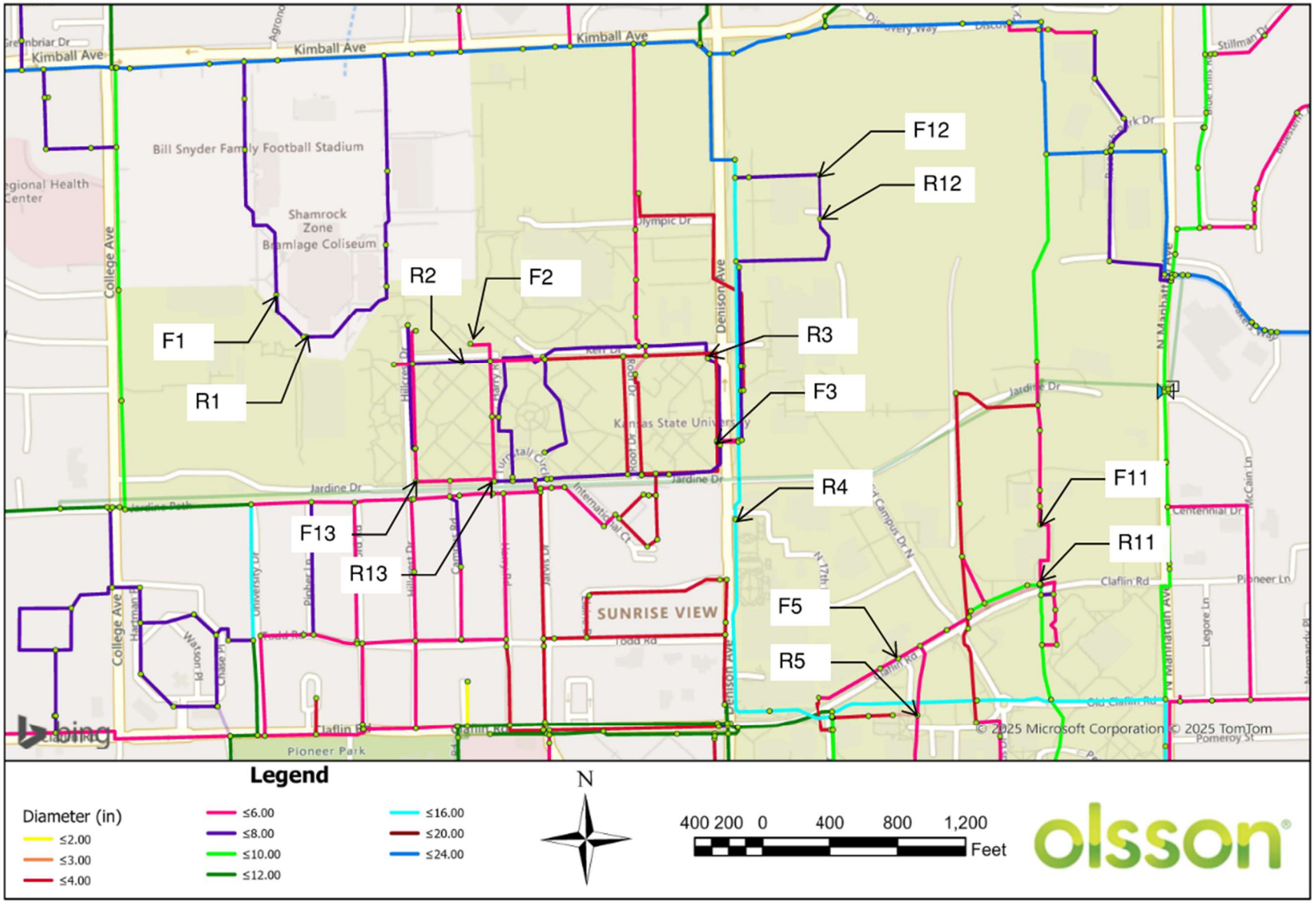

Figure 8. Flow Testing Map – Central.

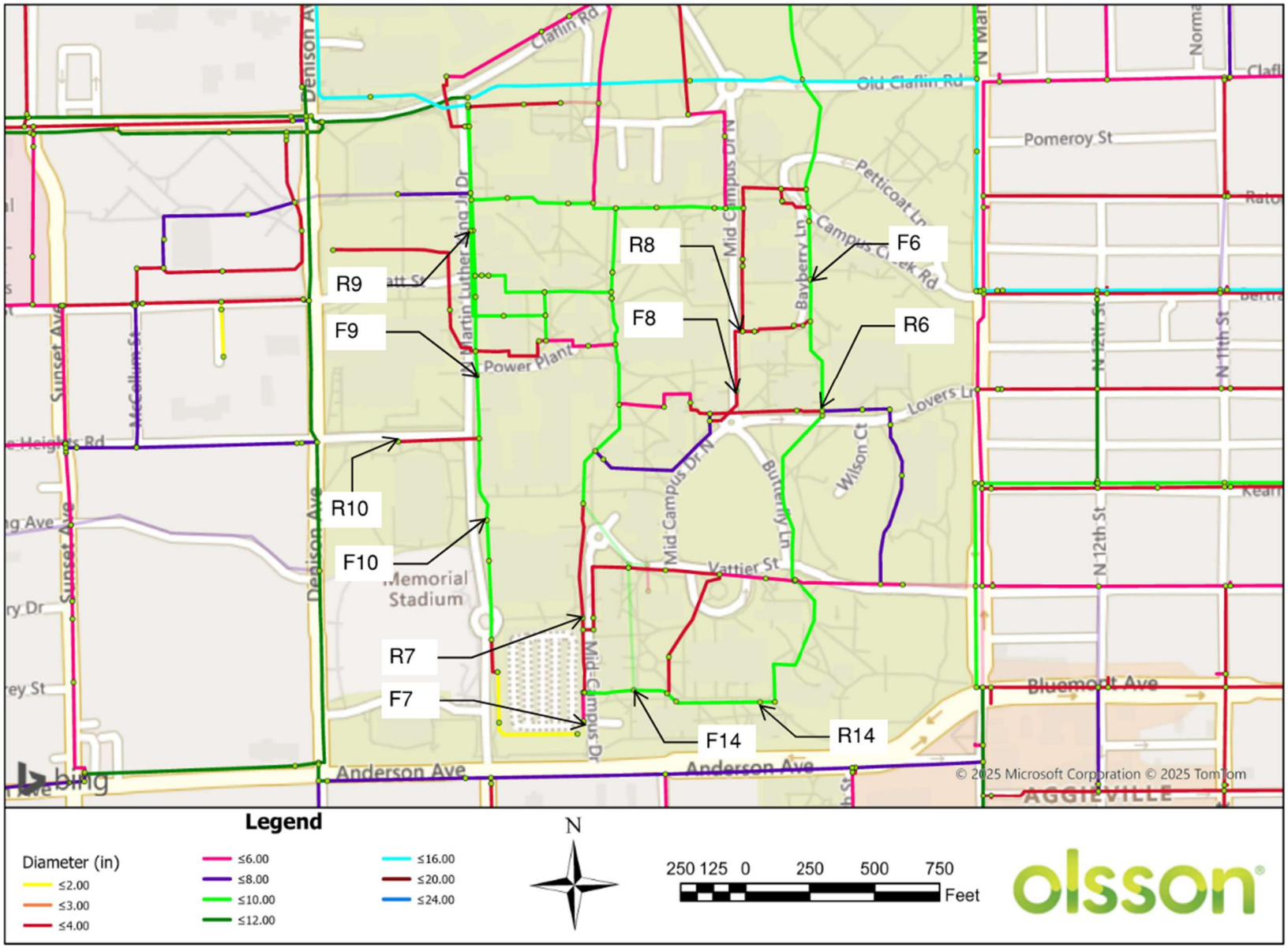

Figure 9. Flow Testing Map – South.

3.4 Model Calibration

After flow testing is completed, the information collected is used to calibrate the hydraulic model to field conditions in an Extended Period Simulation (EPS). Demands on the campus were adjusted to reflect the day of testing, August 24, 2024. A comparison of the same day in 2023 showed campus demands 1.35 times higher than average demands. Thus, demands on the campus were increased by a factor of 1.35 for the calibration.

Where the model static pressures differ from what was recorded in the field, node elevations are adjusted until the static pressures most closely replicate what was observed in the field to within 3 psi.

To calibrate to flow conditions, the calculated flow from each flow hydrant is input into its corresponding node in the model, and the residual pressure in the model is observed. To calibrate the model to field conditions, the roughness/C-values in the nearby water mains are adjusted up and down until the model results match the field results within 7 psi.

The pressure drop, or the change between static and residual pressures, can also be calculated. The field and model pressure drops can be compared as another basis of calibration. The model calibration results are displayed in Table 4.

Water levels in the City‘s Bluemont Tower, which primarily affects the KSU pressures, were provided at the time of calibration. Levels in the tower at the time of flow testing ranged from 57 to 59 feet. In the City model at the time of calibration, tower levels were closer to 61 to 67 feet. This level difference results in an approximate pressure difference of 2 psi. It is outside the scope to modify the settings in the model outside of the KSU water system, but it is expected that model pressures may be up to 2 or 3 psi higher than field pressures due to this discrepancy.

During flow testing, it was noted that the 6-inch water main on Claflin Road south of Boyd Hall was closed. This condition was reflected in the model during calibration. This line was being replaced with a new 10-inch main and a connection to the 4-inch main just east of Weber Hall. Following calibration, the model was updated with this improvement and subsequently used in later analyses within this report.

Tests 2, 6, 9, 11, and 14 were not able to be calibrated within 3 psi for the static pressure after adjusting node elevations. However, it is noted that they are all showing higher model pressures than observed in the field, which may be attributed to the Bluemont tower level difference. Test 11 specifically showed 12 psi higher pressure in the model than in the field. However, this test was performed directly adjacent to the water main construction on Claflin Road near Weber Hall. It is possible that the closure in this area was contributing to this discrepancy.

Approximately half of the residual pressures were unable to be calibrated within 7 psi, even after many changes to roughness values and confirming pipe connectivity. However, it is noted that after accounting for a potential difference of 2 or 3 psi due to the Bluemont Tower levels, only five tests were unable to be calibrated to within 7 psi. This includes Tests 6, 9, 11, 14, and 15. It is notable that Tests 6, 9, 11, and 14 did not calibrate to static pressures after adjusting for tower level either. Both Tests 6 and 11 did have a change in pressure drop within 5 psi when comparing the field and model pressures. This shows that the drop from static to residual pressures is reflected correctly, and something may just be off with the initial static pressure. Test 15 is in the northern-most agricultural area of campus, isolated from the central campus with City water mains. It was noted by the system operator during flow testing that there will be major construction around this area, and this water main would be redone eventually. For this reason, no additional effort was made to calibrate this flow test.

The flow test for Test 4 was thrown out because the flow hydrant northeast of the Davenport Building had very low flow and opening it in the field had no effect on the residual hydrant.

Table 4. Model Calibration Results.

Test #	a. Static Location b. Flow Location	Actual Static Pressure (psi)	Model Static Pres-sure (psi)	Static Diff. (psi)	Actual Residual Pressure (psi)	Model Residual Pressure (psi)	Residual Diff. (psi)	Field Pres-sure Drop (psi)	Model Pressure Drop (psi)	Change in Pressure Drop (psi)	Actual Pitot Tube Flow (gpm)
1	a. South of Bramlage Coliseum b. Southeast of Bramlage Coliseum	86.5	87.95	1.45	70.1	71.89	1.79	16.40	16.06	-0.34	1,300
2	a. Parking Lot C9, Kerr Dr b. Parking Lot C12, Kerr Dr	83.1	87.94	4.84	43	45.34	2.34	40.10	42.60	2.50	1,060
3	a. Corner of Kerr Dr. and Denison Ave. b. Denison Ave west of Jardine Building 1	102.1	102.47	0.37	72.2	77.51	5.31	29.90	24.96	-4.94	1,405
4	a. Denison Ave east of Davenport Building b. Northeast of Davenport Building	104.7	104.94	0.24	-	-	-	-	-	-	-
5	a. Northwest of Waters Hall b. On Claflin Rd south of Umberger Hall	96	97.55	1.55	68	75.12	7.12	28.00	22.43	-5.57	500
6	a. Lovers Ln, southwest of Bluemont Hall b. West of Chem/Biochem Building	103	108.96	5.96	53	63.42	10.42	50.00	45.54	-4.46	1,130
7	a. Mid-Campus Dr, east of Kedzie Hall b. Mid-Campus Dr, southeast of Parking Structure	105	104.09	-0.91	51	58.63	7.63	54.00	45.46	-8.54	1,200
8	a. Northwest of Dickens Hall off Mid-Campus Dr b. Mid-Campus Dr, east of Holton Hall	103	104.46	1.46	50	48.19	-1.81	53.00	56.27	3.27	1,130

Test #	a. Static Location b. Flow Location	Actual Static Pressure (psi)	Model Static Pres-sure (psi)	Static Diff. (psi)	Actual Residual Pressure (psi)	Model Residual Pressure (psi)	Residual Diff. (psi)	Field Pres-sure Drop (psi)	Model Pressure Drop (psi)	Change in Pressure Drop (psi)	Actual Pitot Tube Flow (gpm)
9	a. MLK Jr Dr, west of Ward Hall b. MLK Jr Dr, northwest of Seaton Hall	90.5	95.31	4.81	53.9	67.5	13.60	36.60	27.81	-8.79	1,190
10	a. College Heights Rd. North of the Ahearn Field House b. MLK Jr Dr, west of Ahearn Field House	95.2	97.48	2.28	65.1	61.87	-3.23	30.10	35.61	5.51	1,200
11	a. Claflin Rd. Southeast of Weber Hall b. South of Chiller Plant 2	89.1	101.60	12.50	73	83.74	10.74	16.10	17.86	1.76	650
12	a. Southeast corner of Pat Roberts Hall b. Northeast corner of Pat Roberts Hall	96.7	98.13	1.43	84.9	84.76	-0.14	11.80	13.37	1.57	1,400
13	a. On Jardine Dr. south of circle drive form Frith Community Center b. Corner of Jardine Dr & Hillcrest Dr	88.1	88.38	0.28	52	50.5	-1.50	36.10	37.88	1.78	1,000
14	a. North of Thompson Hall b. North of Nichols Hall	99.5	103.44	3.94	60.1	48.98	-11.12	39.40	54.46	15.06	1,190
15	a. Northeast of LARC Building b. On College Ave, directly west of LARC area	89.8	91.59	1.79	41.1	69.24	28.14	48.70	22.35	-26.35	650
16	a. Agriculture Rd Southeast of Hal Ross Flour Mill b. Agriculture Rd, east of AGRN	97.4	98.50	1.10	80.1	82.85	2.75	17.30	15.65	-1.65	1,405

4. SYSTEM DEFICIENCIES AND RECOMMENDATIONS

The calibrated hydraulic model is now used to identify potential deficiencies in the water distribution system. Where potential deficiencies are identified, the model is used to identify projects to address them. Budget cost estimates were developed for each of the proposed projects in a later section.

4.1 KSU Master Meter Demands

Overall, the model showed a total demand of 622,619 gpd (432 gpm) on nodes within the campus master meter under average day demand (ADD) conditions. This is very close to the average demands outlined in Section 3.2.1, and the variance can be attributed to rounding differences. The ADD distributed throughout the day is shown in Figure 10. The peak hour demand (PHD) of 611 gpm occurs at the 18th timestep, or 6:00 PM. This results in a peak hour factor of 1.41.

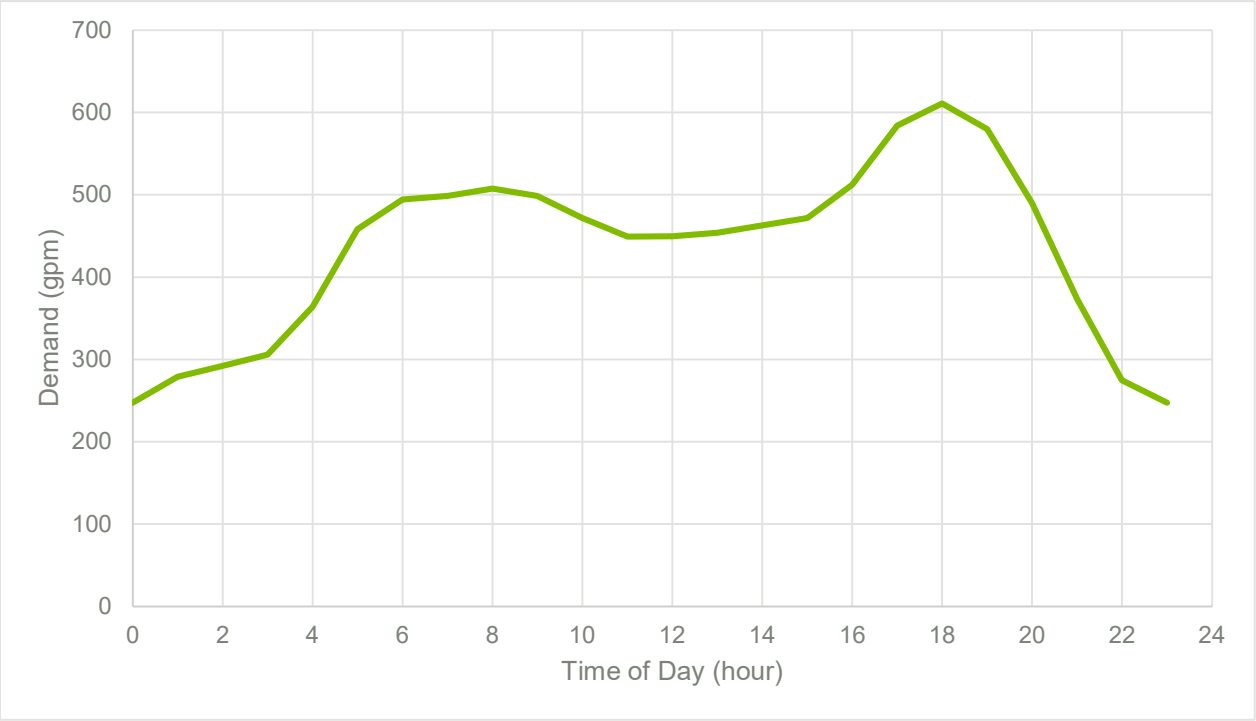

Figure 10. ADD Demand Curve.

During maximum day demand (MDD), the model shows a total demand of 2,422,080 gpd, or an average of 1,682 gpm on the central campus master meter. The demand distributed throughout the maximum day is shown in Figure 11. The demand distribution is the same as ADD, but the PHD at 6:00 PM is now 2,263 gpm. This still results in a peak hour factor of 1.41.

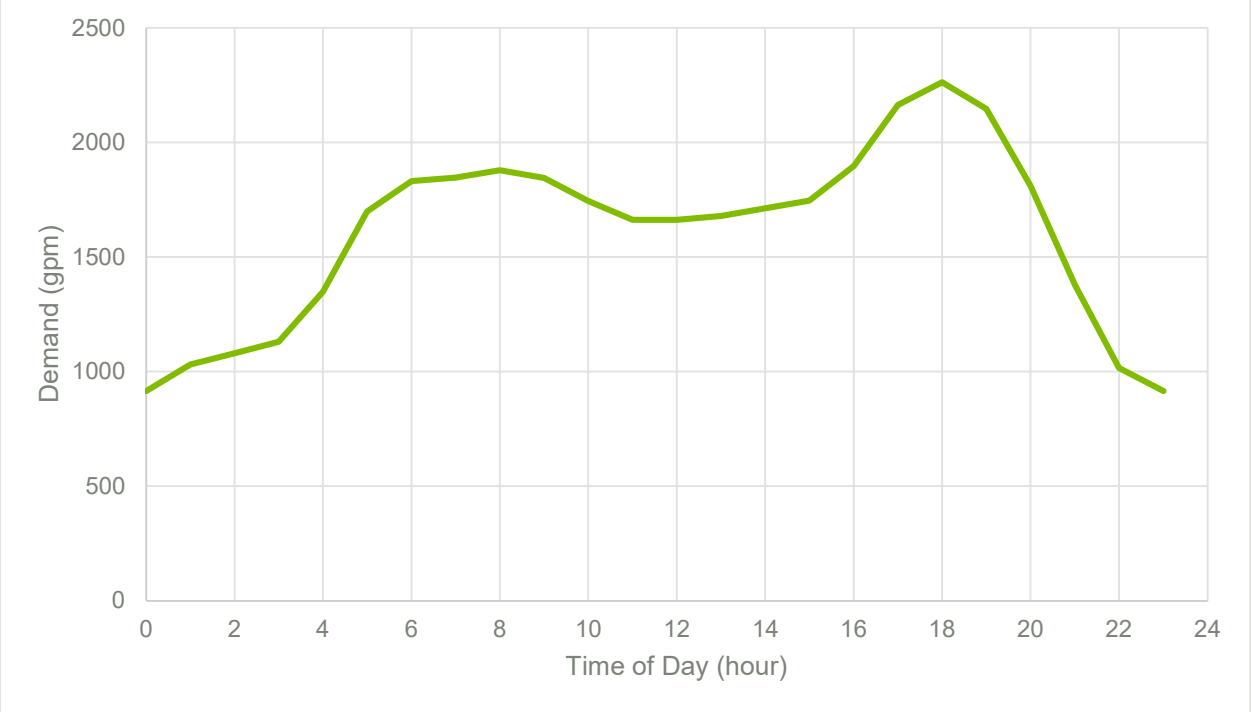

Figure 11. MDD Demand Curve

The peak hour factor for the City overall was found to be 3.06 in the 2003 Manhattan Master Plan. It is reasonable to expect that the campus would experience more consistent demands throughout a typical day compared to the overall Manhattan water system, due to the varied daily schedules of students and the diverse range of activities taking place during class sessions.

4.2 Water Model Results-Available Pressures

Ten States Standards indicate that “The minimum working pressure in the distribution system should be 35 psi, and the normal working pressure should be approximately 60 to 80 psi” (Ten States Standards, 2012). Per the Kansas Department of Health and Environment (KDHE), pressures are not allowed to fall below 20 psi anywhere in the system for any flow condition.

Minimum and maximum pressures can be evaluated on ADD to determine the normal pressure range of the system. Pressures within the KSU water system range from 64 to 126 psi throughout the average day, falling within or above the acceptable range recommended by Ten States Standards. It is noted that the lowest pressures are around Kramer Dining Center and its three associated dormitories, which are all on City water to the west of the central campus and served from the City’s Low pressure zone. The remainder of campus is served from the High pressure zone.

Pressures on the central campus master meter specifically range from 83 to 126 psi throughout an average day, with pressures lowest around the Jardine Apartments and the central west area from Burt Hall to Seaton Hall. Pressures are highest in the south and east of the master meter.

The minimum system pressures during ADD from the calibrated WaterGEMs model are included in Figure 12, and the maximum pressures during ADD are shown in Figure 13. Note that although pressures are shown for City mains outside of the KSU area, these areas were not calibrated or validated in this project.

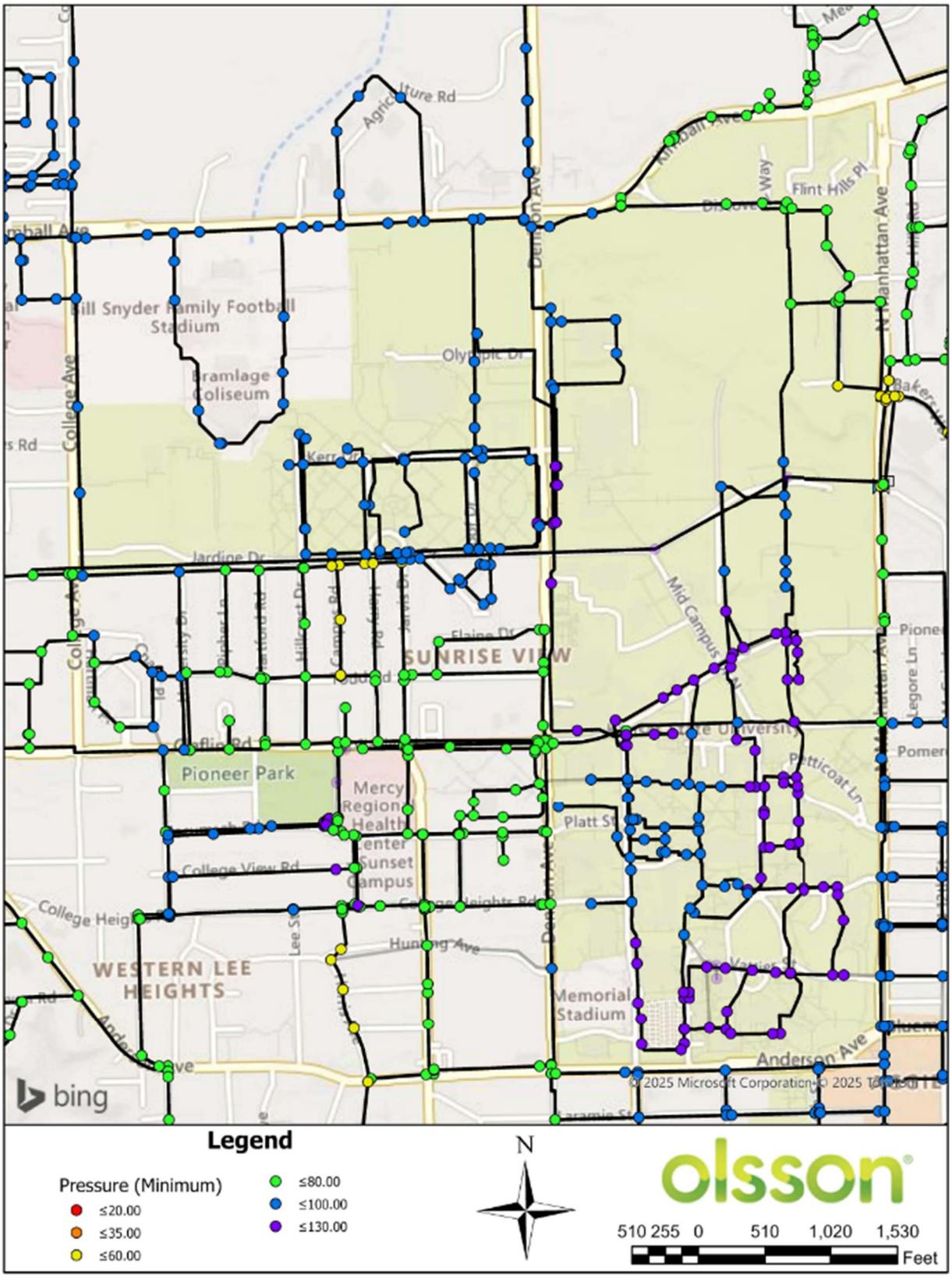

Figure 12. Minimum Pressures Under ADD.

