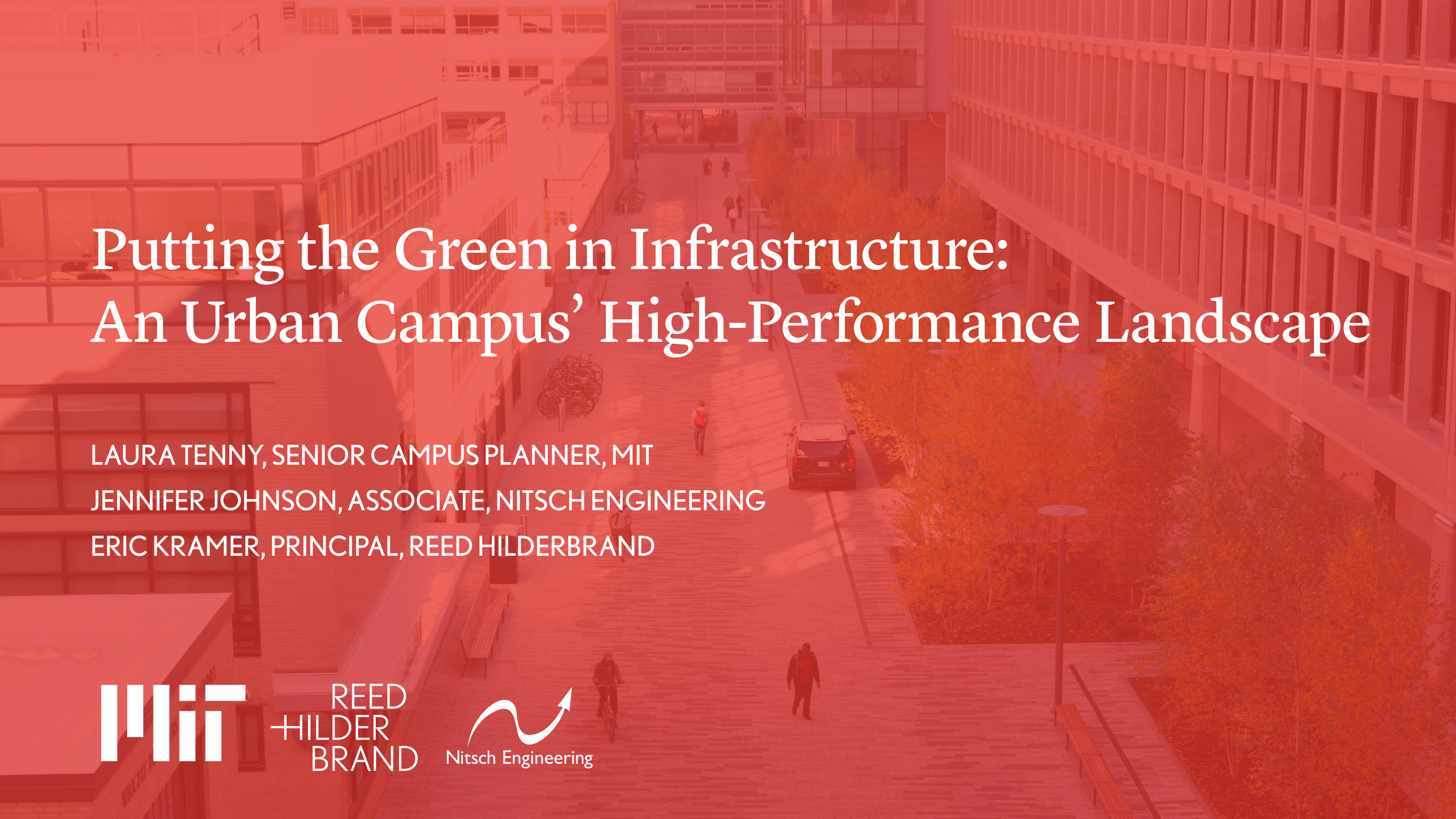


Putting the Green in Infrastructure: An Urban Campus' High-Performance Landscape

LAURA TENNY, SENIOR CAMPUS PLANNER, MIT
JENNIFER JOHNSON, ASSOCIATE, NITSCH ENGINEERING
ERIC KRAMER, PRINCIPAL, REED HILDERBRAND