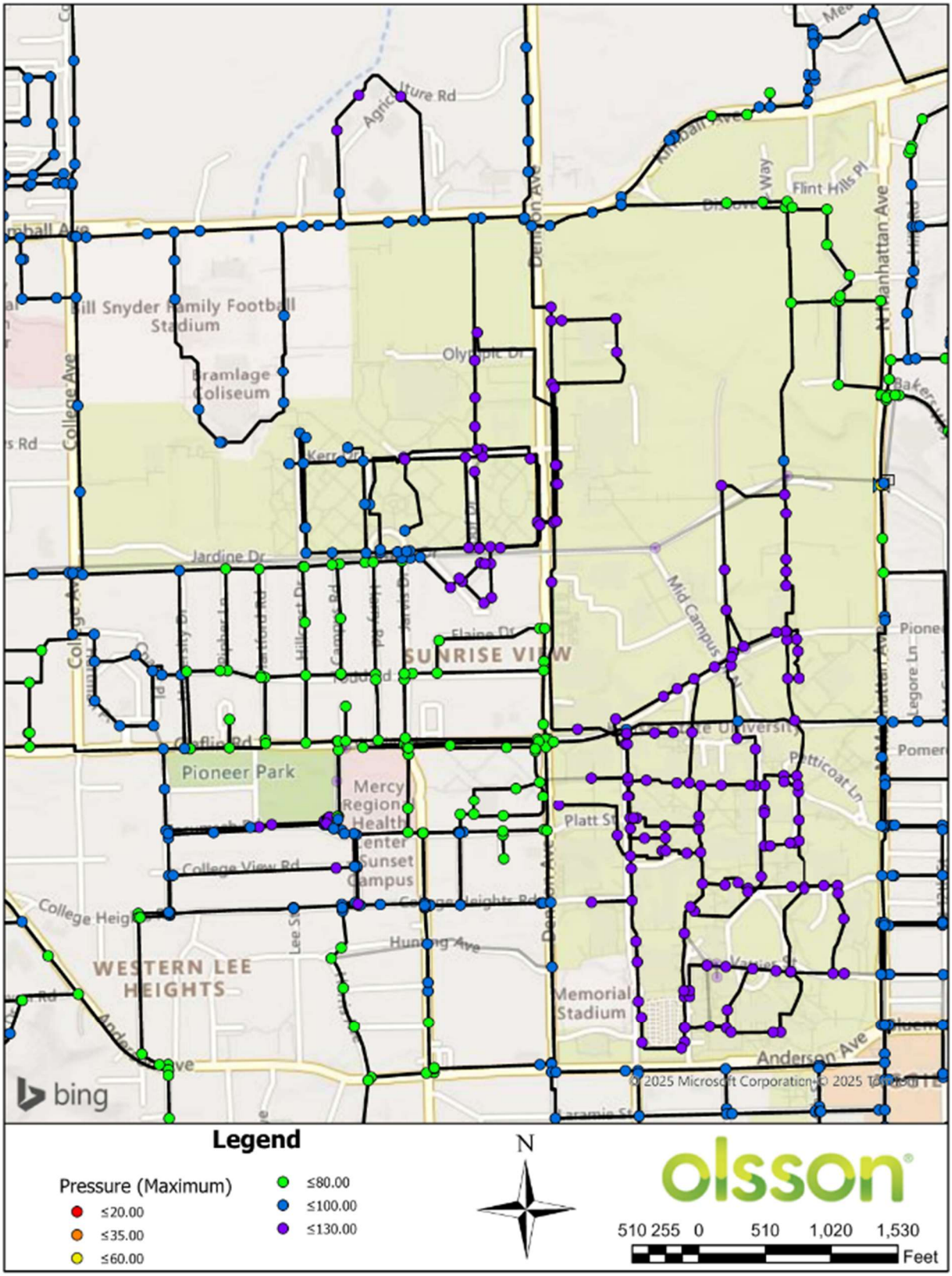

Figure 13. Maximum Pressures Under ADD.

MDD is helpful to show the minimum pressures in the system that could occur in a worst-case scenario, when campus demands are at their highest. For MDD, minimum pressures range from 48 to 100 psi throughout the day, as shown in Figure 14. The only areas with pressures lower than 60 psi include the area near Kramer Dining Center and its three associated dormitories, and this area is served and metered directly by City water. Although this is lower than the ideal 60 to 80 psi range, it is still higher than the minimum 45 psi working pressure.

On the master meter, pressures range from 65 to 100 psi, which is acceptable per Ten States Standards. Pressures are lowest on the west end of the Jardine Apartments and near KSU Chiller Plant 2. Pressures are highest in the southeast.

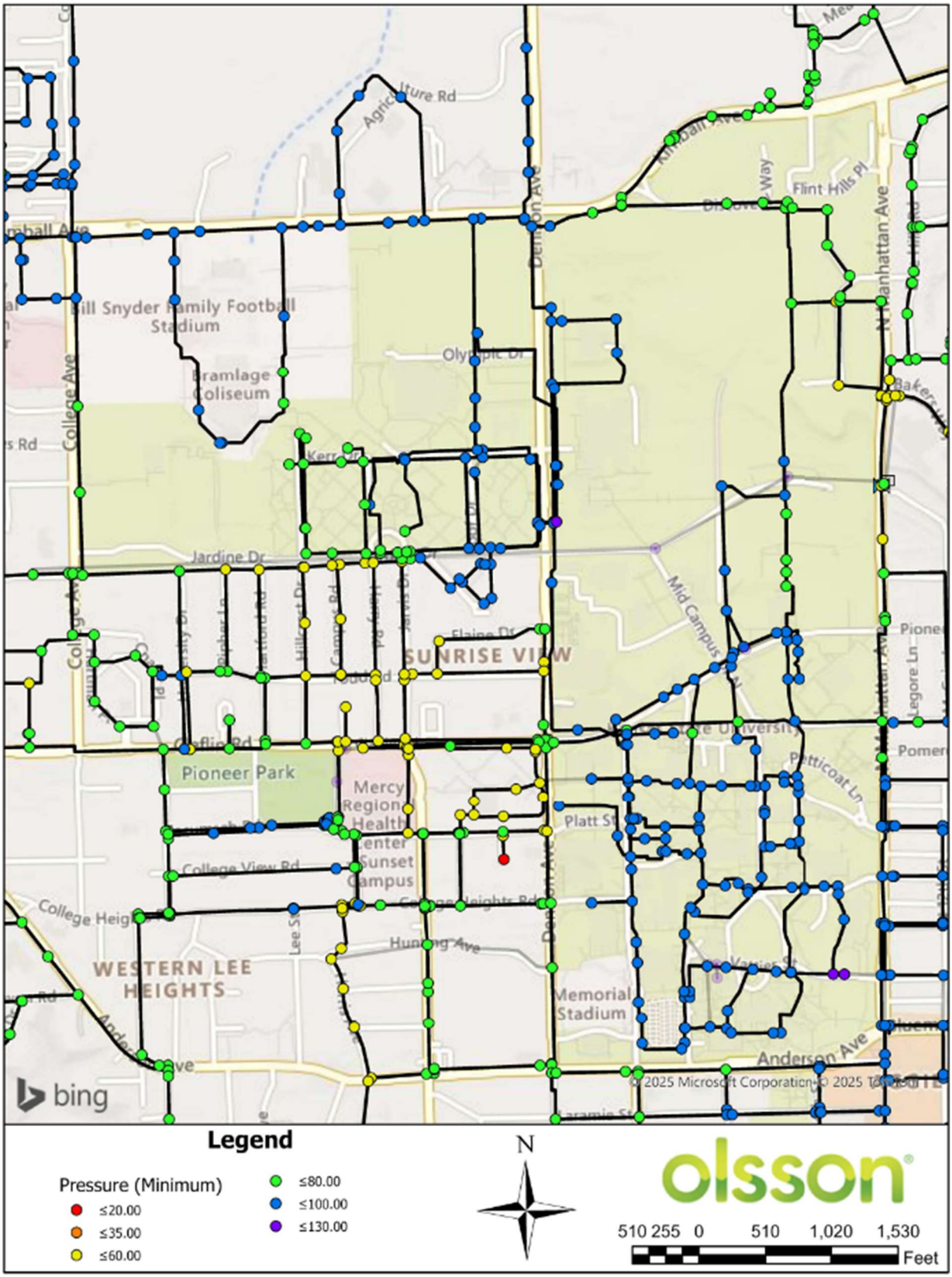

Figure 14. Minimum Pressures Under MDD.

4.3 Water Model Results-Available Fire Flow

In addition to providing domestic water to the campus, the KSU water system provides fire protection. Available fire flow of the water system is defined as the amount of capacity (in gpm) that a hydrant can provide while maintaining a residual pressure of 20 psi.

The fire flow required in a distribution system varies, based upon the building construction material, building square footage, and proximity to other buildings and determining the individual fire flow demands at each building is outside the scope of this report. The 2021 City water master plan recommended that the water system provide a minimum of 1,500 gpm for residential and commercial properties, which would include the KSU campus. Velocities over 10 fps can lead to potential issues with high head loss or surges causing water hammer in a water main.

The calibrated hydraulic model was used to determine the available fire flow throughout the campus. This is accomplished within WaterGEMs by computing a scenario with the Fire Flow Solver option. This computation was run on the 222 nodes within the KSU water system in the model. This scenario was run on the maximum day with a diurnal multiplier of 1, per industry standard recommendation.

The nodes that can provide less than 500 gpm fire flow will be the most critical nodes to implement improvements. The nodes that can provide between 500 and 1,000 gpm fire flow will also be a focus point for campus flow improvements. The nodes that can provide between 1,000 and 1,500 gpm fire flow are slightly lower than the desired 1,500 gpm, but many of the campus buildings likely have sprinkler systems that could assist in the case of a fire, and are not as critical. The nodes that can provide 1,500 gpm or higher meet the 2021 City water master plan recommendation.

4.3.1 Fire Flow Analysis

The calibrated hydraulic model was used to determine the available fire flow throughout the campus. This is accomplished within WaterGEMs by running a scenario with the Fire Flow Solver command, which gradually increases demands at each node in the system until the pressure drops to 20 psi. The demand that corresponds to a residual pressure of 20 psi is the available fire flow at that node. This computation was run on the 222 nodes within the KSU water system in the model. This scenario was run on the maximum day with a diurnal multiplier of 1, per industry standard recommendation.

Table 5 outlines the percentage of nodes able to meet set fire flow ranges. As indicated in the table, less than half of the overall system is unable to provide 1,500 gpm of fire flow. All of the locations that provide less than 500 gpm of available fire flow and many of the mains that provide under 1,000 gpm are where 4-inch or smaller diameter mains are currently in place. The fire flow availability is shown in Figure 15.

Table 5. Fire Flow Capacity without Velocity Constraints

Fire Flow Capability (gpm)	Percent of Nodes
Less than 500	9%
500 – 1,000	13%
1,000 – 1,500	39%
1,500 or higher	39%

Out of the KSU areas on City water meters, the only one with issues, including fire flow below 500 gpm, is the area near Kramer Dining Hall with the three associated dormitories. Both connections to City piping, on the north to Claflin Road and on the south to Platt Street, are 4-inch mains, which is likely causing a significant bottleneck in bringing large flow volumes to this area.

On the master meter, areas with the most nodes unable to provide 1,000 gpm fire flow include many nodes along Mid-Campus Dr and a few parts of the Jardine Apartment area. While the southeast portion of campus had some of the highest pressures during ADD, the fire flow simulation shows that there are issues in pipe size and/or lack of looping that makes it difficult for this area to maintain large flow volumes at acceptable pressures along Mid-Campus Dr in the south. Figure 15 highlights 4-inch water mains to show the relationship between fire flow deficiency and smaller mains.

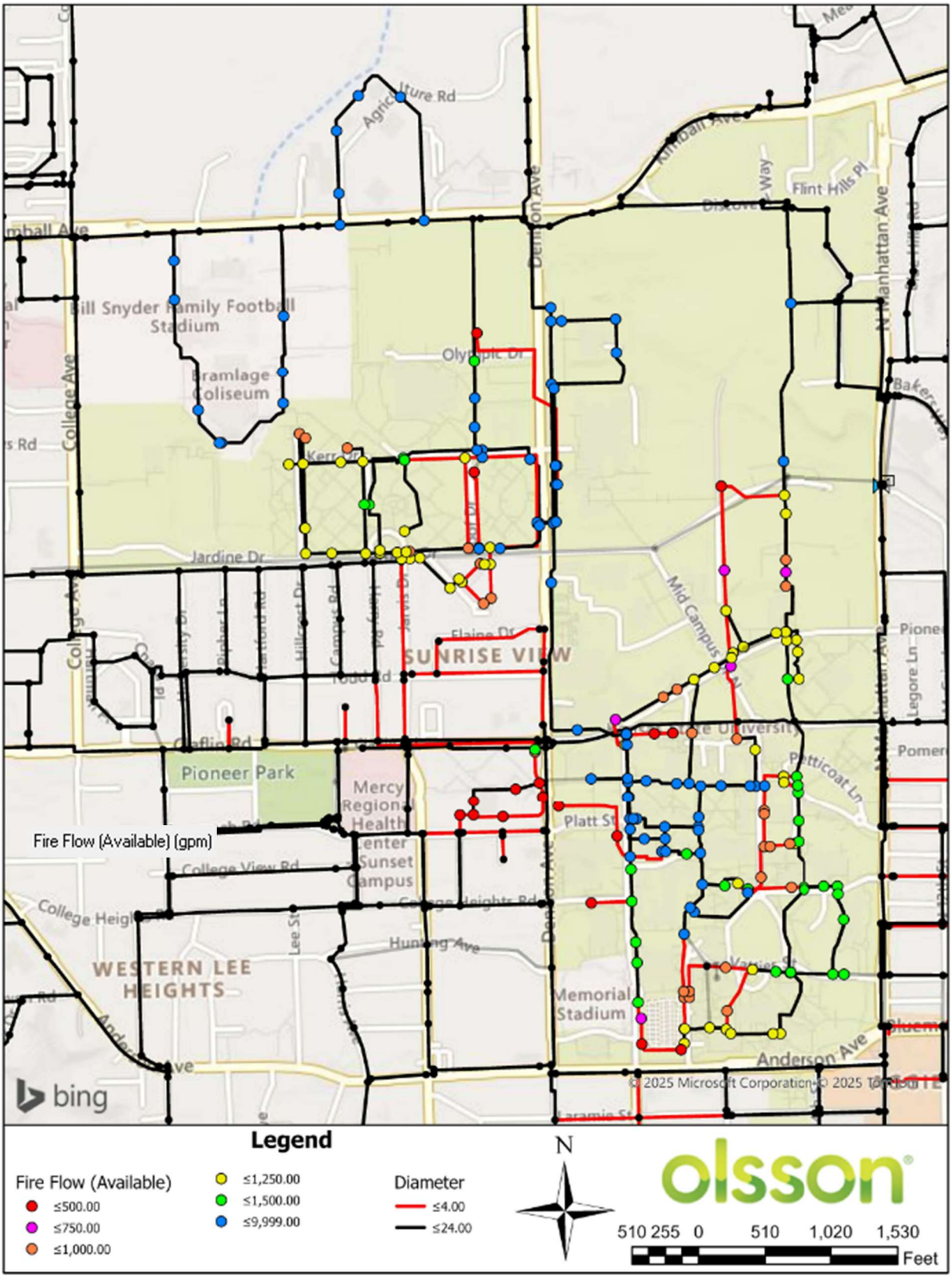

Figure 15. Available System Fire Flow.

4.4 Water Model Results – Velocity

4.4.1 MDD Velocity

In general, velocities are recommended to be no more than 7 fps under normal conditions, and never above 10 fps per Ten States Standards. Velocities over 10 fps can lead to potential issues with high head loss or surges causing water hammer in a water main.

Figure 16 shows the maximum pipe velocity under MDD conditions. Most maximum pipe velocities are less than 2 fps. Several mains are between 2 to 5 fps, mainly near the northeast entry point moving south and some other 4-inch mains around campus. The area that had a velocity between 5 and 7 fps is the 6-inch main going south from the northeast entry point. Although none of these velocities are above unacceptable levels, these high velocity lines can be indicators of potential areas that may cause issues if more flow is demanded or in a fire flow scenario.

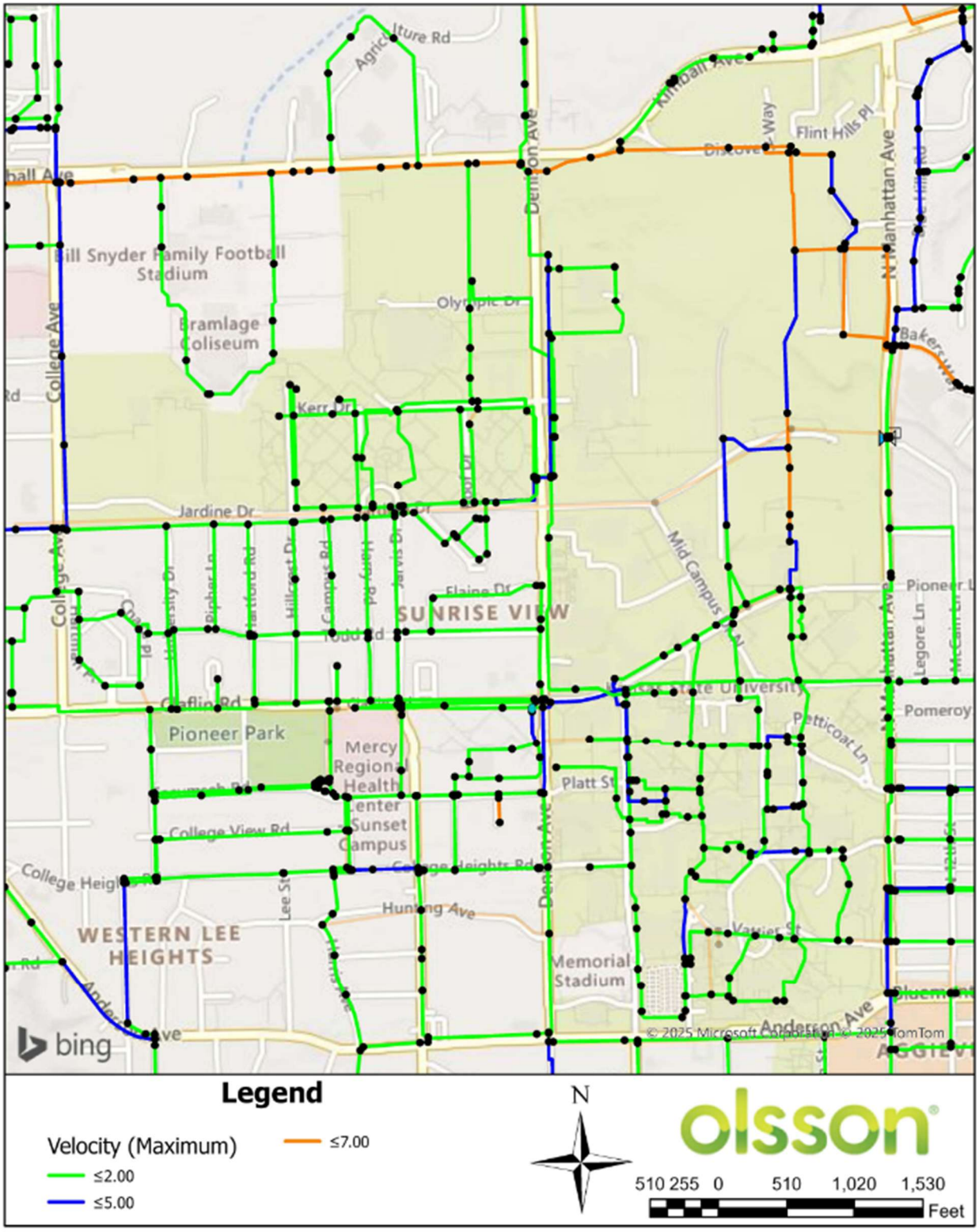

Figure 16. Maximum Velocity at MDD.

4.4.2 Fire Flow Velocity

Although velocity was not a limiting factor for the fire flow scenario, it is noted that many mains have velocities exceeding 10 fps while providing fire flow. There were 58 out of 138 fire flow tests where the velocity exceeded 10 fps. Out of these instances, several mains had two or three occurrences of being the limiting velocity for multiple fire flow tests. Out of the eight mains which had more than one instance of high velocity, they are primarily 4-inch mains located either in the southwest of the Jardine Apartment loop or on Mid-Campus Dr where there is a high concentration of 4-inch mains. Both of these areas were also indicated to have lower available fire flows. Recommendations to upsize mains to better convey fire flows in this area will be outlined in the Potential Alternatives section.

Although not exceeding 10 fps, the 6-inch portion of main fed from the 10-inch northeast entry point to the campus had numerous occurrences of velocity approaching 10 fps during fire flow scenarios. This main creates a bottleneck since the flow enters a 10-inch main and eventually splits to 4- and 6-inch branches. The campus operator noted that this area is a bottleneck that the campus has observed during typical system operation. There will be a recommendation in the Potential Alternatives section to address upsizing this 6-inch portion of pipe.

4.5 Hydrant Spacing

Adequate fire hydrant spacing is important to ensure that any location within the protected area can be reached by one of more hydrants with sufficient flow during a fire flow emergency. Generally, hydrants should be spaced no more than 350 to 600 feet apart per Ten States Standards. For the purposes of this report, and to match the previous KSU master plan, buffers of 400 feet were drawn around each hydrant, as shown in Figure 17. Additional hydrants are recommended in any area not covered within a buffer. As shown in Figure 18, there are six spots where new hydrants are recommended.

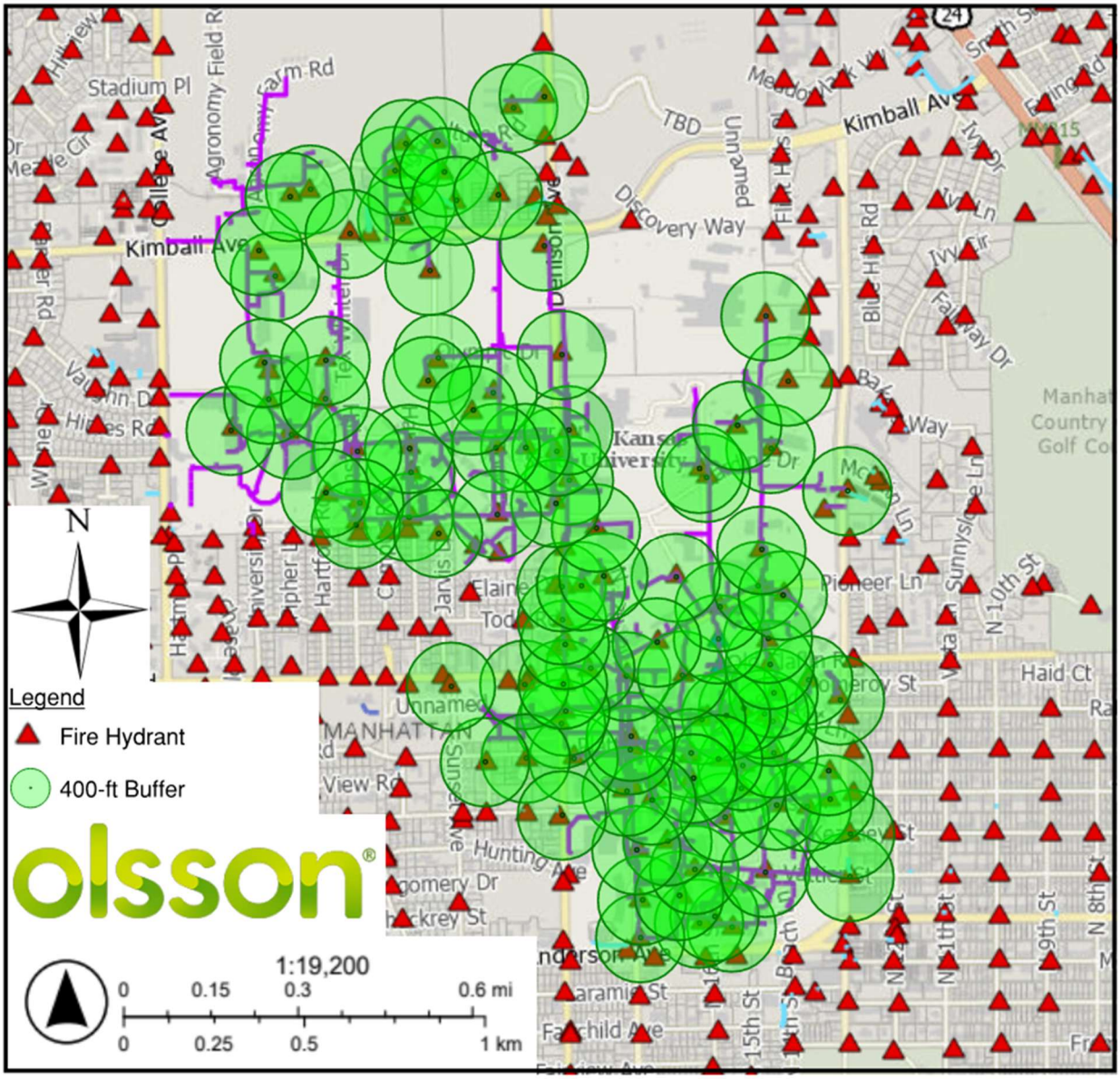

Figure 17. Hydrant Map with 400-ft Buffers.

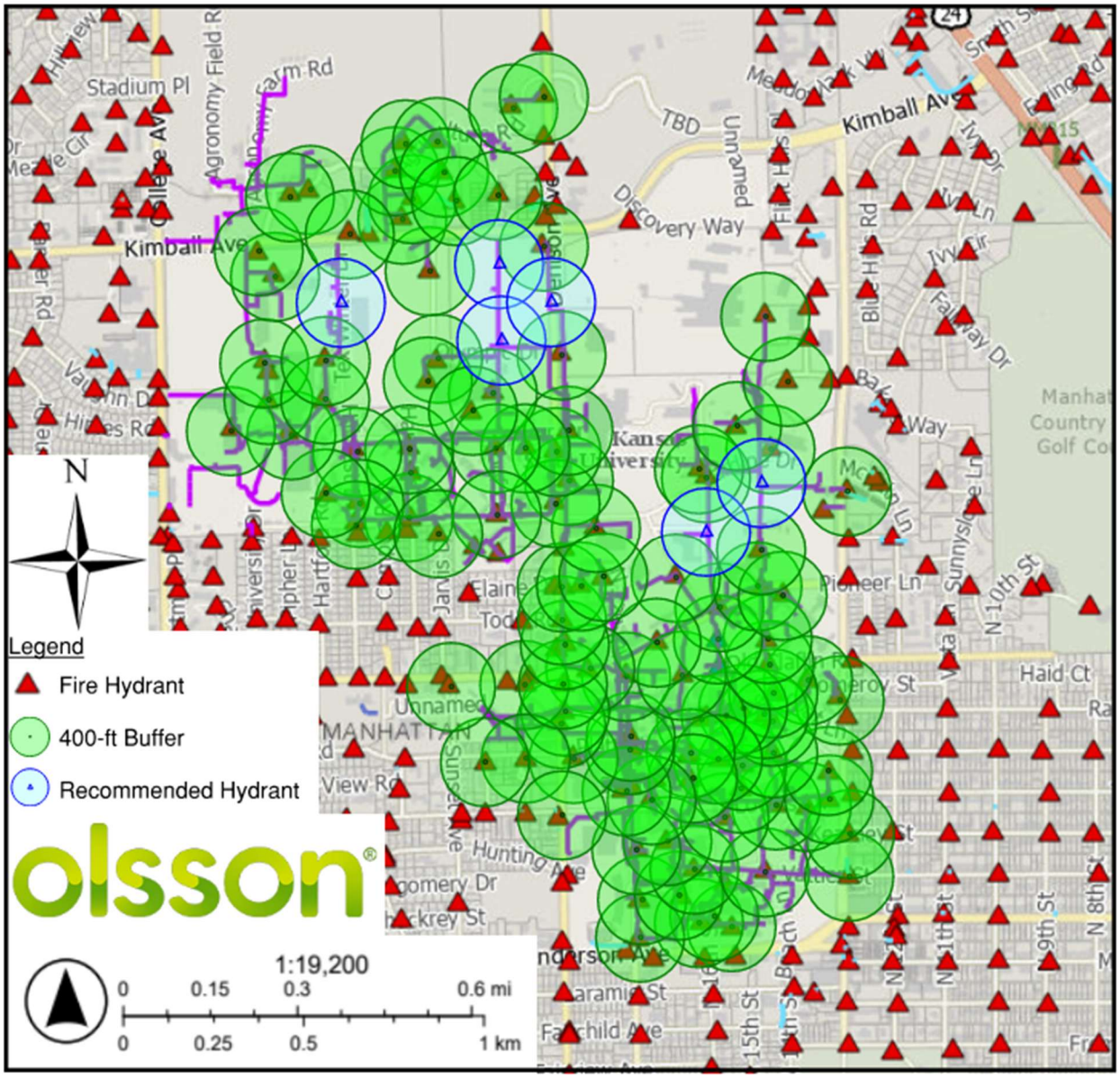

Figure 18. Map of Recommended Hydrants.

4.6 Planned New Structures

Smith Group provided a list of planned short-term and long-term new structures and demolitions on the KSU campus, as included in Appendix B. Table 6 outlines information provided about these new buildings. Based on the building use, such as research, lecture, or office, a water demand was estimated to be similar to other KSU buildings with a similar use type. Smith Group noted that at this time, there are no specific pressure requirements for any planned buildings, so typical pressure standards will be evaluated.

Assuming 11-foot-tall building stories, this results in a pressure drop of approximately 5 psi per story. Future buildings could be up to four stories, so a pressure drop on a multi-story buildings could be as much as 20 psi at the fourth floor.

Table 6. Proposed New Structures and Estimated Water Demands.

Long or Short Term[1]	Location	New Building Use	Estimated Area (gross square feet)	Estimated Water Demand Added (gpm)	Buildings with Demand(s) To Be Removed	Water Demand(s) Removed (gpm)	Net Water Demand (gpm)[3]	Anticipated MDD Min, Pressure at Ground Level (psi)
Short	Burt/Ward Halls	Research	100,000-140,000	3.2	Burt/Ward Halls (~50,000 gsf)	1.5	+1.7	85
Long	Ahearn	Non-research Renovation	N/A	N/A	N/A - Renovation	N/A	N/A	82
Long	Lot A28	Research	140,000	3.5	N/A	N/A	+3.5	81
Long	Lot B18 (north)	Office + Shipping Warehouse	80,000 – 100,000	1.0	Relocate housing/dining from Pittman and main services from Dykstra	0.3	+0.7	80
Long	Near Recycling Center & Lot B2	Research Storage Facility[2]	TBD	0.5	N/A	N/A	+0.5	74
Long	Peters or TBD	Health, Counseling, and Wellness Relocation	Assume similar to Lafene	1.0	Lafene Health Center	1.0	0	90

1 – Short term indicates 0 to 10 years, and long term is more than 10 years
2 – Smith Group noted this would likely be less than a typical building since it will not be occupied.
3 – This is average daily water demand

5. POTENTIAL ALTERNATIVES

Overall, pressures are within or exceed the 60 to 80 psi recommended in Ten States Standards; therefore, no recommendations will pertain to improving pressure. It is not practical to recommend replacement of all small-diameter mains, so instead the fire flow results can be used to determine areas where main upsizing would improve available fire flow to many parts of campus. Potential alternative recommendations will be focused on improving fire flow for some of the 22 percent of KSU nodes that can provide less than 1,000 gpm.

The benefits for each alternate improvement listed below reflect if only that improvement was implemented. Logically, if multiple of the alternates were constructed, the benefits may combine to result in even more improved flow conveyance. The following subsections discuss the potential alternatives to improve flow on campus and discuss their effects. Section 6 will outline and prioritize which alternatives are recommended.

5.1 ALT1 – Northeast Entry Point

The northeast connection point where the KSU master meter connects onto City water is located west of Research Park Dr near Mary and Carl Ice Hall. The KSU main at the connection point is 10 inches, but the southern 260 LF is 6 inches. This pipe then splits into 6-inch and 4-inch branches continuing south. It is recommended to replace the 260-LF segment of 6-inch main with 10-inch main to prevent a bottleneck and efficiently convey flow to the remainder of the campus from this entry point. The fire flow analysis showed that this main frequently experienced velocities of 8 to 10 fps, which is within the acceptable range, but a further indicator of a bottleneck.

Figure 19 shows the area recommended to be upsized and the resulting available fire flow. This improvement raises fire flow in many nodes on the 6-inch main run continuing directly south. Additionally, several nodes on the 10-inch main further directly south near Bayberry Lane are raised to above 1,500 gpm fire flow.

This improvement can likely have even more impact if the 4- or 6-inch mains just south are also upsized, as suggested in improvement ALT2.

Figure 19. ALT1 Available Fire Flow.

5.2 ALT2 – Serum Plant Rd & Jardine Dr

There is currently approximately 2,475 LF of 4-inch main starting in the northeast part of campus connecting to a 6-inch main from the northeast City tie-in point and going south along Serum Plant Road before tying into another 6-inch main just north of Feed Technology. This main is shown in Figure 20. It is noted that the campus utility staff said that this area is known for having terrible flow capacity.

The nodes along this run of main that are only connected to 4-inch main presently have available fire flows ranging from 400 to 600 gpm, much lower than desired. Additionally, since this main is one of two branches that feeds the east central campus with water from the northeast master meter connection point, adequately sizing this main will have many positive effects further south.

It is recommended to upsize the entire 2,475 LF of main to 6 inches since it ties into 6-inch main in the north, south, and center as shown in Figure 20. This significantly improves fire flows on the upsized main, with some nodes now able to provide 1,500 gpm fire flow. Additionally, it raises the available fire flow along a significant portion of main on and near Claflin Road from as low as 500 gpm to between 1,000 and 1,500+ gpm. This modification also increases fire flow on the 8- and 10-inch mains on the far east edge of campus from 1,000-1,500 gpm to over 1,500 gpm.

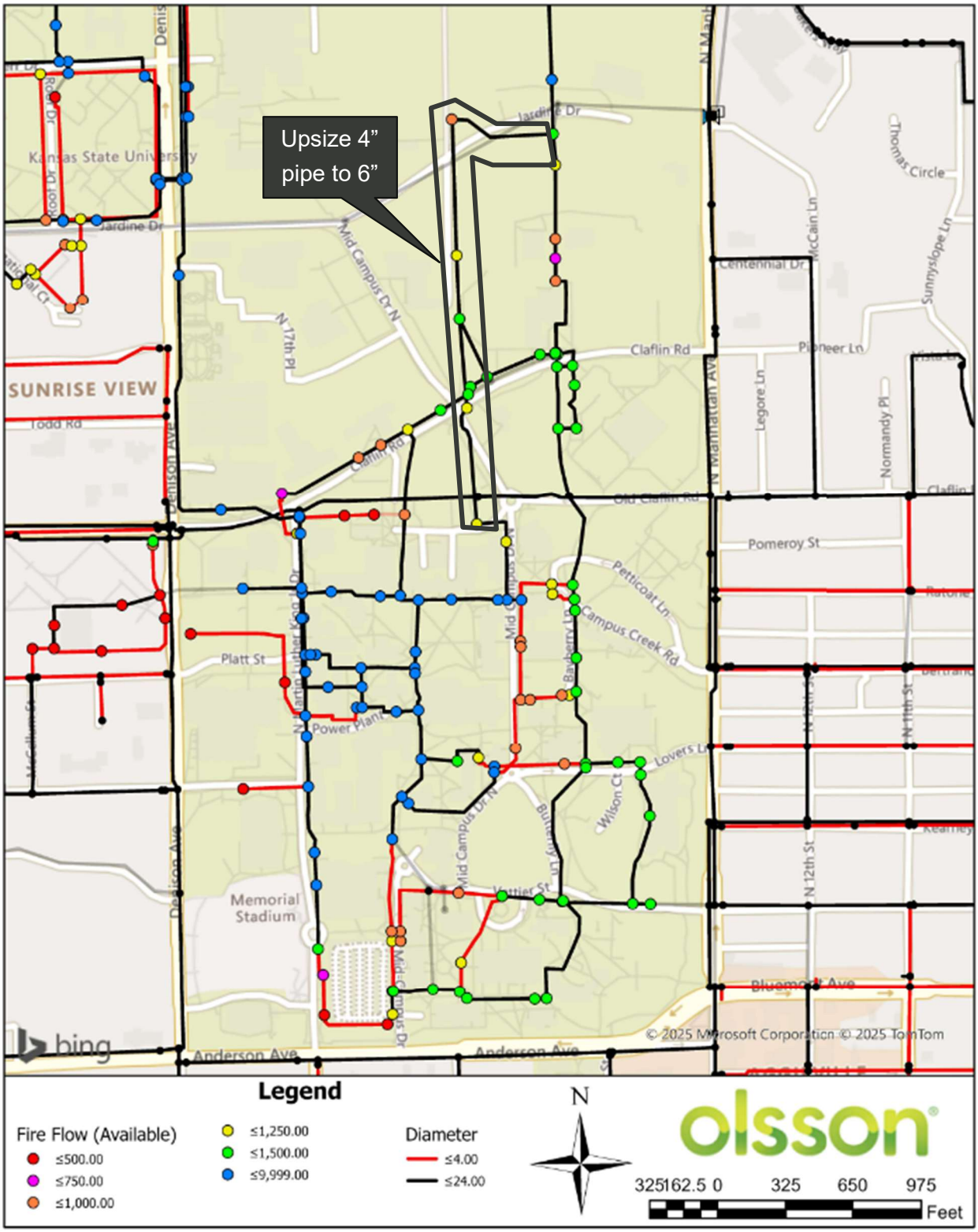

Figure 20. ALT2 Available Fire Flow.

5.3 ALT3 – Between Leadership Studies & King Hall

Currently, there is approximately 330 LF of 4-inch main running between the Leadership Studies Building and King Hall. It currently connects to a 10-inch main to the northeast (which is directly fed from the northeast connection point) and a 10-inch main on the west near Mid-Campus Drive (which continues east across the entire campus). This is shown in Figure 21. Due to both connection points being critical to the conveyance of flow across campus, it is recommended that this 4-inch main be upsized to 10 inches to match both sides. This area also currently has fire flows between 500 and 1,000 gpm along the 4-inch main.

Figure 22 shows the available fire flow in the campus after this main is upsized to 10 inches. Fire flow on the line is improved to exceed 1,500 gpm. Additionally, fire flow increases by as much as 250 gpm in the area around Claflin Road and the southeast edge of campus, with many nodes now above 1,500 gpm. These additional improvements are very similar to those provided through ALT2.

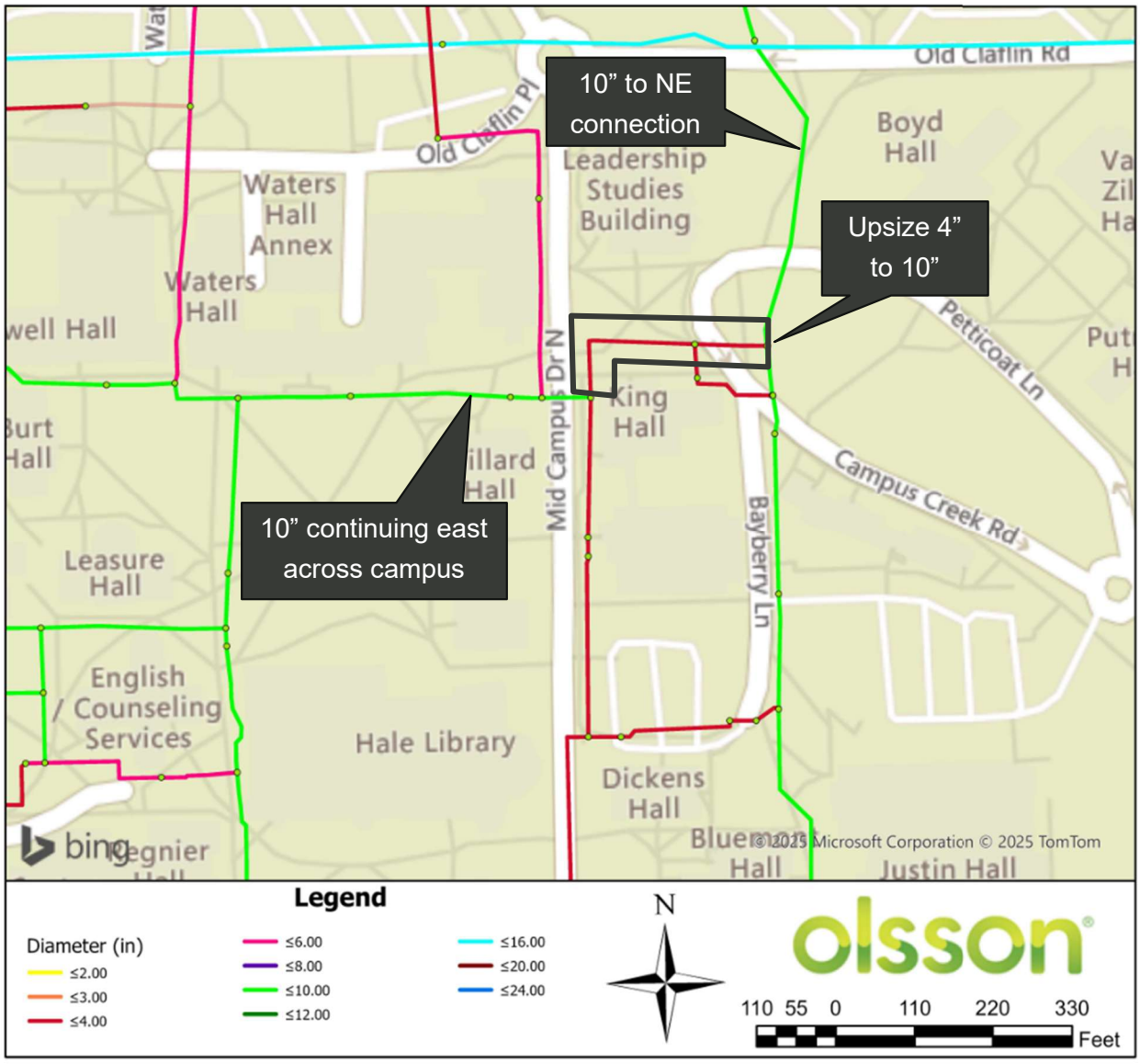

Figure 21. ALT3 Pipe Size Layout.

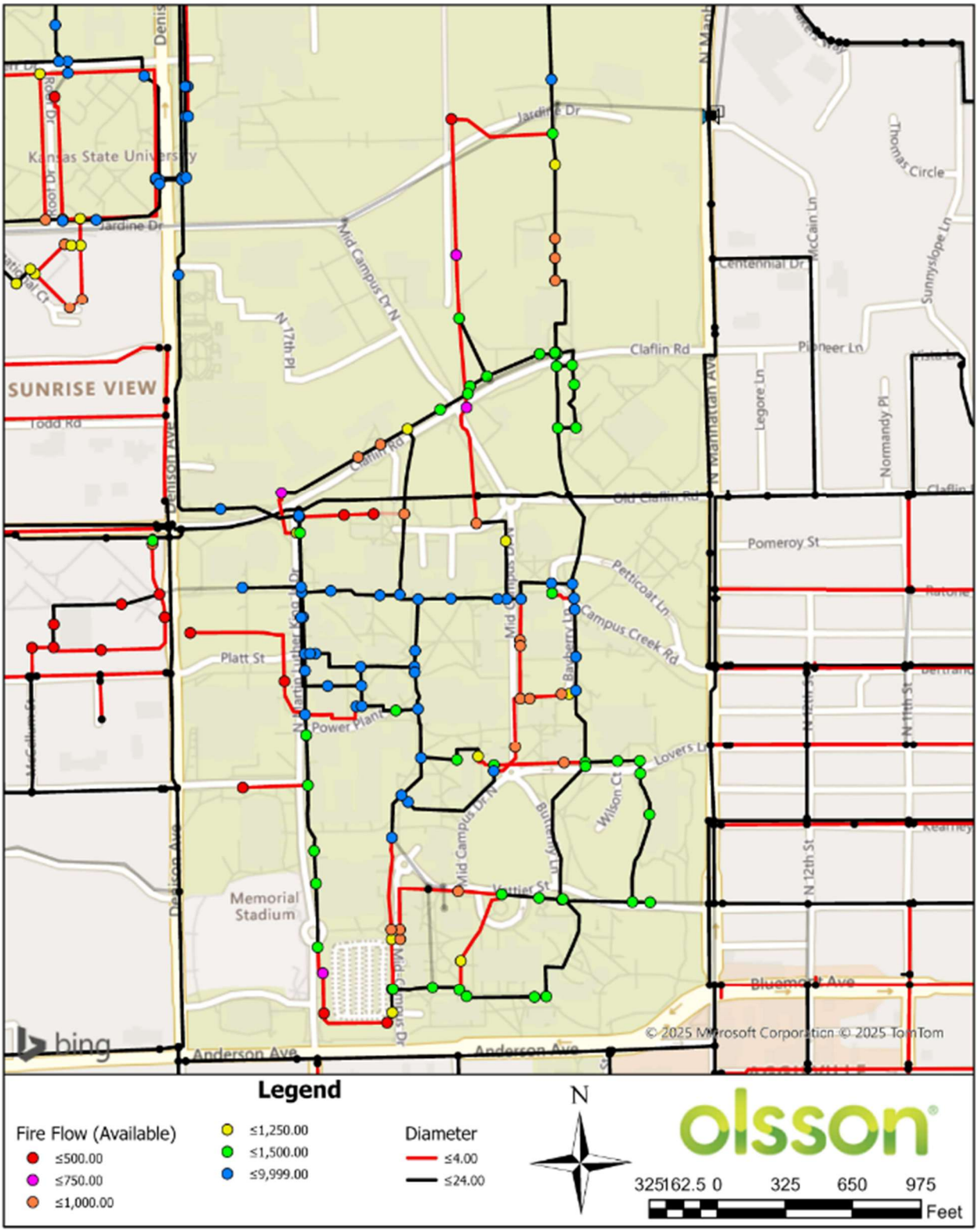

Figure 22. ALT3 Available Fire Flow.

5.4 ALT4 – Lovers Ln, South of Bluemont Hall

On Lovers Lane just south of Bluemont Hall, there is currently a 4-inch main that is connected to an 8-inch main on both the east and west, as shown in Figure 23. It is recommended to upsize this 545 LF of main to prevent it from restricting flow to the east and west. 440 LF of this main is recommended to be upsized to 8 inches, with the remaining 105 LF 6 inches to match the 6-inch branch it connects to.

When a fire flow simulation was run under this scenario, as shown in Figure 24, it was found that the southeast portion of campus is the primary area benefitted, with almost all nodes connected to 6-inch or larger main now able to provide more than 1,500 gpm fire flow. This is the only alternate thus far that results in the furthest south 10-inch main being able to provide 1,500 gpm or higher fire flow.

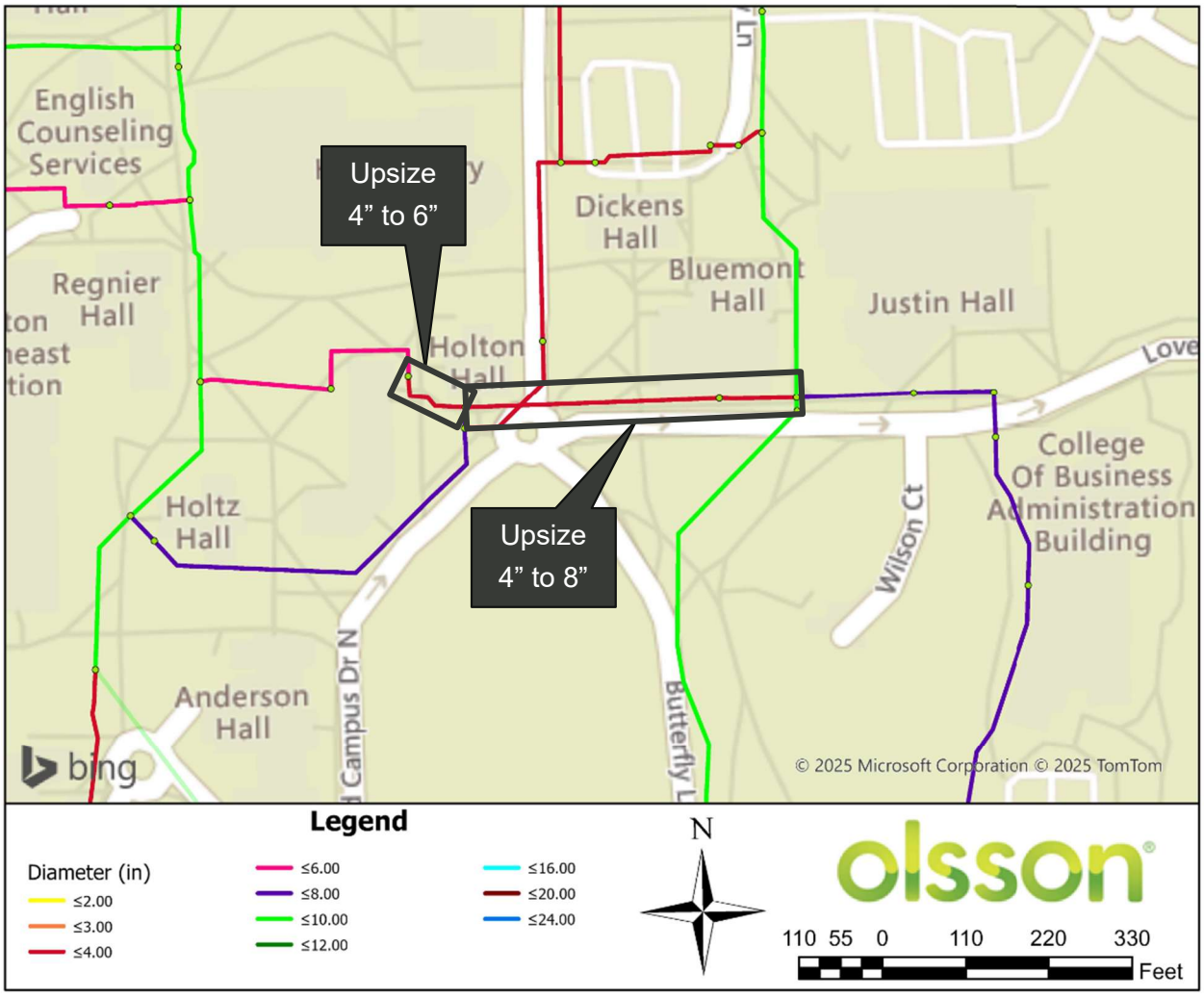

Figure 23. ALT4 Pipe Size Layout.

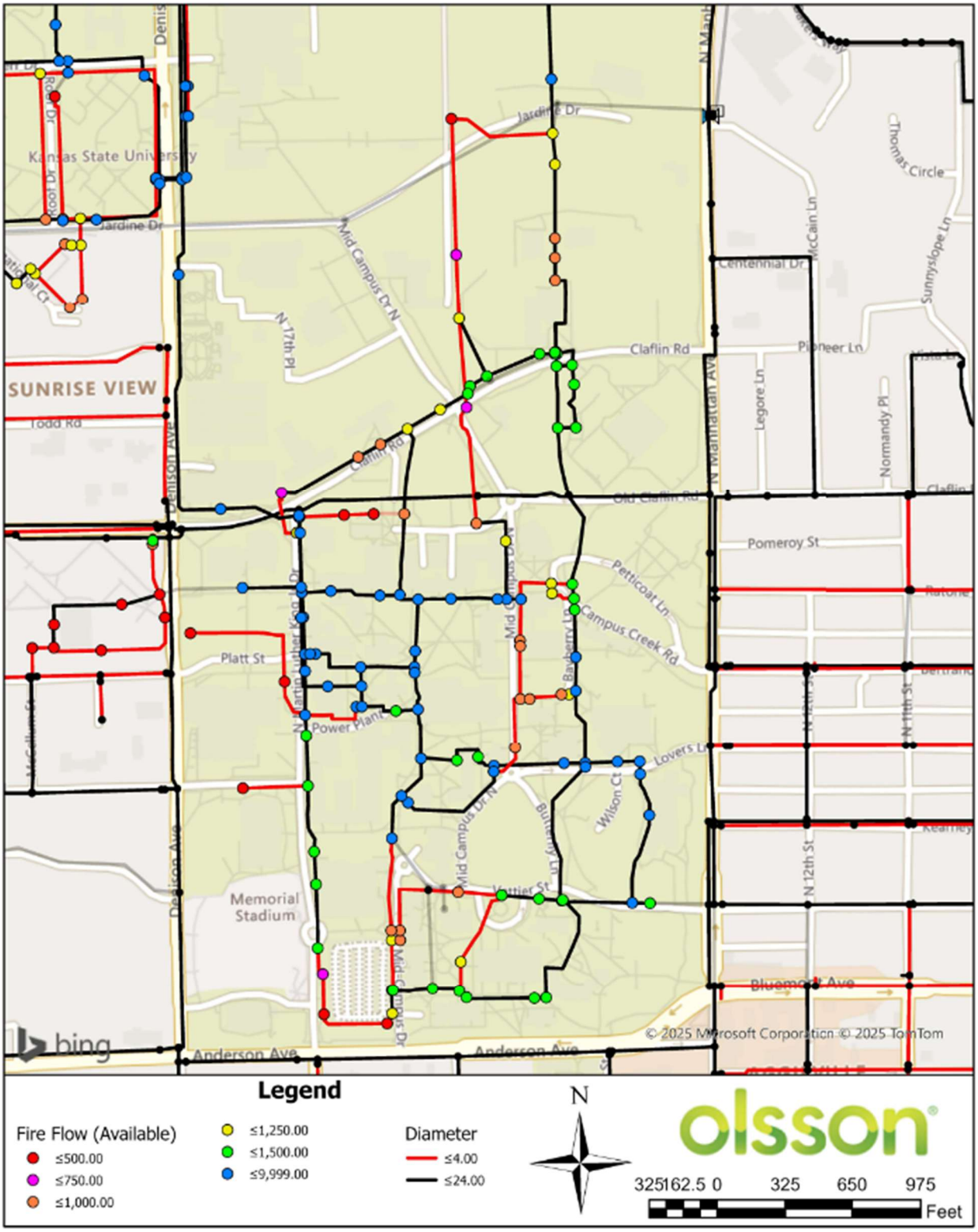

Figure 24. ALT4 Available Fire Flow.

5.5 ALT5 – Main Crossing Claflin Rd near Myers Hall

There is currently 290 LF of 4-inch main crossing Claflin Road near General Richard B. Myers Hall, as shown in Figure 25. This main connects to a 6-inch main to the north and a 10-inch main to the south. on N 17th Steet/Martin Luther King (MLK) Jr Drive. During one fire flow scenario, this main showed a velocity of 28 fps, nearly triple what is recommended in Ten States Standards.

The model shows that upsizing this main to 8 inches will best improve fire flow conditions in the vicinity. While the nearby 6-inch mains in Claflin Road are not currently shown within the model to need replacement, replacing this main today will eliminate the need to disrupt Claflin Road in the future when those mains are replaced. When the other 6-inch mains along Claflin Rd are eventually replaced, it is recommended to upsize them to 8 inches to match this improvement.

This improvement increases the fire flow on Claflin Road, as shown in Figure 25. It is noted that although the direct impact of this improvement alone is small and localized to the area nearby along Claflin Road, it helps replace small-diameter aging main which could help reduce future maintenance, and addresses an area that campus operation staff has identified as a bottleneck during normal operations.

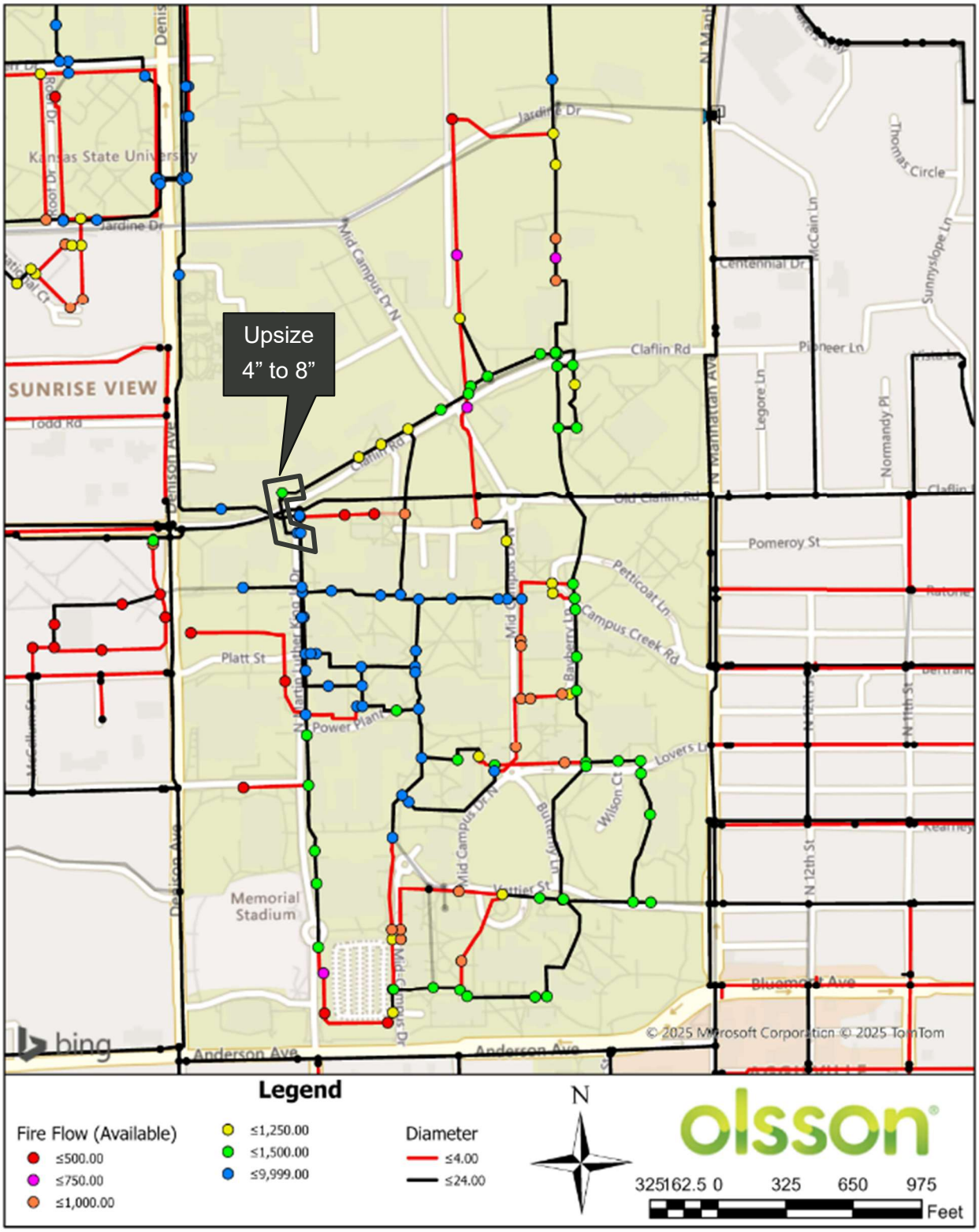

Figure 25. ALT5 Available Fire Flow.

5.6 ALT6 – Mid-Campus Dr, South

Currently, there is an almost-complete 10-inch loop around the south-central campus that is connected to two of the three City connection points. Besides the area mentioned in ALT3, another missing piece to complete the 10-inch loop is located on the south end of Mid-Campus Dr, from Morris Family Multicultural Student Center to Calvin Hall.

It is recommended to upsize this 730-LF portion of main to 10 inches, as shown in Figure 26. One of the existing 4-inch mains in this pipe run was one that had velocities exceeding 10 fps more than once during the fire flow analysis.

When this addition alone is made, the fire flows in the south and southeast of campus significantly rise. Many areas that previously had an available fire flow of 1,000 to 1,500 gpm can now exceed 1,500 gpm. This project has a similar effect as implementing ALT4, but has the added benefit of increasing fire flows on the southern 4-inch mains by as much as 250 gpm.

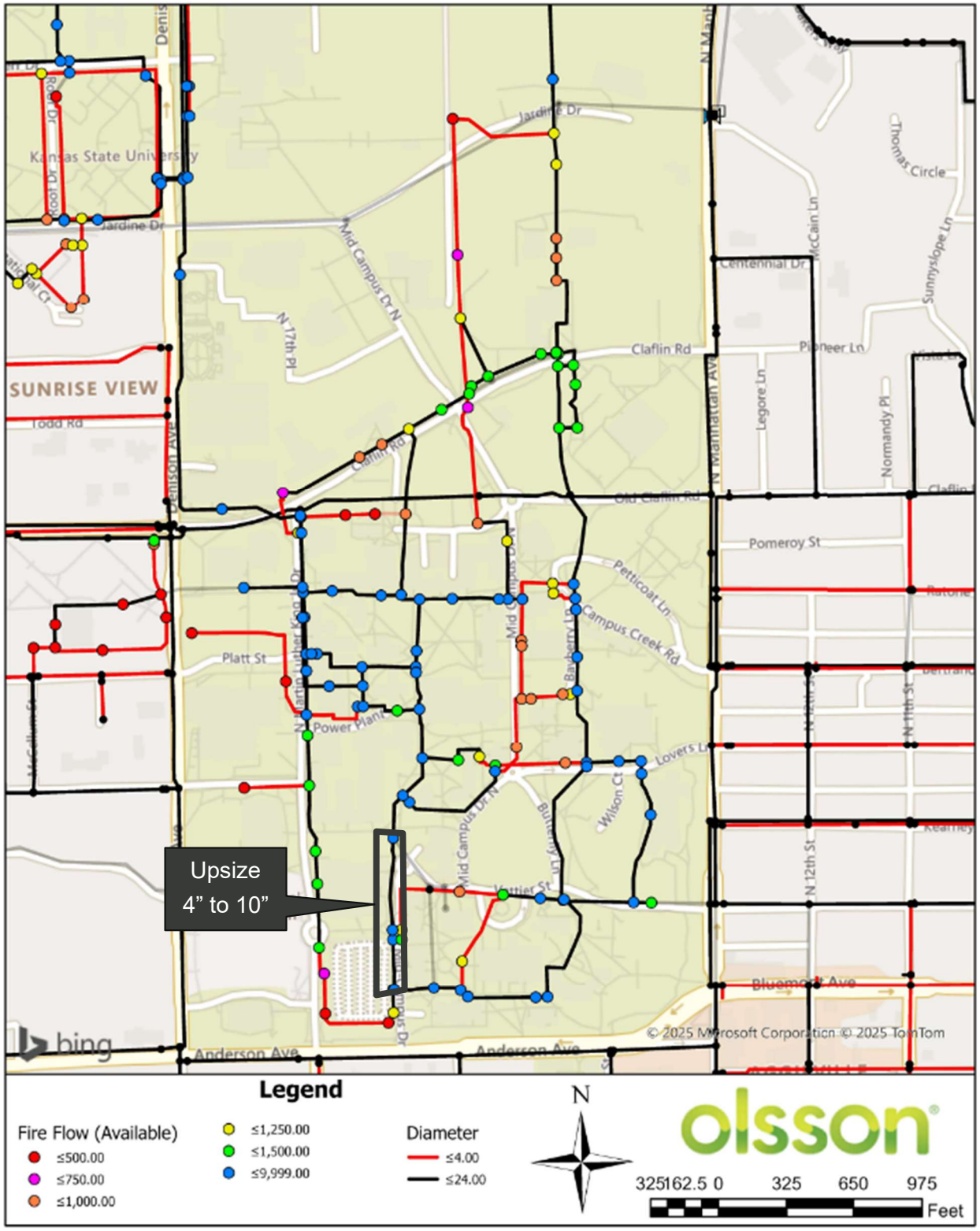

Figure 26. ALT6 Available Fire Flow.

5.7 ALT7 – South of Jardine Loop

Most mains on the loop around the Jardine Apartments are able to provide more than 1,000 gpm, but only the eastern edge can provide more than 1,500 gpm. The areas that provide less than 1,000 gpm are the 4-inch mains in this area. ALT7 includes upsizing approximately 400 LF of 4 inch main to 6 inches just south of Jardine Drive, as shown in Figure 27. This improvement also includes installing approximately 10 LF of 8-inch main to connect an 8-inch dead end to the remainder of the loop, just to the west of where the upsized main connects to the remainder of the Jardine loop. This is also shown in Figure 27.

Figure 28 shows the resulting fire flow availability after this improvement is made. Now, 1,500 gpm fire flow is met in the entire east half of the Jardine loop on 6-inch or larger main. Fire flow on the west end also increases by as much as 250 gpm.

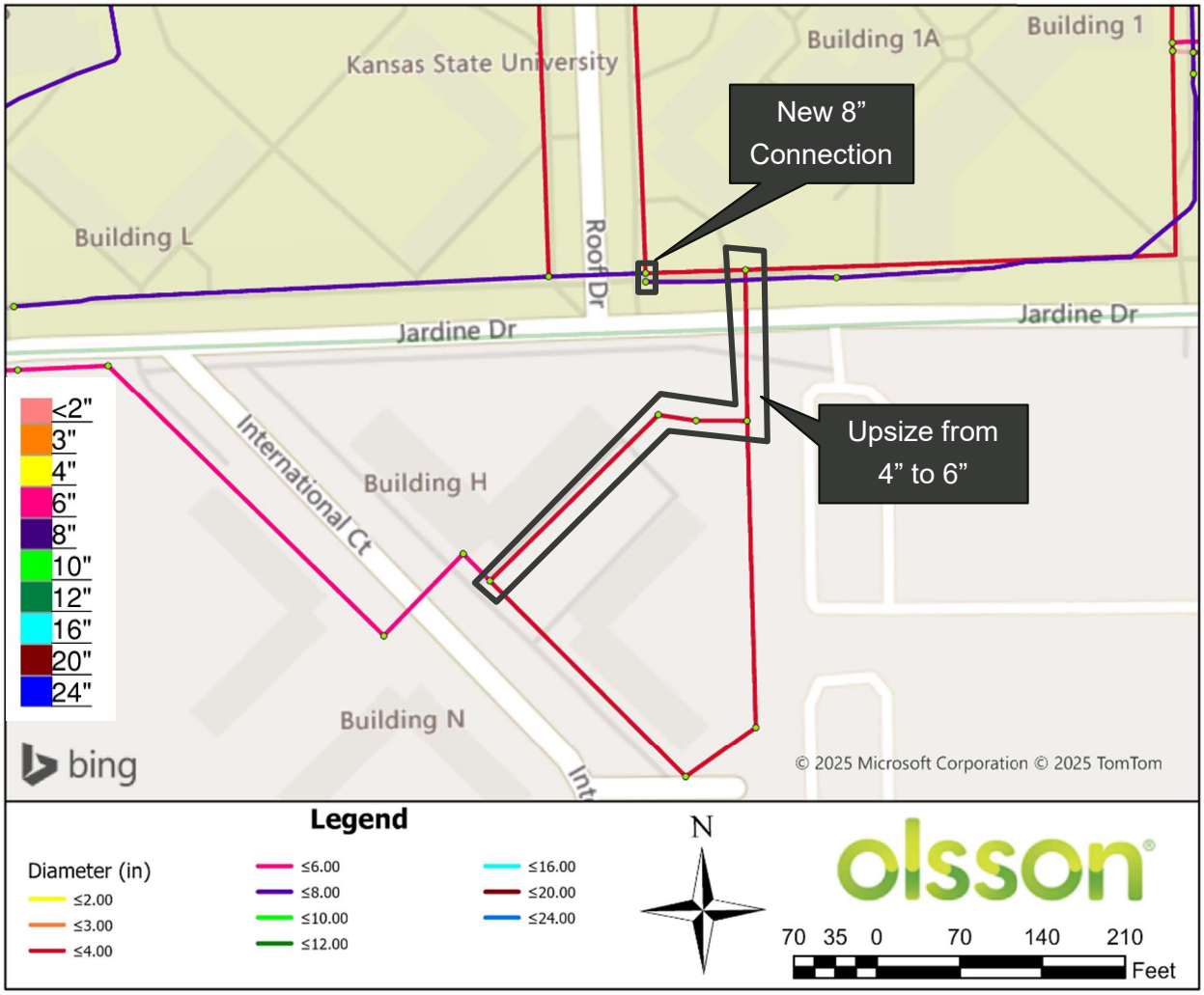

Figure 27. ALT7 Pipe Size Layout.

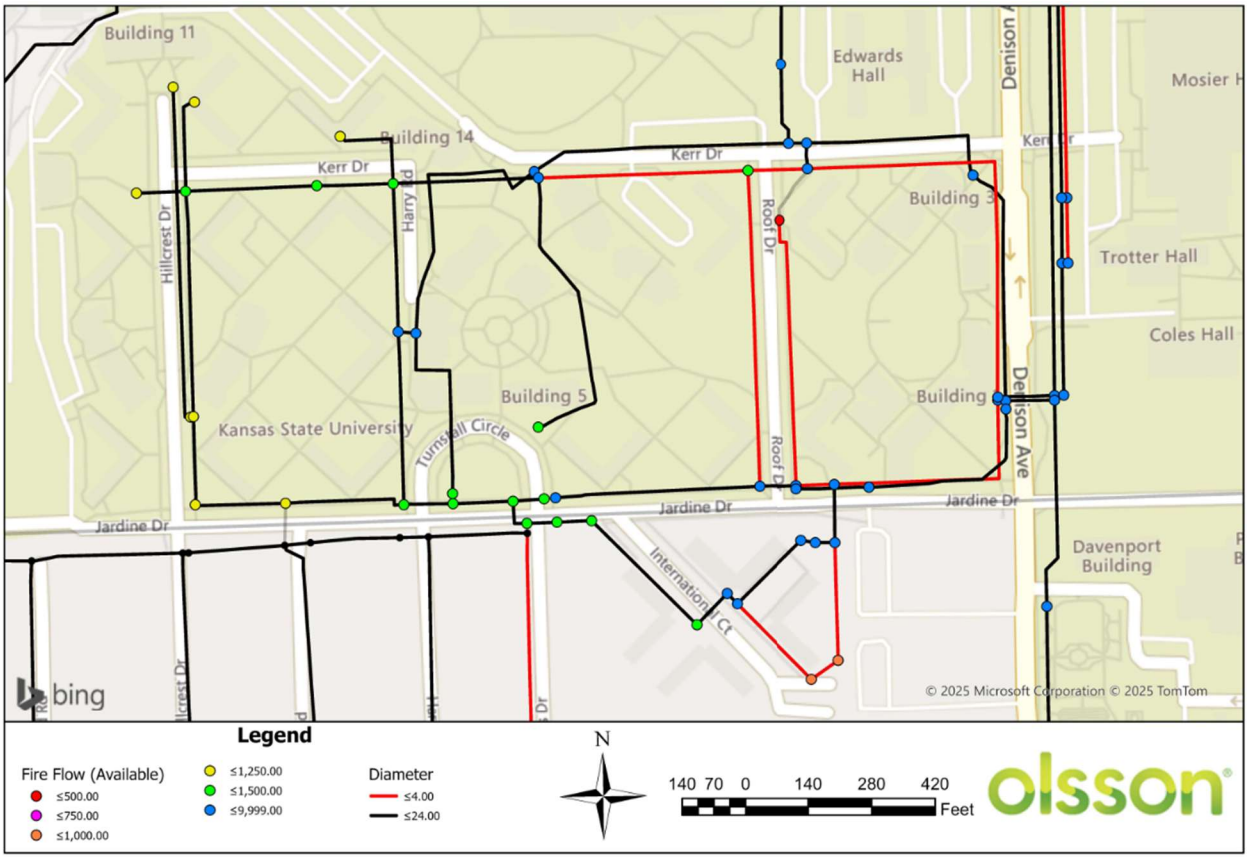

Figure 28. ALT7 Available Fire Flow.

5.8 ALT8 – Roof Dr Interconnect in Jardine Loop

American Water Works Association (AWWA) best practices indicate that where fire protection is provided, mains should be a minimum of 6 inches in diameter, and dead-end mains should be a minimum of 8 inches in diameter. Currently, there is a 600-LF dead-end 4-inch main on Roof Drive within the Jardine Apartments Loop. It is recommended to install approximately 140 LF of 6-inch main to connect this dead end to the 4-inch x 6-inch tee to the north on Kerr Drive, as shown in Figure 29.

With this interconnection in place, the most significant benefit is that the fire flow at the former dead end rises from under 500 gpm to over 1,500 gpm. This improvement also raises a few nodes' fire flows at the south intersection of Roof Drive and Jardine Drive, as shown in Figure 29.

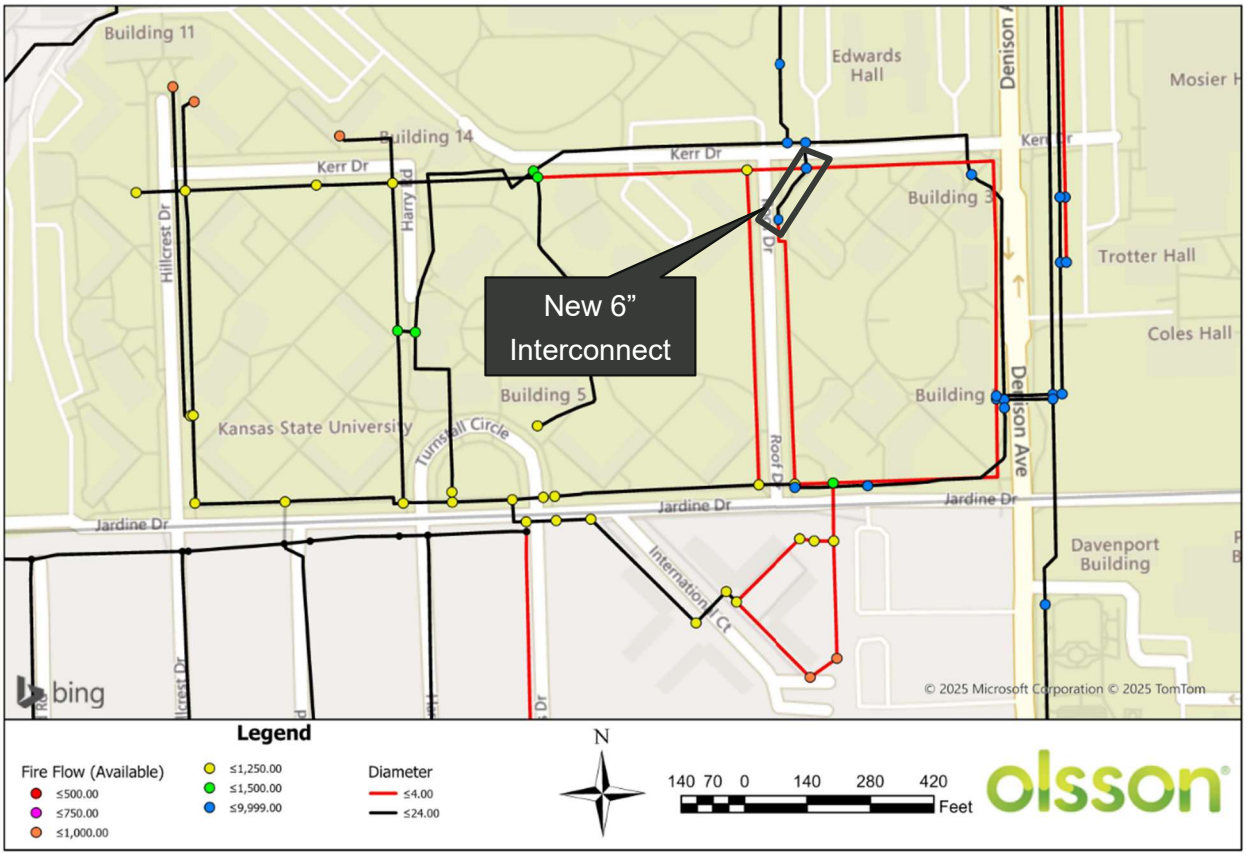

Figure 29. ALT8 Available Fire Flow.

5.9 ALT9 – Kramer Dining & Dorms

All of the nodes around the Kramer Dining Center and associated dormitories are deficient in fire flow, providing less than 500 gpm. That the two City connection points and half of the water main loop in this area are 4-inch main and likely causing the deficiency.

The City water main on Claflin Road at the northern connection is 12 inches, but the model shows that 275 LF of upsized 8-inch main is sufficient to serve the Kramer area from the north. To the south, the existing City main on Platt Street is 4 inches, although there is an 8-inch connection nearby along McCollum Street. It was determined that a 240-LF 6-inch southern connection would be sufficient. With these two upsized connections in place, the area can now provide over 1,500 gpm everywhere except along the remaining 4-inch within the area, as shown in Figure 30.

This remaining 790 LF of 4-inch main could be upsized as an optional improvement, but the two connection points are the most critical immediate improvements so that the majority of this area can meet fire flow requirements.

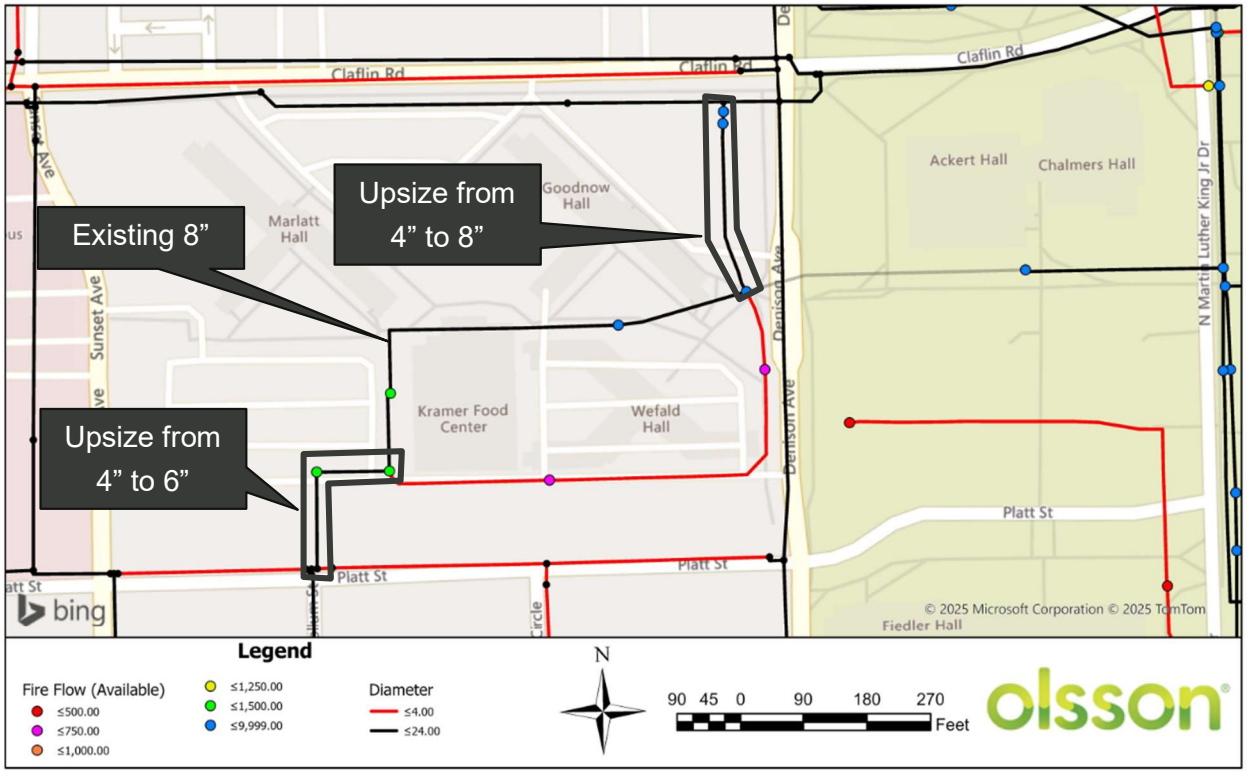

Figure 30. ALT9 Available Fire Flow.

5.10 New 24-inch City Main Interconnect

A new City 24-inch water main is being considered along Jardine Drive in the High Pressure Zone, as shown in the exhibit in Appendix C. It would be considered to have a new interconnect and master meter to the KSU campus with this new main, likely near the eastern edge. There are three potential alignments for the new City main as it moves east-west. It was determined that the best connection point to the KSU water mains would be done by installing approximately 150 LF of main south to tie in near the existing 6-inch x 4-inch tee just south of Jardine Drive. Then, water can be conveyed south to the campus through the 4-inch and 6-inch mains without being restricted to only one path. The new water main path and connection is shown in Figure 31.

Since this interconnect would be a new tie-in point for the KSU master meter, a meter pit with backflow prevention would be required on the interconnect. A new meter vault with a City meter and a double check valve backflow preventer would be recommended. The City may allow a single check valve, which should be determined at the time of design of the interconnection. This would be installed within a below-grade meter vault, estimated to be approximately 19 ft x 8 ft.

It is recommended to tie in the future 24-inch main with a 10-inch main, and it was found that larger mains do not provide additional benefit since flow is still restricted by the 4-inch and 6-inch mains to the south.

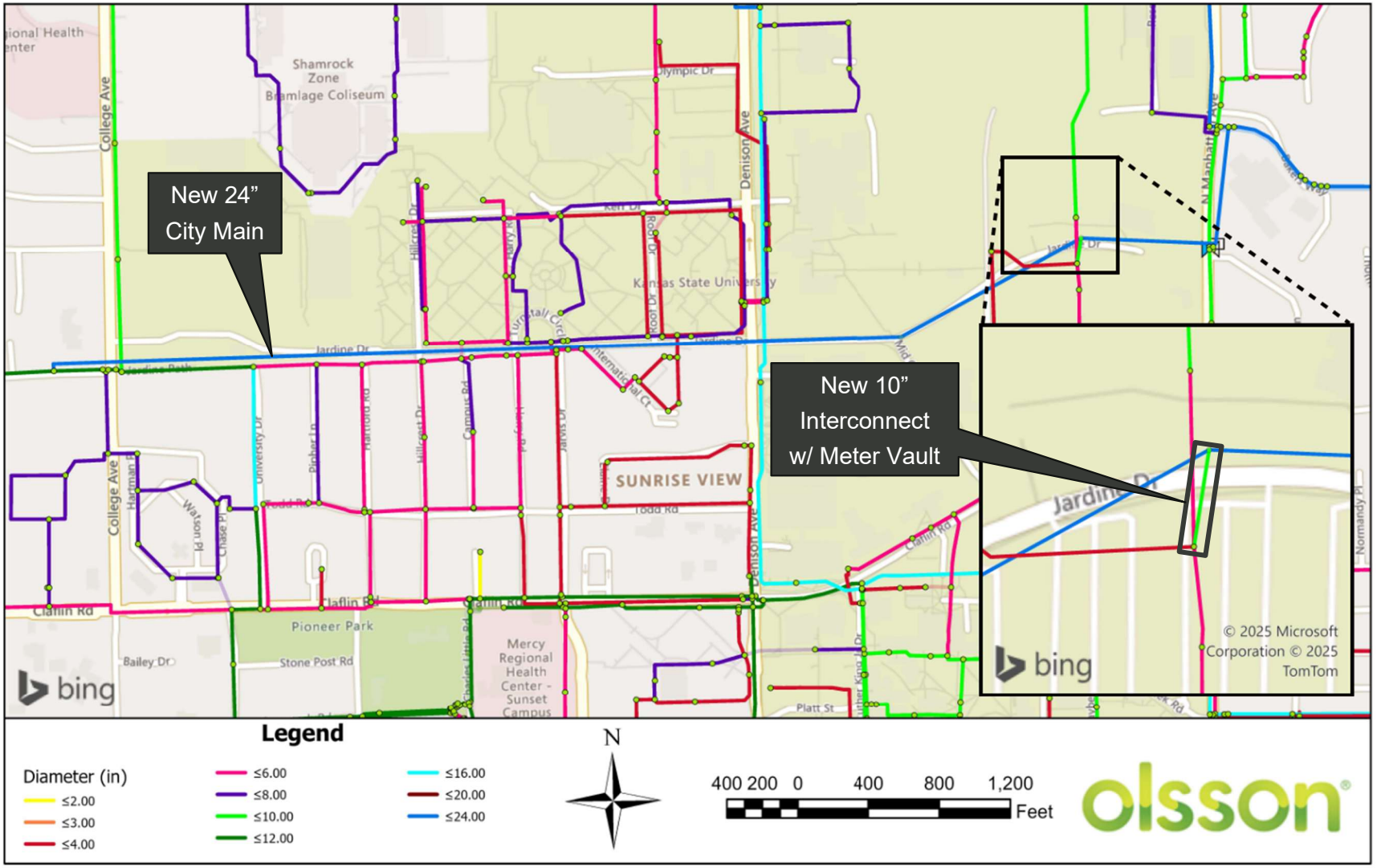

Figure 31. New 24-inch City Main Layout and Connection.

With this new City main and interconnect in place, minimum pressures under MDD conditions slightly increase directly to the south. Some minimum pressures that previously were within a range of 80 to 100 psi are now between 100 and 130 psi. It is recommended to install a pressure reducing valve (PRV) at the interconnect to lower the risk higher pressures damaging pipe or plumbing on campus. The PRV should be set around 25 psi so that maximum pressures are similar to existing. Field pressure testing is recommended to verify how the tie-in affects campus pressures

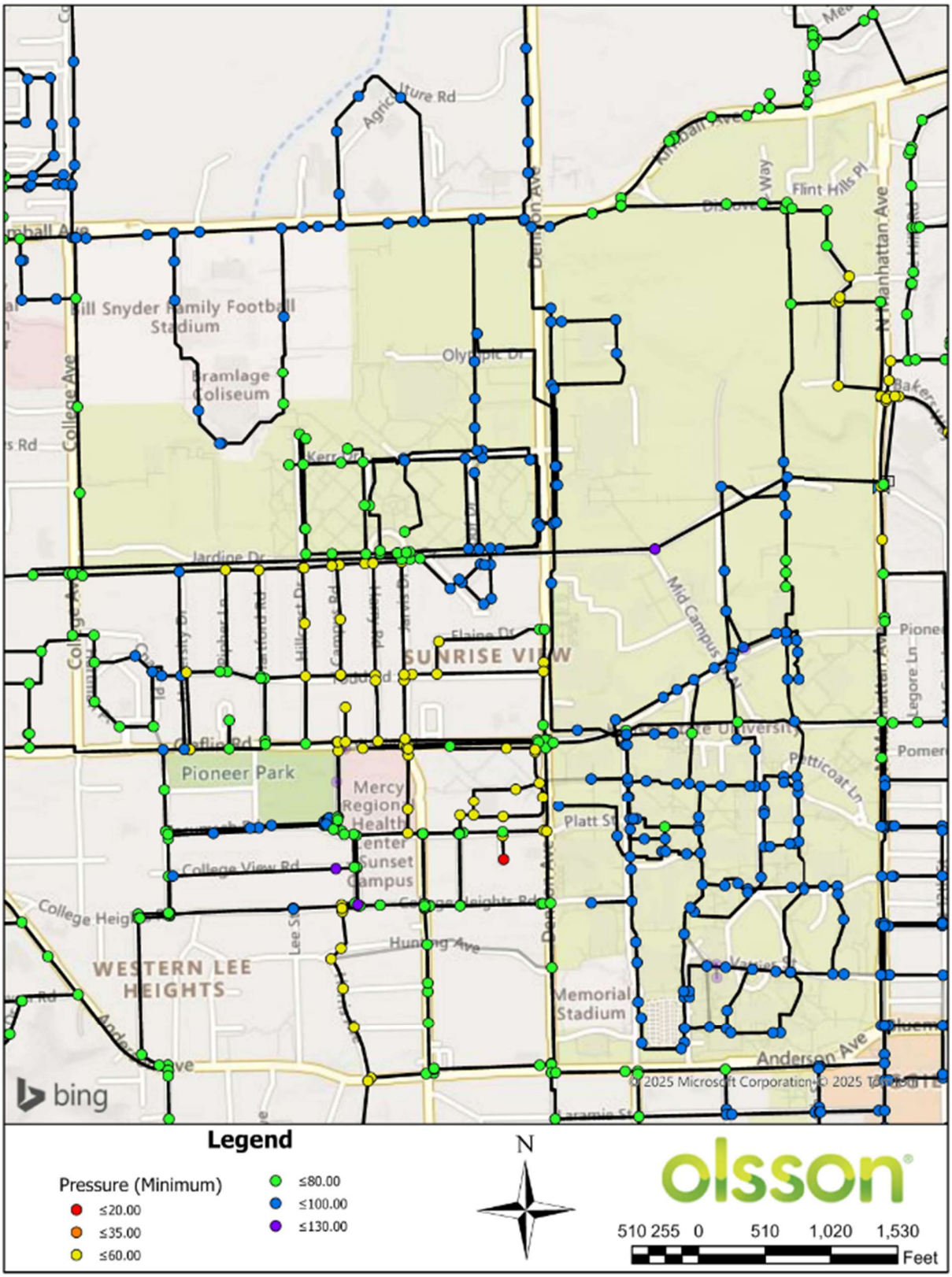

Figure 32. Minimum Pressures at MDD with New 24-inch City Main.

A fire flow simulation was run with the new interconnect in place, and results are shown in Figure 33. Available fire flow increases by around 250 gpm on the 6-inch main directly to the south, on the eastern half of Claflin Rd, and the 10-inch main on the eastern edge of campus. Some of these increased available fire flows are now exceeding the recommended 1,500 gpm.

If this new interconnect is completed, ALT2 would be even more beneficial since it involves upsizing one of the parallel mains that will transmit flow from this area to the rest of the campus. This interconnect may lessen the benefit of ALT1, since a 24-inch main can provide more flow than the 10-inch northeast connection point. However, since ALT1 is a relatively small project, if the new City 24-inch main is planned for many years in the future, it would still be beneficial to complete ALT1 in the meantime.

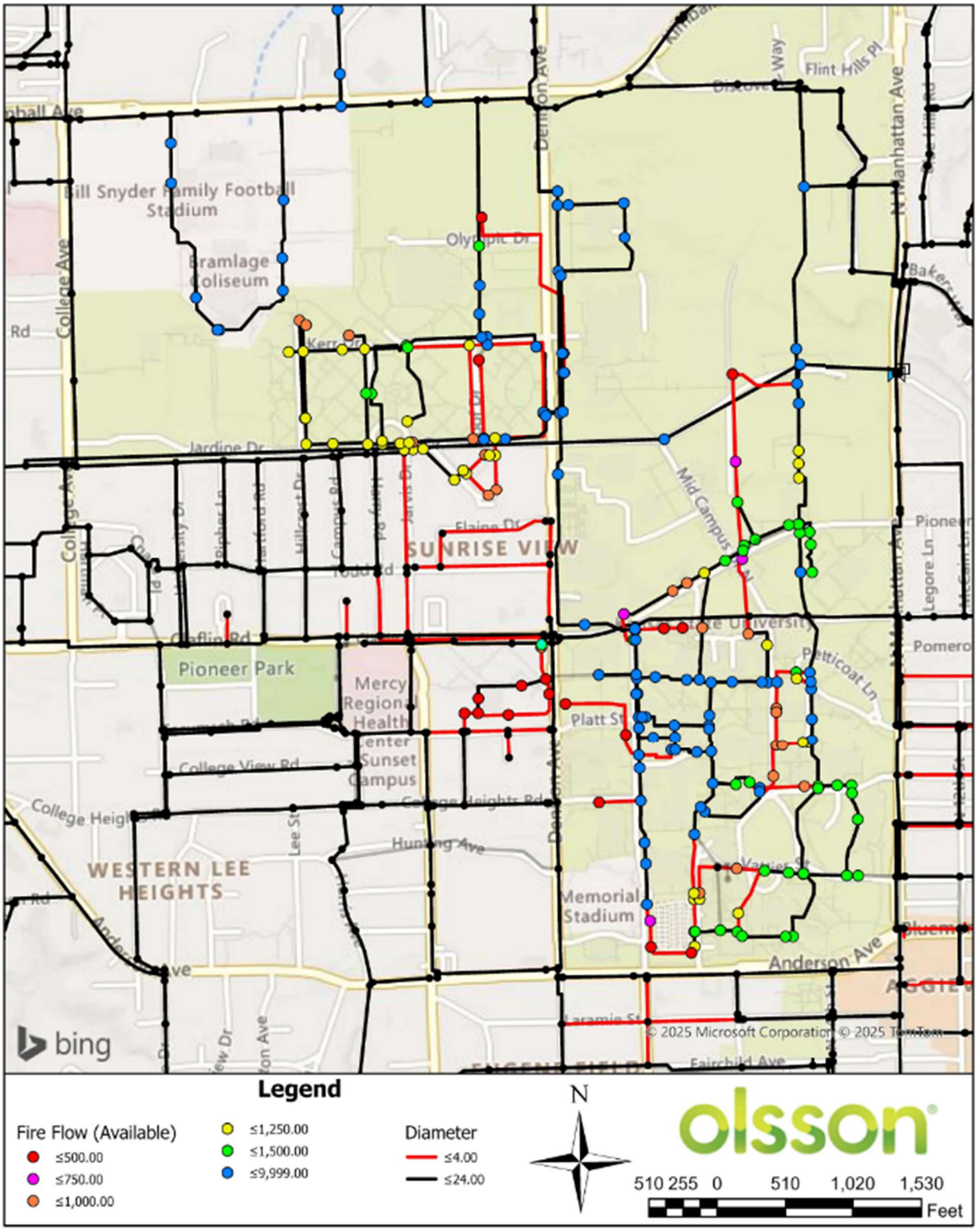

Figure 33. Available Fire Flow with New 24-inch City Main.

5.11 Hydrants

During flow testing on August 8, 2024, it was noted by the system operator that some hydrants were old, leaky, broken, and/or hard to open. These include the following hydrants:

- Hydrant on Claflin Road southwest of Weber Hall - broken
- Hydrant on Campus Creek Road east of King Hall - broken
- Hydrant on Mid-Campus Drive west of Dickens Hall (Residual 8 from flow testing) – Leaky and hard to open
- Hydrant on MLK Jr Drive, west of Student Union (Flow 10 from flow testing) – Hard to open

As of December 2024, the first three of these hydrants have been repaired or replaced. The one remaining is the fourth by the Student Union, which is recommended to be replaced.

The east side of the Jardine Apartment Loop has parallel 4-inch and 8-inch main. AWWA recommends that any water main that provides fire protection shall be 6 inches or larger, which means that the 4-inch mains should not be providing fire flow. It is recommended to review the Jardine area and confirm which water main hydrants are connected to, and reconnect to the 8-inch main as needed. Based on the Riley County GIS, it appears that there is only one hydrant on a parallel 4-inch main, along Kerr Drive near parking lot C7. It is recommended to field verify or use as-builts to confirm where this hydrant is connected. If it is on the 4-inch main, it should be relocated to tie into the 8-inch main in the same area.

Additionally, there were six areas found to be deficient in hydrant coverage in section 4.5. Hydrants are recommended to be installed in these areas, as shown in Figure 18. It is noted that the eastern two hydrants are in areas that would be affected by construction of ALT1/New 24-inch City Interconnect and ALT2, so it would be recommended to add those hydrants at the time of those improvements if they are completed.

6. PRIORITIZATION OF RECOMMENDATIONS

The hydrant recommendations should be implemented as soon as possible, since other fire flow improvements will not be beneficial if the hydrant cannot be accessed or could easily be moved to a larger-diameter main.

The new 24-inch City main interconnect was found to be very beneficial for fire flows on the east side of campus, and is recommended to be constructed

ALT9 is recommended to be a top priority project since currently three dormitories and the Kramer Dining center can provide less than 500 gpm fire flow.

ALT1 through ALT8, which pertain to the KSU campus on the master meter can be prioritized based upon their impact to the overall system. ALT1 should be a top priority since it is a relatively small project, but will impact a significant part of the campus water system by removing a bottleneck from the connection to the Manhattan Water System. If the new 24-inch City interconnect is completed within the next five years, then upsizing this 6-inch main is less important to the overall campus flow conveyance since the 24-inch connection will be much more beneficial. However, since ALT1 is a relatively small project, if the new City 24-inch main is planned for many years in the future, it would still be beneficial to complete ALT1 in the meantime.

The next top priority improvement on the central campus master meter is ALT6. This area had a few exceedances of 10 fps velocity during fire flow, and it benefits much of the southeast portion of campus by creating a larger distribution main for fire flow and working towards the goal of completing a 10-inch loop. ALT5 had similar benefits to ALT6, which makes it lower on the priority list if ALT6 is constructed.

ALT2 and ALT3 provide similar benefits to the overall campus in addition to raising fire flow on the segments of main to be replaced. ALT2 will be more expensive since it covers a larger area, but it will directly benefit an area of the campus known for flow problems and help convey flow from the northeast entry point. Alternatively, ALT3 offers similar benefits to the surrounding area for a smaller project size, but does not give any benefit to the buildings along Serum Plant Road. Since Serum Plant Road currently has many nodes unable to provide even 1,000 gpm fire flow, that should be prioritized with ALT2 being completed first. Additionally, if the new City 24-inch main interconnect was complete, this would create even more benefit to prioritizing ALT2.

The next highest priority improvement should be ALT7, since it benefits the entire Jardine Apartment Loop and upsizes a significant portion of aging 4-inch main.

After ALT2 is in place, there will still be some fire flows lower than 1,000 gpm on the west end of Claflin Road, which suggests that ALT5 would be beneficial to provide higher fire flow to these

mains. This project is a small amount of water main, but it does cross Claflin Road which would need to be considered as a construction challenge.

ALT8 should be the next priority since it would be a relatively small project. It primarily provides benefit to the 4-inch line that will now be looped, but that main currently has fire flow availability less than 500 gpm so it will be a relatively low investment for a significant improvement of fire flow in that area.

The two remaining alternatives for the central campus, ALT3 and ALT4, will benefit the campus overall by replacing and upsizing aging, corroded 4-inch mains. However, the additional benefit to campus fire flow is mostly achieved by the other improvements. Thus, these two alternatives are currently the lowest priority projects identified in this report.

A campus water main map of all nine recommended alternatives and their priority ranking is included in Figure 34.

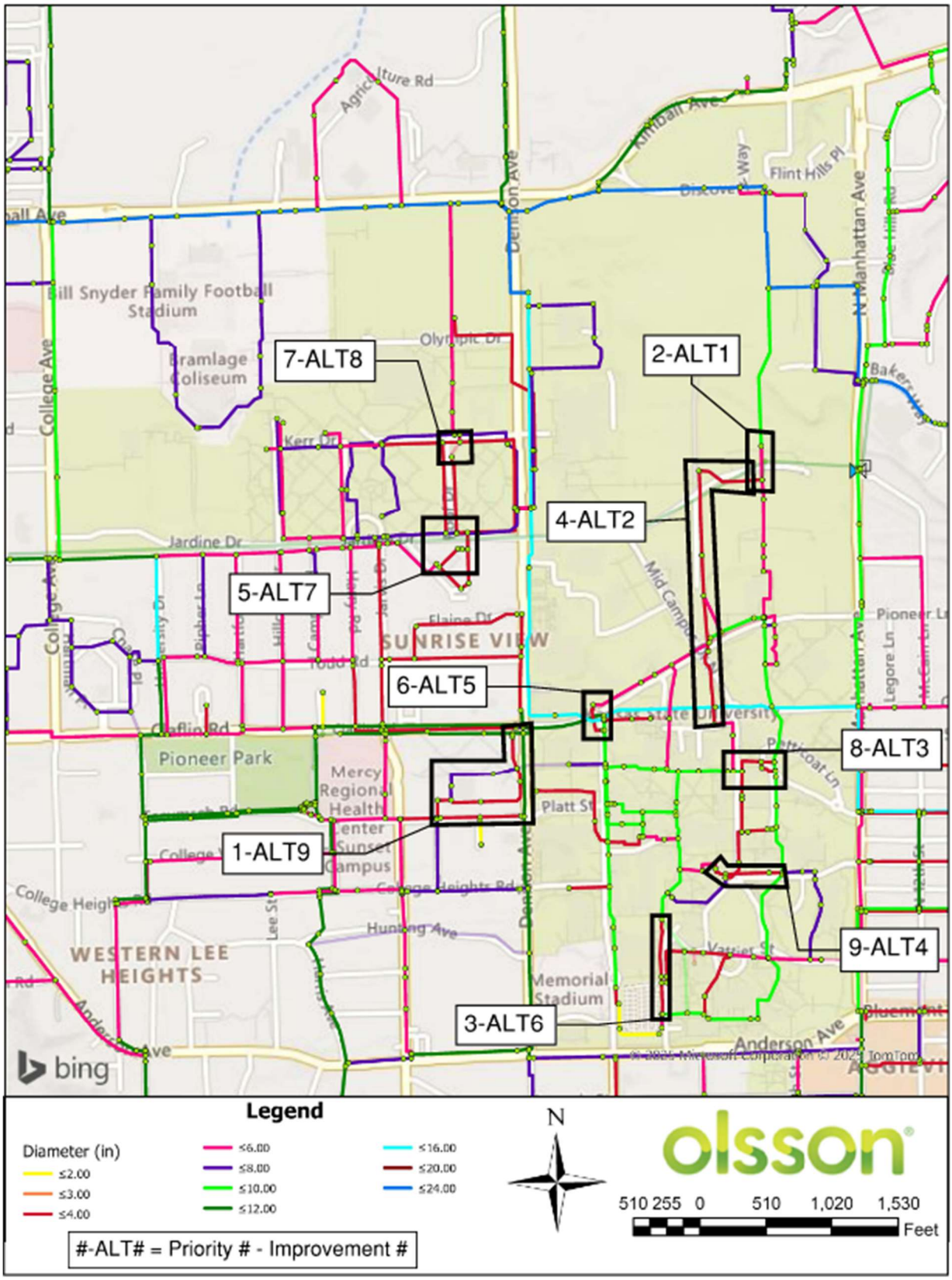

Figure 34. Map of Recommended Alternatives with Priority Ranking.

6.1 Cost Estimates

A budget cost per inch-diameter of water main was used to estimate the potential cost for each distribution project, which accounts for hydrants, valves, disinfection and testing, pavement removal and replacement, service line installation, and other miscellaneous items associated with the construction of new water mains. These costs assume water mains are constructed in congested areas that would require more pavement replacement.

A budget cost per inch-diameter of water mains was derived from recently bid projects, RS Means Estimating Guide, the Lincoln, Nebraska Water System Master Plan (2020), and information provided by vendors and suppliers. All cost estimates for this analysis are numbers for congested areas with paving and other site challenges. The water main budget cost is $32.00 per inch-diameter. These unit costs for varying pipe sizes are summarized in Table 7.

Table 7. Water Main Budgetary Costs.

Main Size (in)	Construction Cost Per LF
6	$192.00
8	$256.00
10	$320.00
12	$384.00

Table 8 outlines the budgetary cost estimates for each of the recommended water main projects, including their priority ranking. Table 9 outlines the budgetary cost estimate for the other recommended projects.

Table 8. Budgetary Cost Estimates and Priority for Recommended Water Main Projects.

Priority	Improvement Name	New Pipe Size (in)	Length of Pipe (LF)	Unit Cost	Extended Cost	Notes
2	ALT1 - Northeast Entry Point	10	260	$320.00	$83,200.00	Not recommended to be top priority if new City main interconnect is constructed within the next 5 years
4	ALT2 - Serum Plant Rd & Jardine Dr	6	2,475	$192.00	$475,200.00	
8	ALT3 - Between Leadership Studies & King Hall	10	330	$320.00	$105,600.00	
9	ALT4 - Lovers Ln	6	105	$192.00	$132,800.00	
		8	440	$256.00		
6	ALT5 - Crossing Claflin Rd near Myers	8	290	$256.00	$85,376.00	Additional 15% added for crossing Claflin Rd
3	ALT6 - Mid-Campus Dr, South	10	730	$320.00	$233,600.00	
5	ALT7 - South of Jardine Loop	6	400	$192.00	$79,360.00	
		8	10	$256.00		
7	ALT8 - Roof Dr Interconnect in Jardine Loop	6	140	$192.00	$26,880.00	
1	ALT9 - Kramer Dining & Dorms	6	275	$192.00	$114,240.00	
		8	240	$256.00		
				TOTAL	**$1,336,256.00**	

Table 9. Budgetary Cost Estimates for Other Recommended Projects.

Description	Quantity	Unit	Unit Cost	Extended Cost	Notes
New City Main Interconnect, 10" Main	150	LF	$320.00	$48,000.00	
New City Main Interconnect, Meter Vault	1	EA	$125,000.00	$125,000.00	
Remove and Replace Hydrant near Student Union	1	EA	$10,000.00	$10,000.00	
Confirm Hydrants are Connected to Jardine 8-inch	1	EA	$3,300.00	$3,300.00	Quantity may change after field/as-built investigation
New Hydrant	6	EA	$8,800.00	$52,800.00	Consider installing eastern hydrants in conjunction with other upgrades for cost savings

7. CONCLUSION

This report outlined the existing water infrastructure for the KSU campus. Based on the hydraulic model created as part of this project, potential system deficiencies can be found, and recommendations for improvement can be made. Overall, the majority of campus deficiencies found were due to lacking available fire flow due to small-diameter main and/or high velocities. Campus hydrant coverage was also evaluated, with several key areas recommended to add hydrants.

8. REFERENCES

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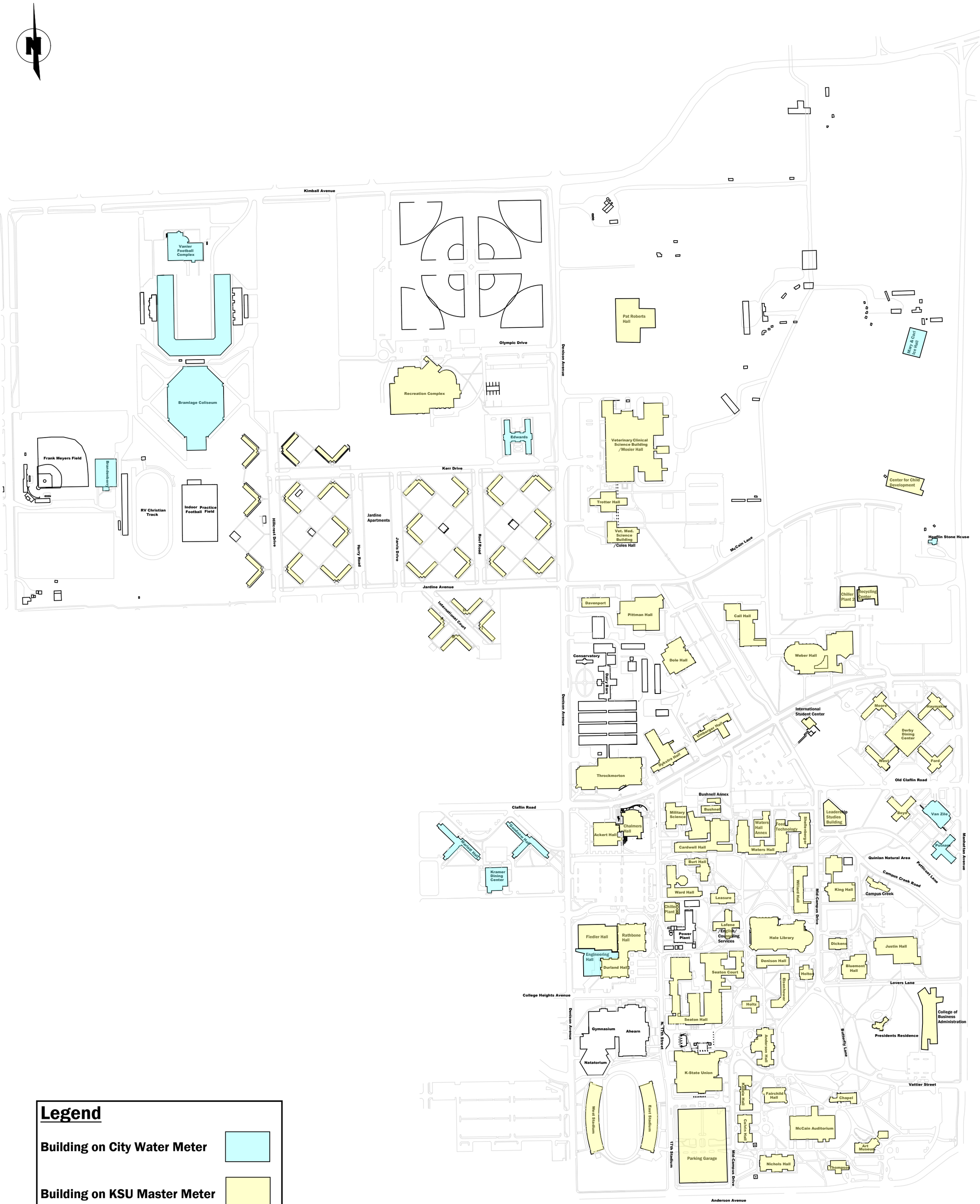
APPENDIX A
CAMPUS BUILDINGS WITH KSU METERS VS CITY METERS



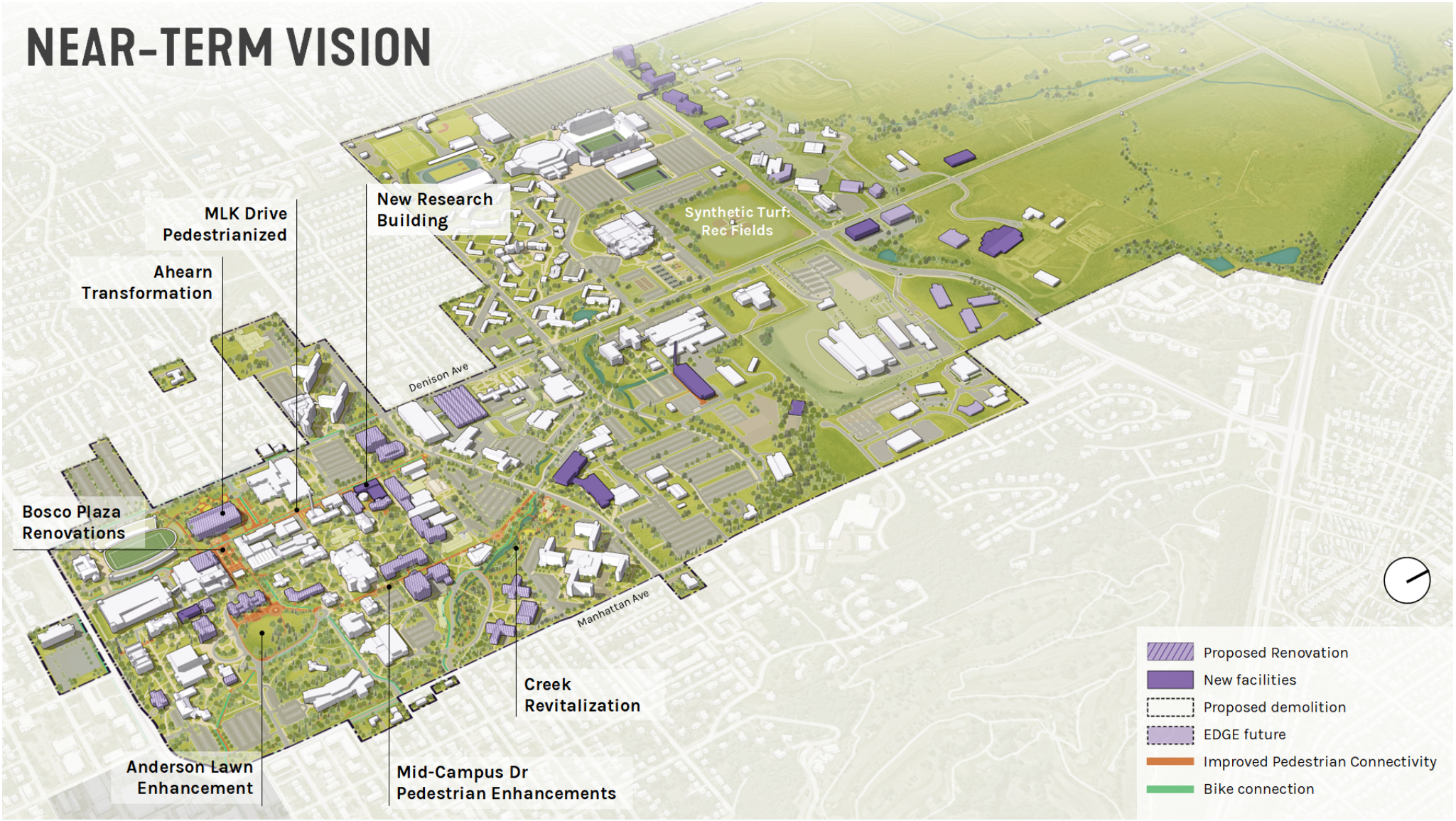
Legend

Building on City Water Meter

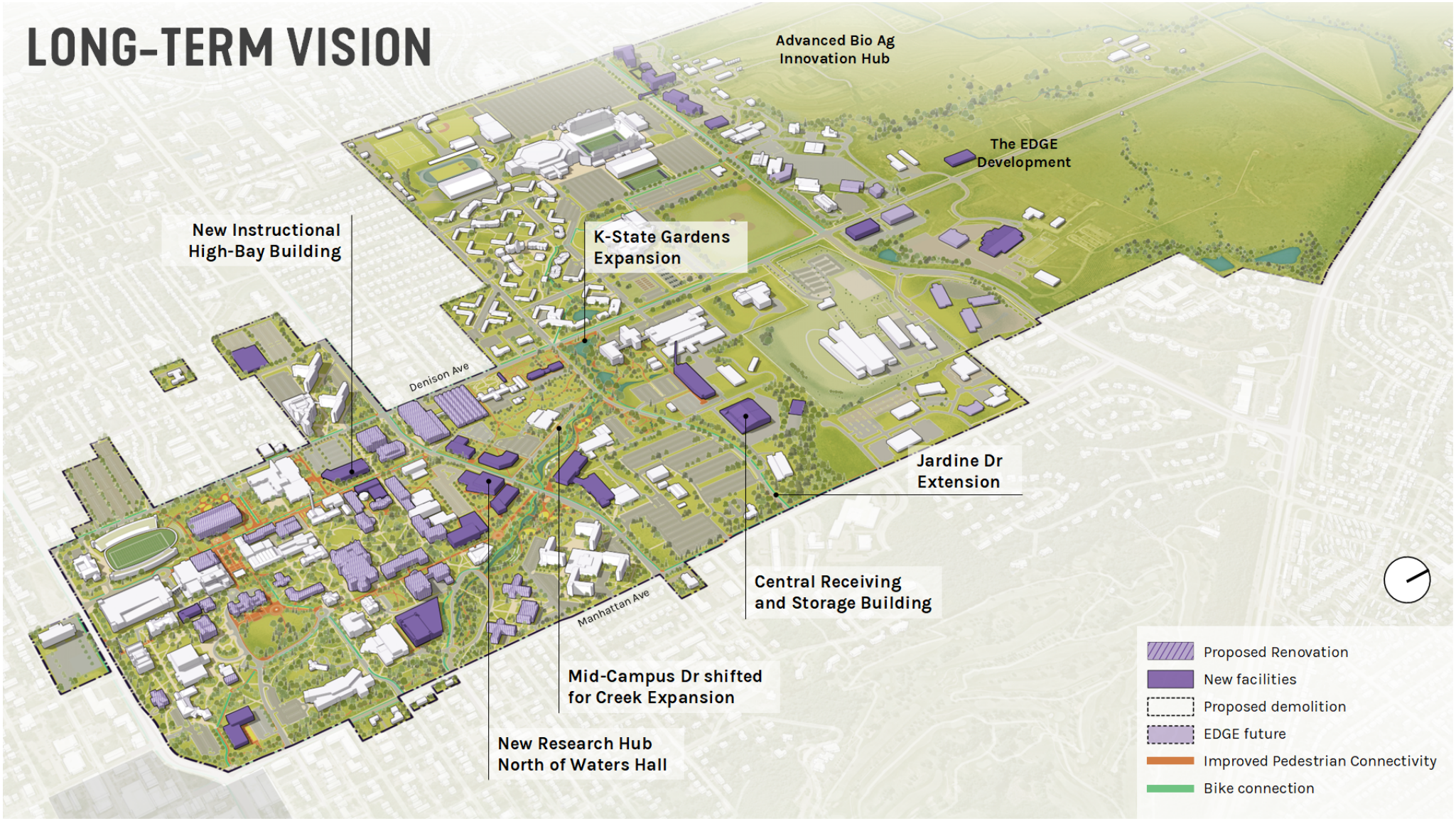
Building on KSU Master Meter

APPENDIX B
SMITHGROUP PLANNED CAMPUS RENOVATIONS

NEAR-TERM VISION



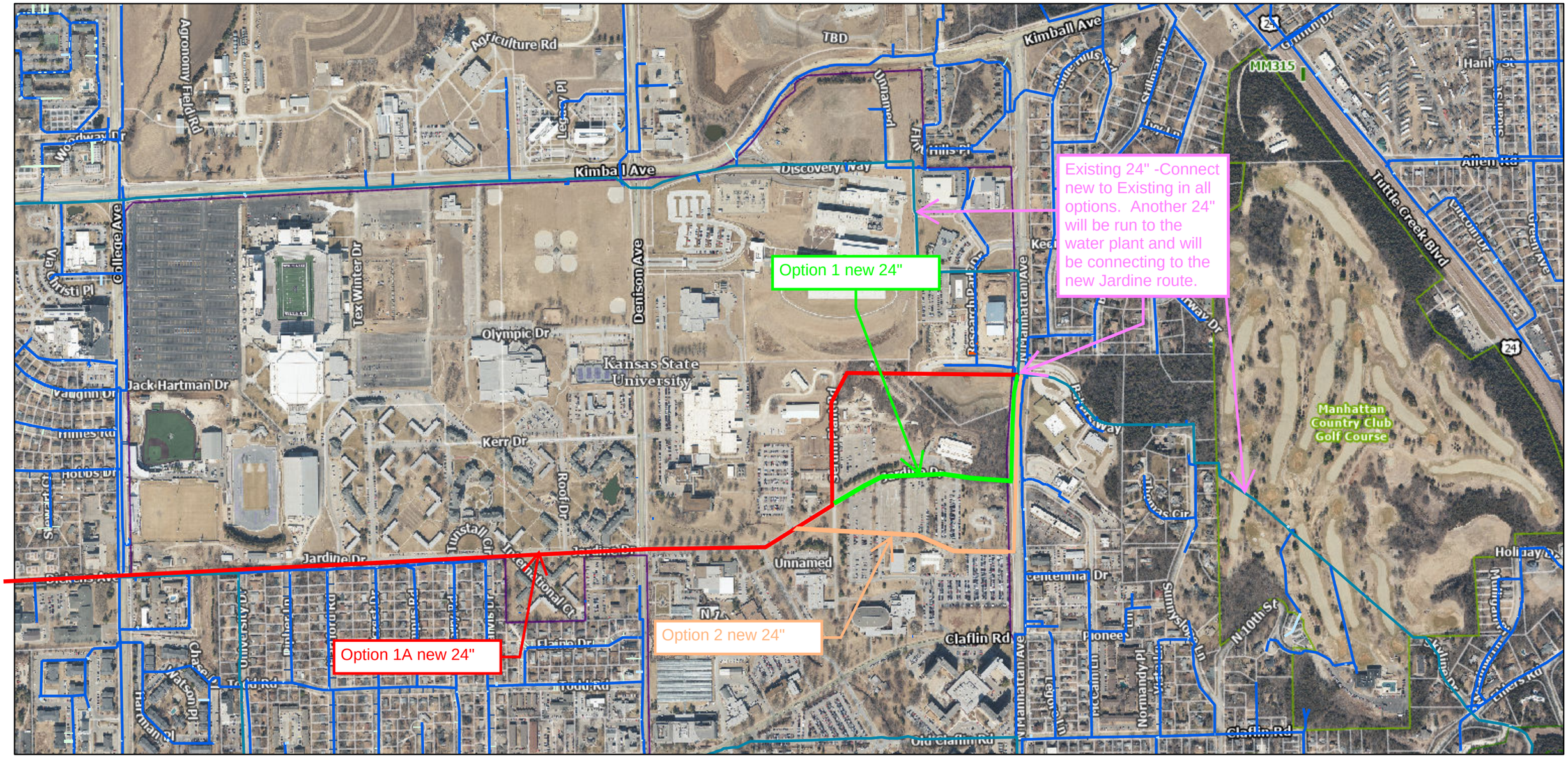
LONG-TERM VISION




Storage
55,000
High-Bay
Research
82,500
Research
62,000
Garden Expansion
15,000
Vet Med
Diagnostic Lab
52,000
Nuclear
Research
50,000
Research
75,000
Academic
13,000
Research
78,000
Research
130,000
Storage
15,000
Storage
75,000
Global Center
115,500
Research
132,000
Parking Deck - 100,000
Wellness Building - 120,000
Performing Arts
70,000

APPENDIX C
NEW 24-INCH CITY WATER MAIN EXHIBIT

New 24" Water Transmission options



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KANSAS STATE UNIVERSITY
WATER SYSTEM MASTER PLAN

Manhattan, Kansas

August 2025

Olsson Project No. 023-06090

KANSAS STATE UNIVERSITY®

STORMWATER SYSTEM

TECHNICAL MEMO

To:	Rafael Murillo Smithgroup
From:	Brad Schleeter, P.E.
RE:	Kansas State University Master Plan Update – Stormwater System
Date:	August 8, 2025

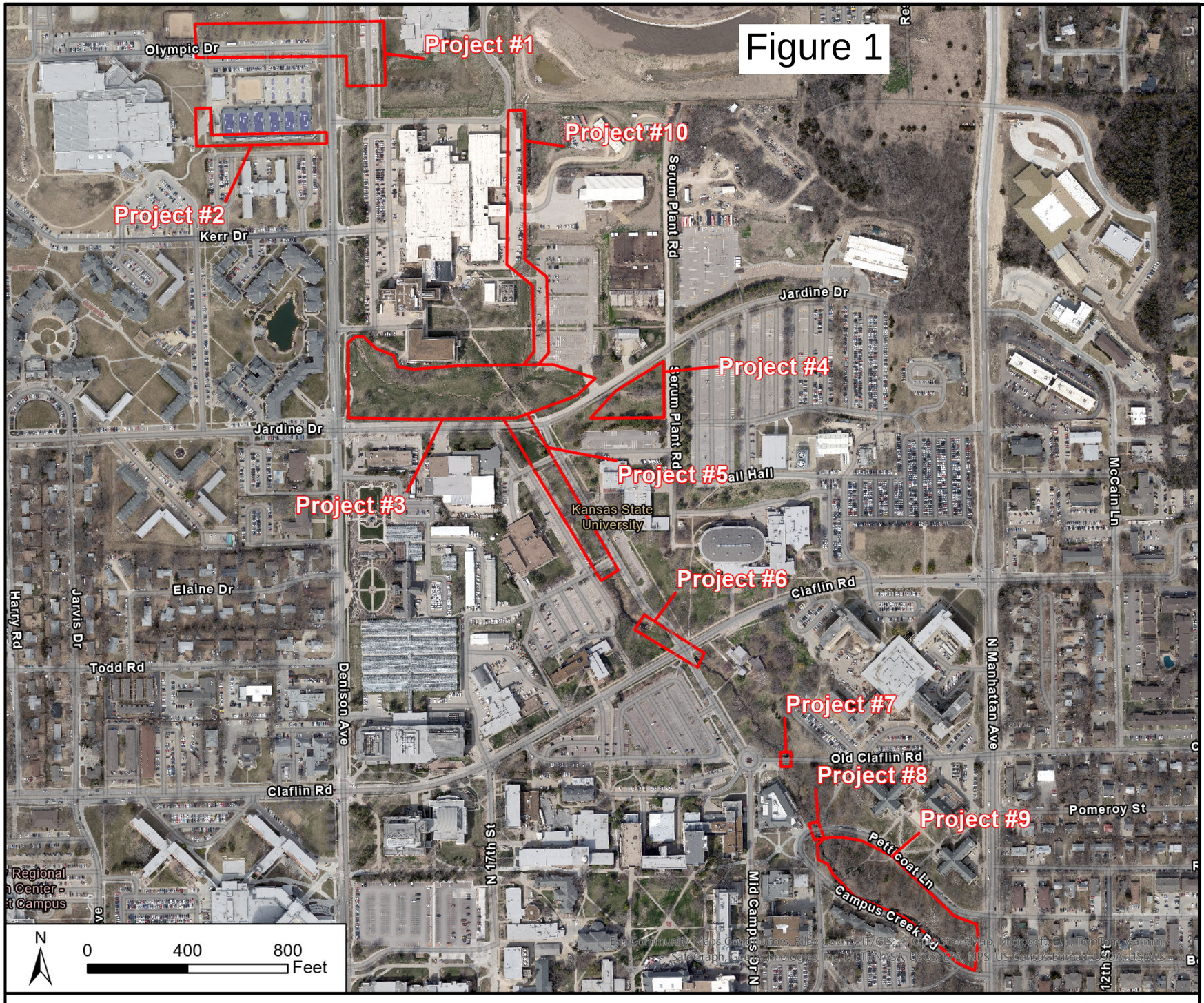
1. Introduction

The most recent campus-wide stormwater system review was part of the 2025 Kansas State University (KSU) Master Plan Update, titled Stormwater System Final Report (BG Consultants, 2013). This report documented the existing campus stormwater system (including historic flooding and field survey to identify main system characteristics), analyzed existing system pipe and detention storage capacity, and recommended improvement projects aimed at addressing known flooding and storm sewer system capacity issues. A total of 20 storm system improvement projects were identified in the 2013 report, including 10 capital improvement projects and ten additional storm system upgrade projects. Concept cost estimates for each of the improvement projects were also included.

The stormwater system related scope of the current campus master plan includes reviewing the 2013 report, speaking with Kansas State University Division of Facilities staff to identify which improvement projects have been completed and determine the highest priority projects moving forward, and provide updated 2013 concept cost estimates to 2024 costs. Each of these stormwater system task items are discussed below.

2. Review of 2013 Stormwater System Final Report

The 2013 Stormwater System Final Report was reviewed for this master plan update to understand the scope and type of stormwater system improvements being proposed. The 2013 report performed hydrologic and hydraulic modeling to determine existing system capacity, flood impacts, and conceptual sizing of system capacity and detention improvements. A total of 10 system improvement projects were identified in this report. These projects are all located in the Campus Creek watershed and are located directly along Campus Creek or its major tributaries. Figure 1 shows the locations of the ten system improvement projects along with a brief description of each project. The cost estimates included on this exhibit with each project are from the 2013 report. See below for updated conceptual cost estimates for each project.



Project Descriptions from 2013 Stormwater System Report

Project #1 - REC CENTER DIVERSION AND PAT ROBERTS HALL DETENTION. Tie in 950 LF of 36" RCP to existing area inlet south of the rec fields. 2013 Cost Estimate: $240,000

Project #2 - TENNIS COURT DIVERSION. Pipe 2-P-05 is currently 279% over maximum capacity and would be 204% over with Project #1. Construct a 30" RCP diversion around the south side of the tennis courts. Split flow approximately 50/50 from 2-P-05 at area inlet junction box just west of tennis courts. This project makes replacement of 2-P-05 unnecessary, a very favorable prospect with the recent renovations to the tennis courts. 2013 Cost Estimate: $110,000

Project #3 - MOSIER HALL DETENTION FACILITY EXPANSION. Detention pond designated 2-R-06 can be maximized to increase capacity from 12 Ac-Ft to 18 Ac-Ft of runoff. 2013 Cost Estimate: $360,000 (min)

Project #4 - NEW CALL HALL DETENTION. The area directly north of Call Hall has the potential for a new detention facility. It is recommended that 2-P-40, currently a (2)4'x2' CMAP, be replaced at a lower flowline with a single 36" RCP. This would be easy to accomplish with Project #3 but is still possible without it. Additionally, pipes 2-P-38 and 2-P-39 should be replaced with 3'x2' and (2)3'x2' RCAP's, respectively. Creates approximately 2.5 Ac-Ft of maximum storage volume. 2013 Cost Estimate: $285,000

Project #5 - MID CAMPUS DRIVE OPEN CHANNEL. Converting 805' of (2)4'x4' RCB (2-P-46 and 2-P-47) and (2)70"x48" CMAP (2-P-49 and 2P-52) to open channel. Existing parking lot would be removed with this project. The new channel adds 3.0 Ac-Ft of storage to the existing downstream open channel section (2-R-10). Pipes 2-P-45 and 2-P-48 require extensions to reach the new open channel. Pipe 2-P-42 will be replaced with a (2)5'x4' RCB. 2013 Cost Estimate: $610,000

Project #6 - CLAFLIN RD STRUCTURE REPLACEMENT. Replace existing 2-P-62, a (2)6'x4' CMAP, with a (2)5'x5' RCB. 2013 Cost Estimate: $320,000

Project #7 - OLD CLAFLIN RD STRUCTURE REPLACEMENT. Replace existing 2-P-67, a 9'x6' RCB, with a (2)6'x5' RCB. 2013 Cost Estimate: $90,000

Project #8 - PETTICOAT LN STRUCTURE REPLACEMENT. Replace existing 2-P-70, a 12'x5' Arch Bridge, with a (2)10'x6' RCB. 2013 Cost Estimate: $140,000

Project #9 - CAMPUS CREEK RD DETENTION EXPANSION. Reconstruct the concrete flume on open channel section (2-R-14). Connect the detention basin inlet and outlet flowlines on a straight grade. A pedestrian path in this area must be considered during design. By maximizing this detention, the storage can be increased by 7 Ac-Ft at full capacity. 2013 Cost Estimate: $400,000

Project #10 - VETERINARY MEDICINE RCB. Discretionary project associated with potential build-out for Veterinary Medicine east of Mosier Hall. Construct a 1,110' long (2)5'x5' RCB. The estimated max capacity for the (2)5'x5' RCB is 460 cfs. It is recommended that the conditions from the NBAF site be completely understood for optimizing the size of this proposed RCB. 2013 Cost Estimate: $860,000

Project #11 - UPSIZING OTHER EXISTING DEFICIENT PIPES. Split up into 10 projects with a total 2013 cost estimate of $1,695,000

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2013 Stormwater System Report

Recommended Project Locations and Descriptions

Kansas State University
06/20/24
Manhattan, KS

In addition to the 10 system improvement projects discussed above, ten localized storm sewer system capacity improvement projects were also identified through the analysis performed. The storm sewer improvement projects address localized system capacity issues. Updated conceptual cost estimates for each of these projects are also presented below.

From conversations with Division of Facilities staff, none of the system improvement projects or localized storm sewer system capacity improvements have been completed since the 2013 report. Streambank stabilization work in the Project #9 area along Campus Creek has been completed, but these improvements did not construct the proposed detention in this area. In addition, this same project extended the reinforced concrete box culvert at the downstream end of Project #9 further north to accommodate a roundabout at Campus Creek Road and Petticoat Lane. The extension of the existing box culvert (double 7-foot-by-4-foot) does not provide any additional system capacity as the storm sewer system capacity restrictions east of Manhattan Avenue (double 4-foot-by-5-foot box culvert) still exist. While a project to increase the system capacity at Manhattan Avenue is identified as a capital improvement project by the City of Manhattan, Kansas, this project is currently not funded or programmed at this time.

Construction drawings from the City of Manhattan's Manhattan Avenue, Campus Creek Road & Bayberry Lane Infrastructure Improvements project are included as Exhibit 1 in Appendix A.

3. Priority Improvement Projects Moving Forward

Based on feedback from Division of Facilities staff and our assessment of the projects identified in the 2013 report (see Figure 1), the following projects are identified as those with the greatest potential to address system capacity and flooding issues within the Campus Creek system. A discussion about each priority project or group of projects is provided below.

Project #3 – Mosier Hall Detention Facility Expansion

The expansion of the existing Mosier Hall detention facility is identified as Project #3 in the 2013 report. An additional 6 acre-feet of flood storage is proposed to be added to this existing detention area. Of all the detention improvements identified in the 2013 report, Project #3 proposed the greatest increase in overall detention storage, and it's located immediately upstream of the Campus Creek system capacity and flooding issues, making it an improvement project with a high potential for downstream capacity and flood reduction benefit.

In addition to the stormwater system improvements at this location, the university has a KSU Gardens Master Plan that covers the Project #3 area, specifically Phase III of this master plan, which identifies an extensive plan for park improvements including pedestrian trails and viewpoints, native woodland restoration, and wetland feature amenities. Division of Facilities staff has indicated that there are ongoing stream erosion issues within the project area. The Project #3 area provides a tremendous opportunity to incorporate additional detention storage to address downstream system issues, implement the Phase III of the KSU Gardens Master Plan, and

address ongoing stream erosion issues at this site. A graphic showing the KSU Gardens Master Plan is attached as Exhibit 2 in Appendix A.

Project #5 – Mid Campus Drive Open Channel

Project #5 runs parallel to Mid-Campus Drive on the west side. The 2013 report indicates that the storm sewer system through this area is undersized and proposes to remove the pipe conveyance and excavate an open channel to provide increased conveyance and detention storage within the channel. The 2013 report indicates that the open channel would impact the parking on the west side of the channel to provide the proposed 3 acre-feet of storage. Division of Facilities staff have indicated that losing this parking space to construct a channel at this location is not an option. While it may not provide all the flood storage proposed in the 2013 report, it appears to be feasible to excavate most of this storage and incorporate a retaining wall along the existing parking strip to maintain the parking. A large block wall recently constructed along Campus Creek Road would be an example of this type of solution. This project is immediately upstream of several undersized road crossing culverts and the added detention would reduce the potential for overtopping at the road crossings.

Projects #6, #7, and #8 – Claflin Road, Old Claflin Road, and Petticoat Lane Structure Replacements

The 2013 report identifies all three of these roadway culverts as being undersized leading to roadway overtopping during significant rain events. As these three culvert crossings are in series, the reduction in roadway overtopping would only be fully realized once all three culverts are replaced.

Project #9 – Campus Creek Road Detention Expansion

Project #9 is at the very downstream end of the Campus Creek system on campus. Adding detention at this location would benefit both adjacent flooding and reduce the frequency of overtopping at Campus Creek Road and Manhattan Avenue. The university has recently completed improvements at the south end of this project area, extending the existing reinforced box culvert to accommodate a roundabout at the intersection of Campus Creek Road and Bertrand Street and stabilizing the streambank of Campus Creek that was threatening to undermine Campus Creek Road. A selection of plan sheets from this project are included in Appendix A for reference. Adding detention at this location would necessitate the removal of a significant number of trees at this location.

Of the proposed detention expansion projects proposed in the 2013 report, this would be less effective than most because it is located at the very downstream end of the Campus Creek system on campus. The University will need to weigh the benefit to reduced flooding with the construction of this project with the potential tree impacts required to construct the project.

4. Project Cost Updates

The concept cost estimates from the 2013 report are over 10 years old and need to be updated if they are to be used for planning purposes by the university. Through a combination of cost escalations using the Engineering News-Record (ENR) Construction Cost Index (Engineering News-Record, 2025) and current construction bid prices from the region, the 2013 report concept costs were updated to current 2025 dollars. The cost items and quantities of those items were not changed from the 2013 report, only the unit prices for the cost items were updated. The effort to update costs included the following:

- For lump sum bid items, items bid per each where the quantity is unknown, or bid items with multiple elements wrapped into a single item where quantities could not clearly be identified, the 2013 unity prices were multiplied by a cost escalation factor from the ENR index, as follows:

    - March 2013 ENR Construction Cost Index Value = 9,456
    - July 2025 ENR Construction Cost Index Value = 13,893
    - **Cost Escalation Factor = 1.47**
- For bid items that could be compared to similar bid items on recently (within the last 18 months) bid projects from the region, the unit prices were updated to match an average bid price from one or more projects.

With these updates to unit prices and cost escalations, the concept cost estimates for the projects identified in the 2013 report are provided in 2025 dollars. Table 1 provides the 2013 cost estimate and updated 2025 cost estimate for each stormwater system improvement project included in the 2013 report. The percent change between these two costs and comments to explain the most significant cost increases with certain projects are also provided.

Table 1. 2013 Report Cost Updates.

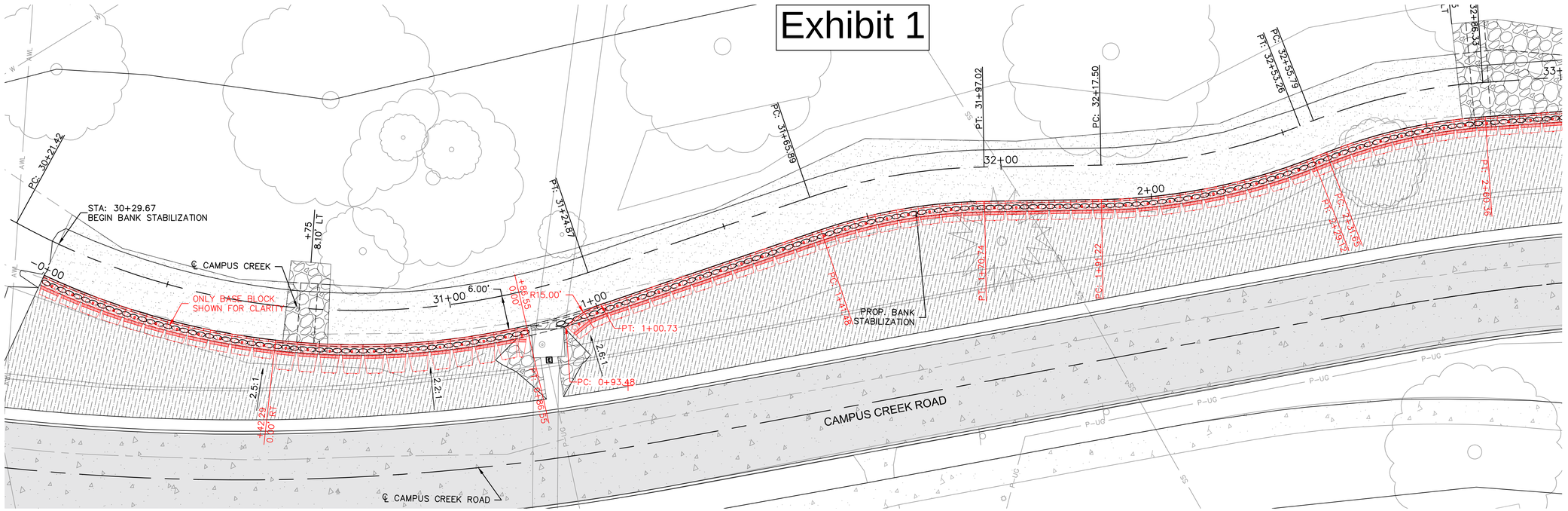
Project Number	Project Name	2013 Study Concept Cost	Updated 2025 Concept Cost	Percent Increase	Comments
1	Rec Center Diversion and Pat Roberts Hall Detention	$237,370	$406,991	71%	36” RCP unit price increased from $95/ft to $180/ft
2	Tennis Court Diversion	$108,500	$172,388	59%	Structure and pipe cost increases
3	Mosier Hall Detention Facility Expansion	$360,325	$859,691	139%	Excavation unit price increased from $10/CY to $30/CY
4	New Call Hall Detention	$284,326	$508,328	79%	Pipe and excavation cost increases
5	Mid Campus Drive Open Channel	$609,035	$962,835	58%	Pipe and excavation cost increases
6	Claflin Rd Structure Replacement	$317,450	$464,745	46%	ENR Index increase
7	Old Claflin Rd Structure Replacement	$92,400	$135,077	46%	ENR Index increase
8	Petticoat Ln Structure Replacement	$140,140	$205,743	47%	ENR Index increase
9	Campus Creek Rd Detention Expansion	$401,800	$847,501	111%	Excavation cost increases
10	Veterinary Medicine RCB	$858,200	$1,261,306	47%	ENR Index increase

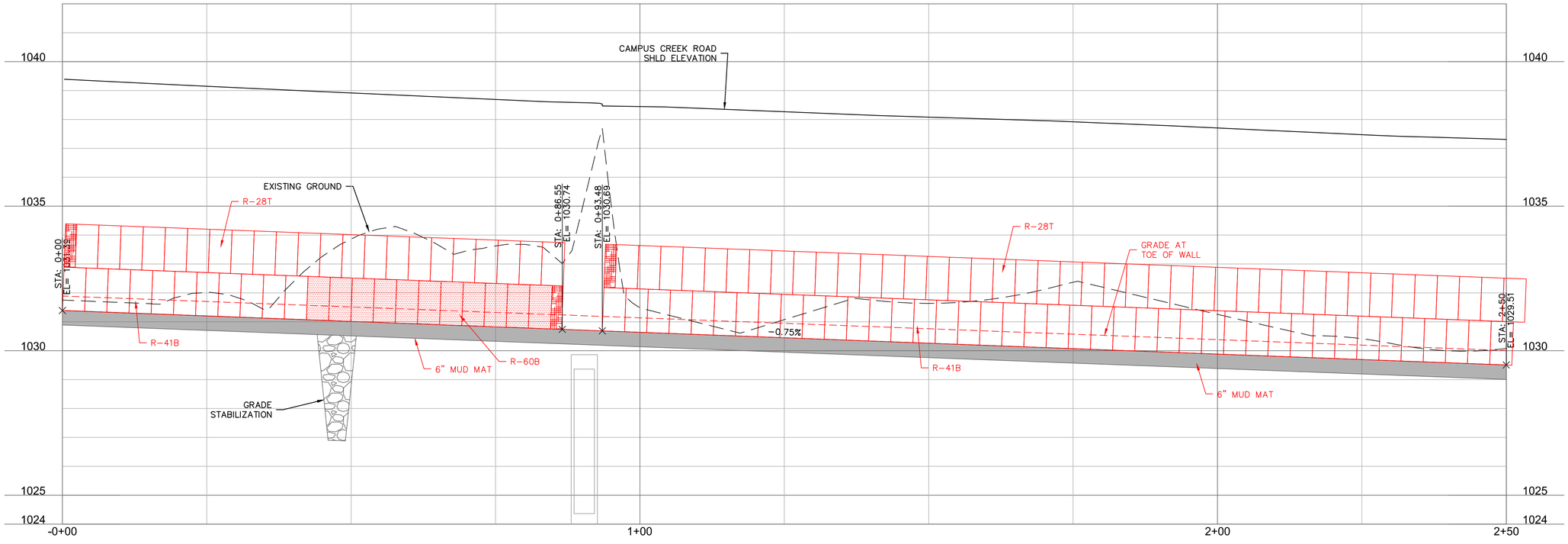
Table 2. 2013 Report Cost Updates Continued.

Project Number	Project Name	2013 Study Concept Cost	Updated 2025 Concept Cost	Percent Increase	Comments
Project 11: Upsizing Other Deficient Pipes					
11a	Kansas State Athletics Basin	$326,361	$515,433	58%	Pipe cost increases
11b	Campus Creek Basin - Rec Complex/Denison Corridor	$193,452	$449,224	132%	Pipe cost increases
11c	Campus Creek Basin - Denison Avenue/Jardine Drive Intersection	$95,648	$133,650	40%	ENR Index increase
11d	Campus Creek Basin - Serum Plant Road/Jardine Drive Intersection	$125,748	$194,886	55%	Pipe cost increases
11e	Campus Creek Basin - Throckmorton to Campus Creek	$365,792	$513,778	40%	ENR Index increase
11f	Campus Creek Basin - South Mid-Campus Drive/Old Claflin Road Intersection	$60,858	$94,986	56%	Pipe cost increases
11g	South Campus Basin - East Side KSU Indoor Practice Football Facility	$174,524	$279,276	60%	Pipe and removals cost increases
11h	South Campus Basin - West of KSU Union Parking Garage	$180,992	$262,343	45%	ENR Index increase
11i	South Campus Basin - Beach Art Museum	$56,518	$85,451	51%	Pipe cost increases
11j	South Campus Basin - North of Parking Lot West of Memorial Stadium	$81,193	$135,618	67%	Pipe and removals cost increases

Appendix A

Exhibit 1





0' 5' 10' 20'
SCALE IN FEET

4'
2'
1'
0'

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IAN ANDREW PALOUCEK
LICENSED
22924
KANSAS
PROFESSIONAL ENGINEER
12/12/23

REV. NO.	DATE	REVISIONS DESCRIPTION
		REVISIONS

REDI ROCK WALL SUBMITTAL

MANHATTAN AVENUE, CAMPUS CREEK ROAD & BAYBERRY LANE IMPROVEMENTS

2023

MANHATTAN, KANSAS

drawn by:
checked by:
approved by:
QA/QC by:
project no.:
drawing no.:
date:

SHEET
2

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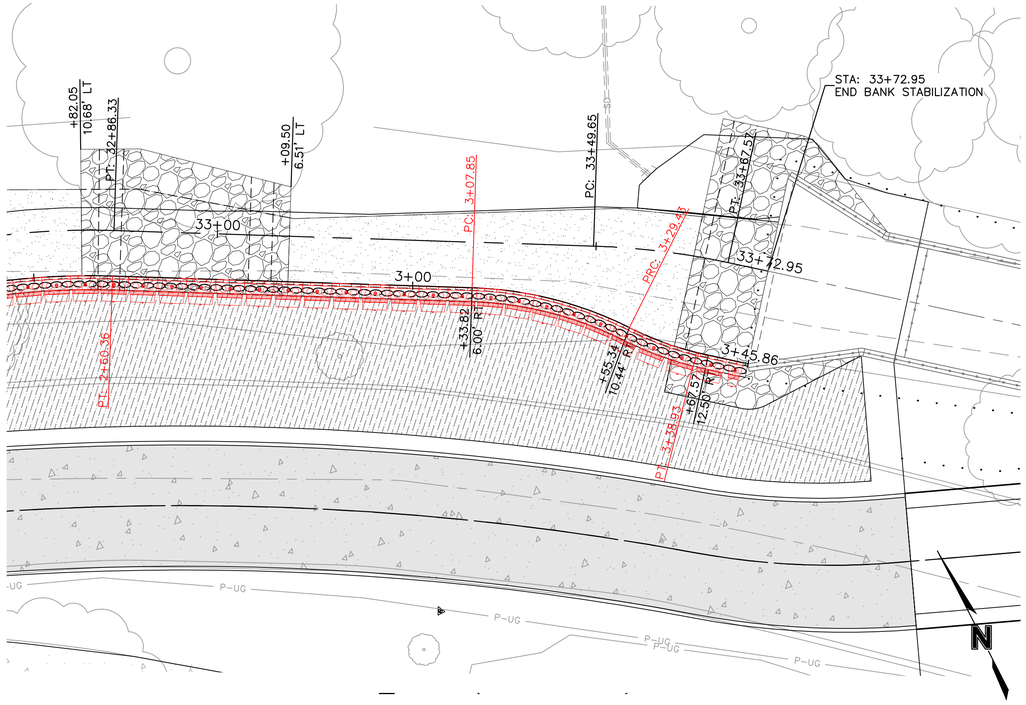
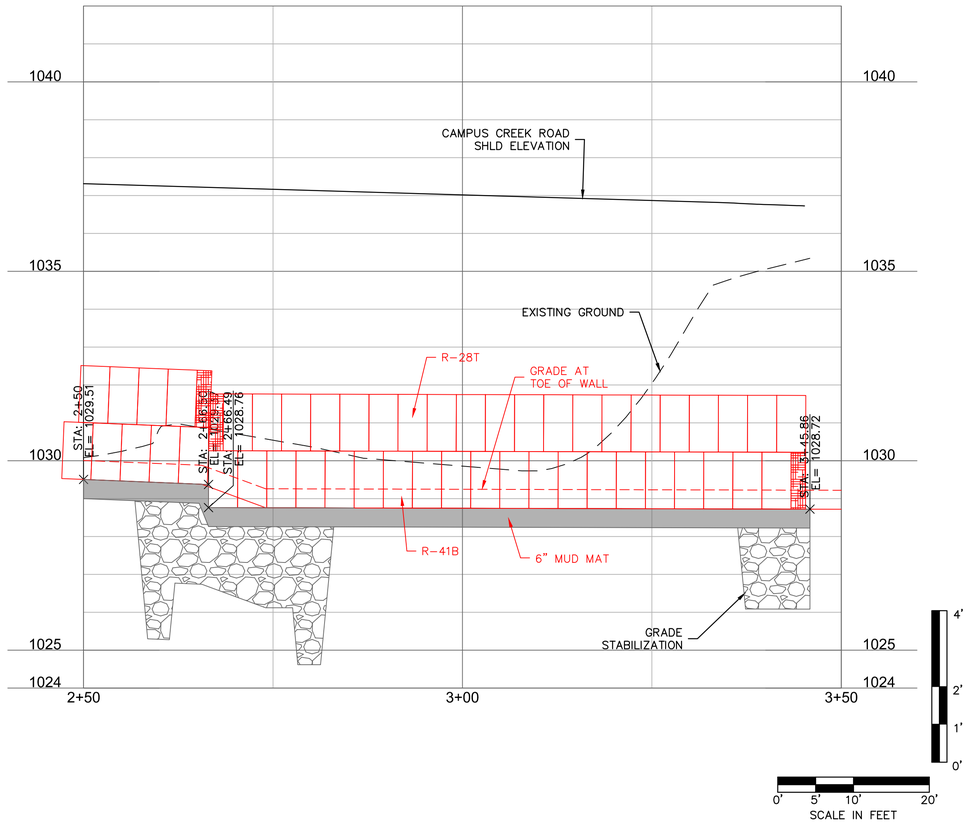
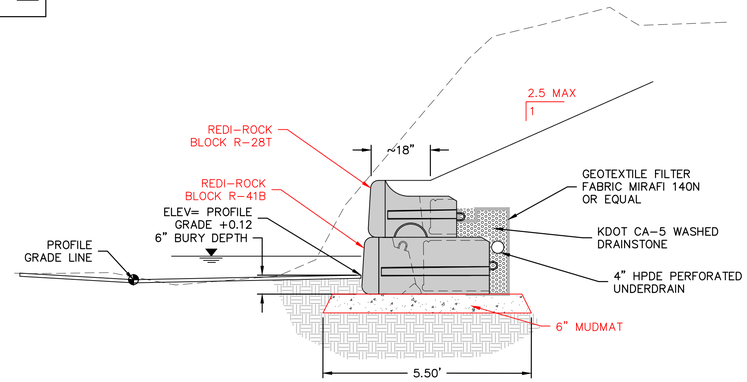
Exhibit 1







REDI-ROCK GRAVITY RETAINING WALL
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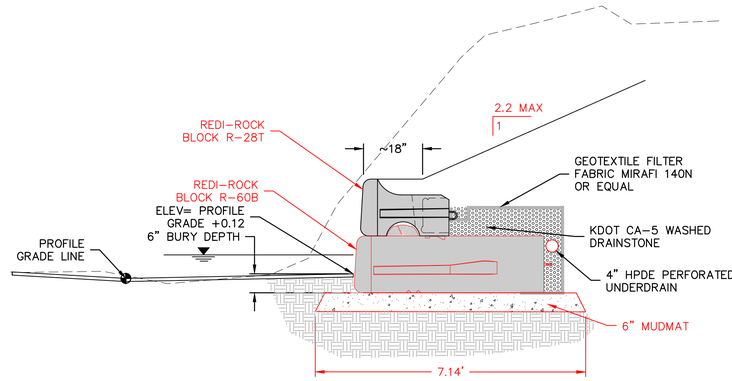
41" BASE UNIT



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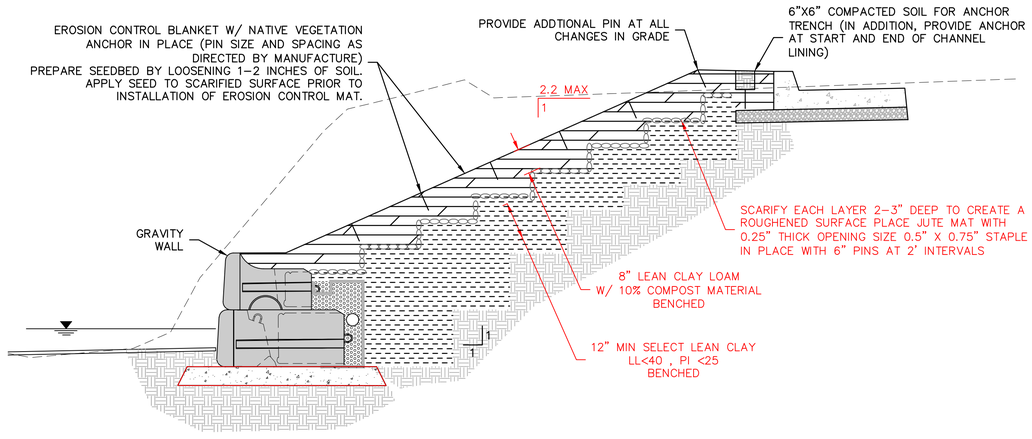
60" BASE UNIT



SLOPE STABILIZATION

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KANSAS
PROFESSIONAL ENGINEER
12/12/23

REV. NO.	DATE	REVISIONS DESCRIPTION
		REVISIONS

REDI ROCK WALL SUBMITTAL

MANHATTAN AVENUE, CAMPUS CREEK ROAD
& BAYBERRY LANE IMPROVEMENTS

2023

MANHATTAN, KANSAS

drawn by:
checked by:
approved by:
QA/QC by:
project no.:
drawing no.:
date:

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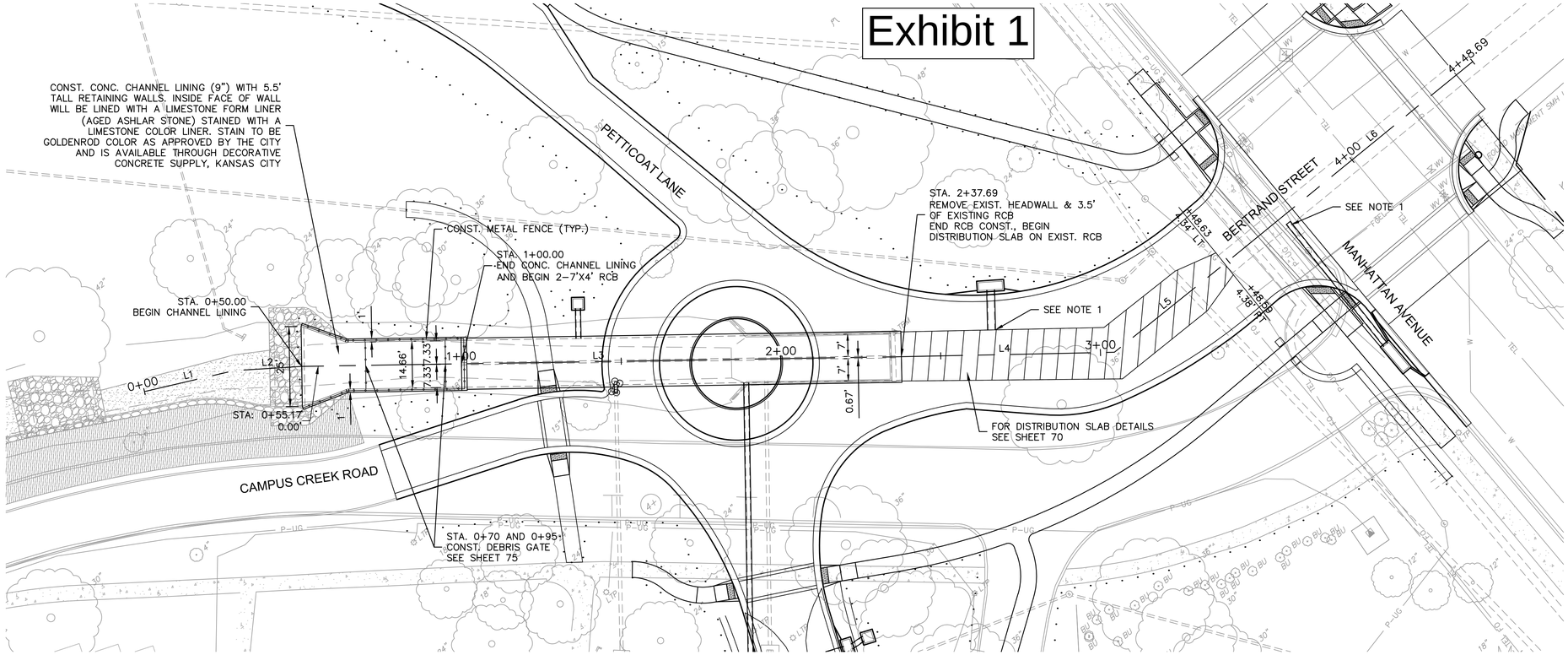
Exhibit 1

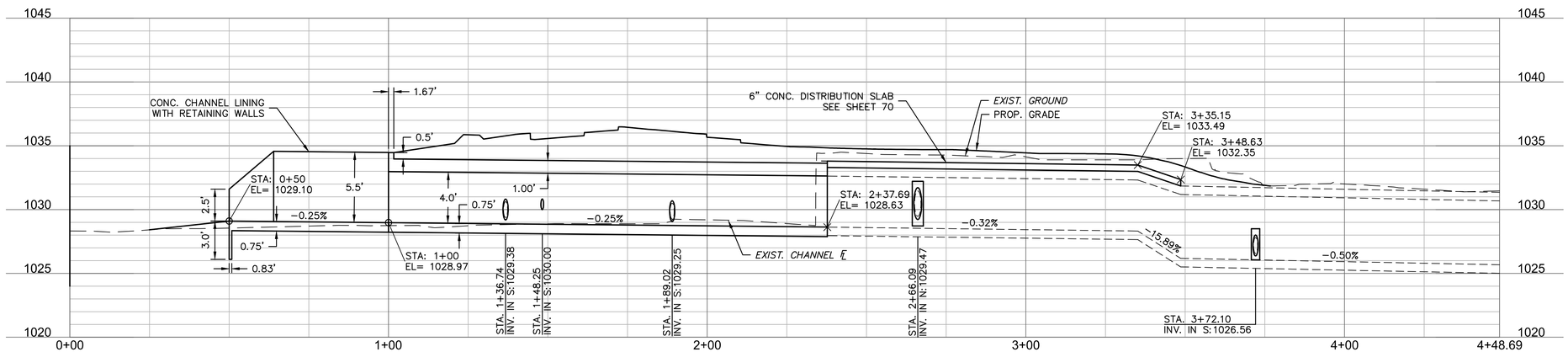


NOTE 1:

PROVIDE A FORMED CONCRETE WALL REPAIR AROUND THE PIPE PENETRATIONS NEEDED INTO THE EXISTING WALLS. LOCATION AND LIMITS SHALL BE FIELD VERIFIED, EXTEND NO MORE THAN 6" BEYOND CIRCUMFERENCE OF PIPE, AND SHALL NOT BRIDGE ACROSS AN EXPANSION OR CONTROL JOINT. INTENTIONALLY ROUGHEN THE EXISTING FACES OF THE PROPOSED CONSTRUCTION JOINT TO ¼" AMPLITUDE. INSTALL 1-#5 HORIZONTAL ANCHOR WITH AN APPROVED EPOXY-RESIN ANCHOR SYSTEM USING A 6" MIN. EMBED. AND 12" EXTENSION INTO THE PROPOSED REPAIR AT CENTER OF WALL IN EACH CORNER. TRIM ANCHORS AS REQUIRED TO MAINTAIN 1.5" MIN. CLEARANCE AROUND PIPE. CONCRETE SURFACES SHALL BE CLEANED, FREE OF LAITANT OR LOOSE MATERIAL, AND DAMPENED PRIOR TO POURING NEW CONCRETE. WALL REPAIR MATERIAL SHALL BE GRADE 4.0 CONCRETE. ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT THE PIPE PENETRATIONS INTO THE EXISTING STRUCTURE SHALL BE CONSIDERED SUBSIDIARY TO OTHER ITEMS. NO SPECIAL MEASUREMENT OR PAYMENT WILL BE MADE.

DUAL 7'x4' RCB EXTENSION									
NO.		STATION	NORTHING	EASTING	LENGTH	LINE/CHORD BEARING	DELTA	TANGENT	RADIUS
L1		0+00.00 0+28.85	315721.4900 315708.4522	1715483.3924 1715509.1231	28.85'	S63°07'43"E			
L2		0+28.85 0+50.00	315708.4522 315695.8786	1715509.1231 1715526.1355	21.15'	S53°31'57"E			
L3		0+50.00 2+35.86	315695.8786 315578.7319	1715526.1355 1715670.4262	185.86'	S50°55'39"E			
L4		2+35.86 3+04.35	315578.7319 315535.7970	1715670.4262 1715723.7886	68.49'	S51°10'49"E			
L5		3+04.35 3+48.59	315535.7970 315534.8059	1715723.7886 1715768.0220	44.24'	S88°42'59"E			
L6		3+48.59 4+48.69	315534.8059 315533.3399	1715768.0220 1715868.1042	100.09'	S89°09'39"E			

DUAL 7'X4' RCB EXTENSION



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City of Manhattan Kansas

REV. NO.	DATE	REVISIONS DESCRIPTION

REVISIONS

DUAL 7'X4' RCB EXTENSION PLAN & PROFILE

MANHATTAN AVENUE, CAMPUS CREEK ROAD & BAYBERRY LANE IMPROVEMENTS

2023

MANHATTAN, KANSAS

drawn by: AKU
checked by: PBM
approved by: PBM
QA/QC by: PBM
project no.: 019-1873
drawing no.: RCB_PP01_0191873
date: 06/07/2023

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69 OF 167

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Exhibit 2

Kansas State University Gardens
MASTER PLAN

1. Visitor Center Garden
2. Conservatory Garden
3. Alumni Garden
4. Woodland Garden
5. Pocket Garden
6. Poison Plant Garden
7. Sensory Garden
8. Prairie Garden
9. Wetlands Garden
10. Children's Garden

KANSAS STATE UNIVERSITY®

CHILLED WATER SYSTEM

Chilled Water

Chilled water is produced from two separate chilled water plants and distributed to buildings on campus. Chilled Water Plant 1 (CWP1) has five chillers arranged for primary-secondary distribution while Chilled Water Plant 2 (CWP2) has two chillers arranged for variable primary distribution. CWP1 is generally base loaded and the output of CWP2 is varied to meet the campus chilled water demand. Each plant utilizes York YK electric driven centrifugal chillers with R134a refrigerant and variable frequency drives for capacity control. Ratings and operating conditions for each chiller are listed in Table 1 below. Total installed chiller capacity is 11,750 tons with an actual capacity of 11,214 tons due to derating of chillers 102, 103 and 104 for reduced delta-T. Firm capacity, defined as the installed capacity minus the capacity of the largest capacity chiller is 8,289 tons when accounting for the delta-T derate of the three chillers in CWP1.

Table 1: Campus Chiller Asset Table

KSU CHILLER SUMMARY									
LOC / TAG	YEAR OF INSTALL	RATED CAPACITY (TONS)	DERATED CAPACITY (TONS)	RATED DELTA-T (°F)	DESIGN CH. WATER FLOW (GPM)	DESIGN CH. WATER OUTLET TEMP (°F)	DESIGN CON. WATER FLOW (GPM)	DESIGN CON. WATER INLET TEMP (°F)	NOTES
Chiller Plant #1									
CH101	2004	900	900	12	1,800	42	2,700	85	
CH102	2011	1,250	1,071	14	2,143	40	3,513	85	Derate for 12°F dT
CH103	2011	1,250	1,071	14	2,143	40	3,513	85	Derate for 12°F dT
CH104	2011	1,250	1,071	14	2,143	40	3,513	85	Derate for 12°F dT
CH105	2014	1,250	1,250	12	2,490	40	3,750	85	
Chiller Plant #2									
CH201	2015	2,925	2,925	12	5,826	40	8,775	85	
CH202	2015	2,925	2,925	12	5,826	40	8,775	85	
Installed Capacity		11,750	**11,214**						
Firm Capacity		8,825	**8,289**						Minus Largest Asset

Hourly MMBTU values observed for individual buildings on campus from June through September of 2022 and 2023 were collected and validated against manually recorded operating values at the plant level. Based on a review of this data, the current campus peak chilled water demand occurred during the summer of 2023 with a value of 6,700 tons. This peak is within the current firm capacity of the chilled water plants. Modeling of the campus chilled water network also indicates adequate pumping capacity and flow capacity within the distribution mains to meet the current peak chilled water demand. It is worth clarifying that recent improvements in data collection capabilities for building chilled water flows and temperatures were implemented in the summer of 2024 and were not available at the time of this report. Continued monitoring of building performance and campus peak chilled water loads would be recommended to verify continued operation within the firm capacity limits of available chillers and to identify additional opportunities for improvements within individual buildings.

Future changes in chilled water demand were evaluated from projections identified in the campus master plan and through discussions with staff members from the University. Table 2 provides a summary of projected changes in chilled water demand through 2050. For the purposes of this study, short-term projections would encompass demolitions, renovations, conversion or new additions expected on campus over the next five years and would generally be considered to have a higher degree of certainty for planning purposes. Long-term projections would cover changes expected beyond five years and the likelihood of implementation becomes less certain as time goes on.

Table 2: Projected Changes in Chilled Water Demand

YEAR	BUILDING	PROJECT TYPE	ADDITIONAL DEMAND (TONS)	CUMMULATIVE DEMAND (TONS)	PROBABILITY	REMARKS
2023	Baseline - Plant Level Metering			6,700		From 2023 plant level metering
2024	Baseline - Plant Level Metering			7,060		Projected increase from past data
2025	Global Food Center	New Build	800	7,860	High	
2025	Fairchild Hall	Conversion	175	8,035	High	
2025	Van Zile Hall (Strong Complex)	Conversion	350	**8,385**	High	
2026	Thompson Hall	Renovation	105	8,490	High	
2028	Vet Diagnostic Lab	Conversion	1100	9,590	High	
2030	Derby Food Center	Conversion	956	10,546	High	Independent chillers near end of life.
2030	Leasure Hall	Renovation	93	10,639	High	
2030	Ward Hall	Renovation	83	10,722	High	
2030	Weber Hall	Conversion	585	**11,307**	High	
2035	Ahearn Field House	Renovation	172	11,479	Medium	
2035	Campus Creek Complex	Renovation	83	11,562	Medium	
2035	Seaton Hall	Conversion	74	11,636	Medium	
2035	New Facility - North of Waters - Ph 1	New Build	320	**11,956**	Medium	
2040	Calvin Hall	Renovation	109	12,065	Medium	
2040	Dickens Hall	Renovation	62	12,127	Medium	
2040	Waters Hall	Conversion	239	12,366	Medium	Partial Conversion
2040	College of Veterinary Medicine	Conversion	2600	14,966	Medium	
2040	Willard Hall	Renovation	91	15,057	Medium	
2040	New Facility - North of Waters - Ph 2	New Build	319	**15,376**	Medium	
2050	General Richard B. Myers Hall of Military Science	Conversion	82	15,458	Low	
2050	New Facility - West of Ward	New Build	95	15,553	Low	
2050	New Facility - North of Seaton	New Build	635	16,188	Low	
2050	New Facility - North of Waters - Ph 3	New Build	319	16,507	Low	
2050	Waters Hall	Conversion	158	**16,665**	Low	

Figure 1 overlays the projected changes in chilled water demand against chiller capacities. The shaded bars represent the installed and firm capacities of available chillers, and the blue line represents the demand curve. Chilled water demand from 2017 to 2024 is based on normalized peak chiller loads observed at the plant level. Changes in chilled water demand from 2025 through 2050 are based on the incremental changes listed in Table 2. The additional loads expected from the Global Food Center, Fairchild Hall and Van Zile Hall in 2025 will increase the campus peak towards the firm capacity limit of the existing chillers. Further increases in campus chilled water loads will require additional chiller capacity to ensure a reliable source of cooling can be provided to the campus.

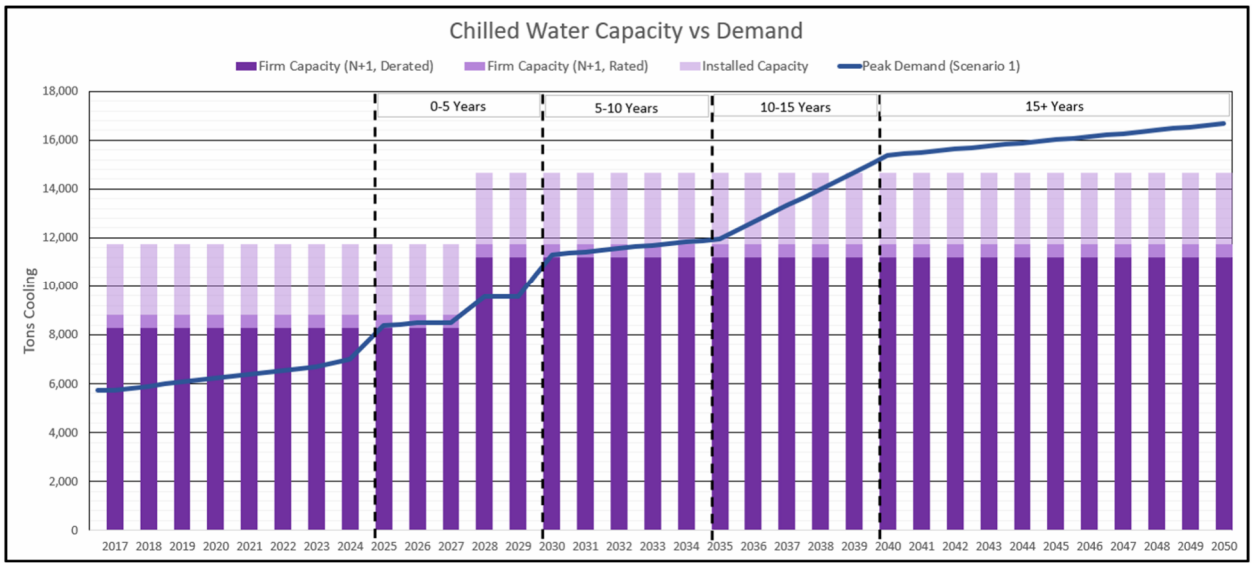

Figure 1: Peak Cooling Demand Projection

Based on the likelihood of the renovations and new buildings projected to be constructed over the next five years, it is recommended that the University budget for and proceed with the installation of a new chiller in CWP2. The original design of CWP2 included provisions for the installation of up to two additional chillers (nominal 2850-ton capacity), cooling towers and their associated pumps. At least one of these chillers will be required in the next five years and is shown in Figure 1 as the increased capacity in 2028. A second chiller or a thermal energy storage tank (as an option) should be planned for in the 5 to10 year timeframe pending any changes in the long-term projections for building loads or decommissioning of existing chillers. No significant changes to the chilled water distribution network are expected to be required except for services to new buildings or renovated facilities requiring increased chilled water flow. The Vet Diagnostic Lab (VDL) and decommissioning of the existing chillers at the College of Veterinary Medicine will require further evaluation to determine the required line sizing and routing of new chilled water lines to these facilities.