REED HILDER BRAND

Nitsch Engineering

LEARNING OBJECTIVES

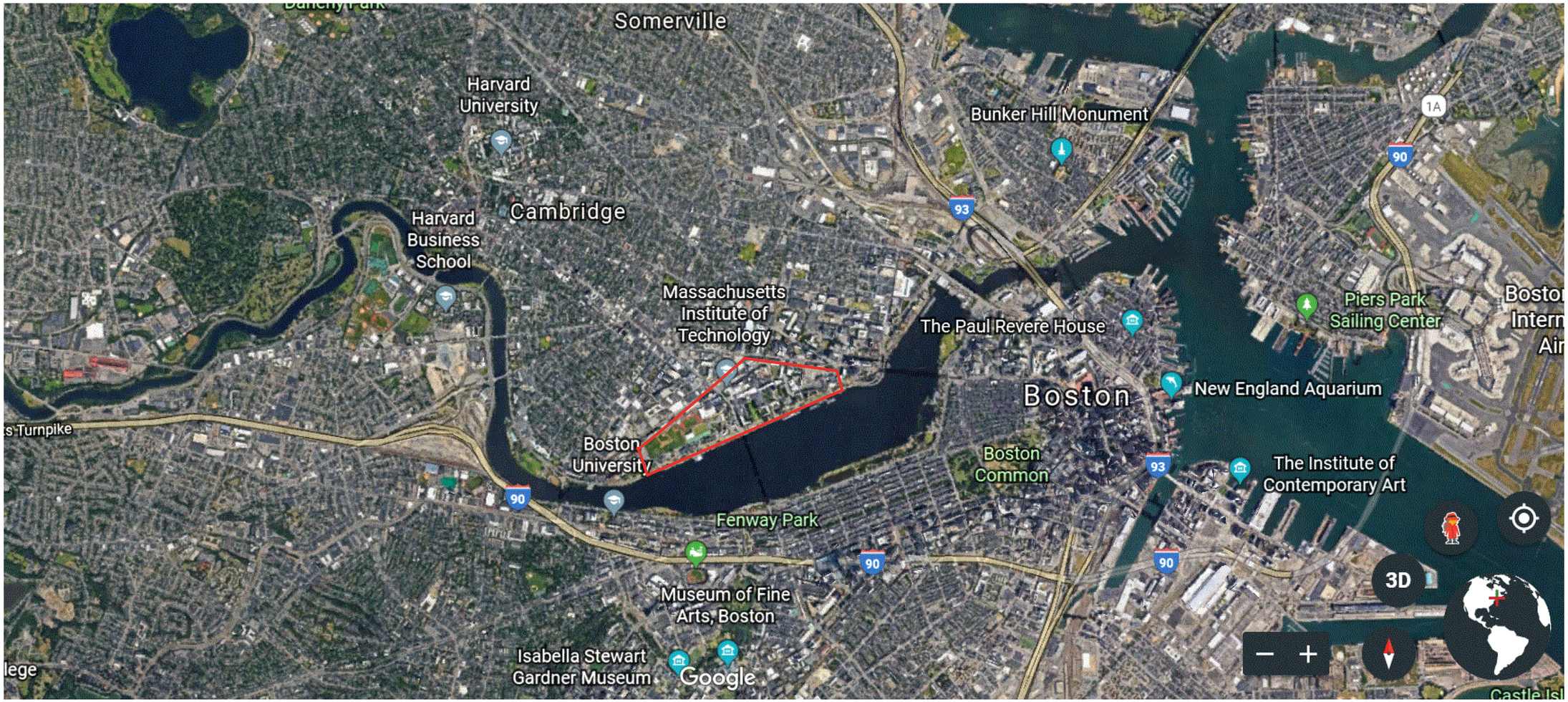
Demonstrate to leadership reasons to invest in green infrastructure by turning planning strategies into implementation projects that transform a community's perception of what is possible.

Integrate high-performance green infrastructure into the core of an urbanized campus where a dense web of existing utilities, limited open space, intensive programmatic requirements, active service for day-to-day institutional support, and ongoing construction all might limit success.

Unite the institution, design team, and contractor around a clear set of goals to develop an accelerated and flexible design and construction process that makes complex systems achievable with limited time and resources.

Apply innovative practices that mitigate flooding, treat stormwater, and support healthy plant communities and also function as common landscape elements that shape a vibrant hub for connectivity and student interaction.

INTRODUCTION



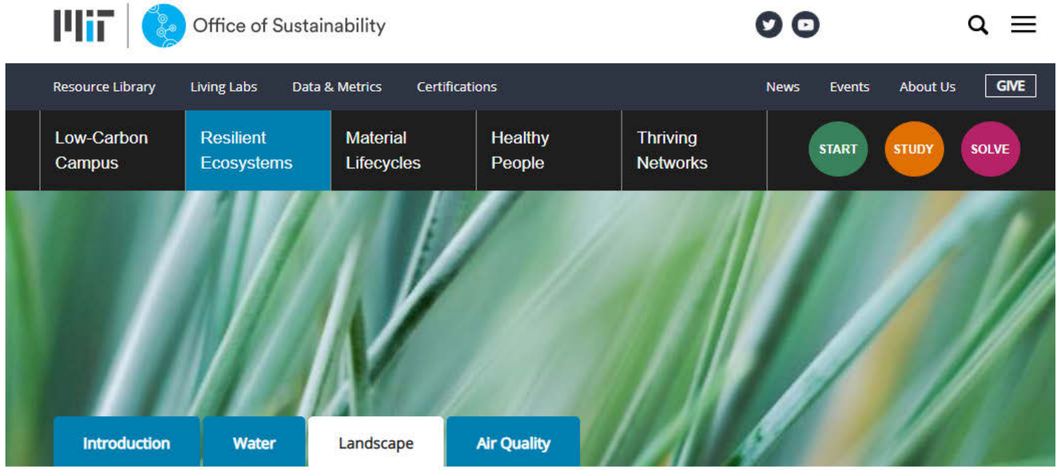
INSTITUTIONAL LEADERSHIP ON SUSTAINABILITY

MIT's mission: to advance knowledge in science and technology to serve the nation and world

Be a global leader in climate resiliency solutions

2016 MIT Plan for Action on Climate Change "to improve and advance our understanding of climate change and advance novel, targeted mitigation and adaption solutions"

Advance and demonstrate resiliency on our physical campus



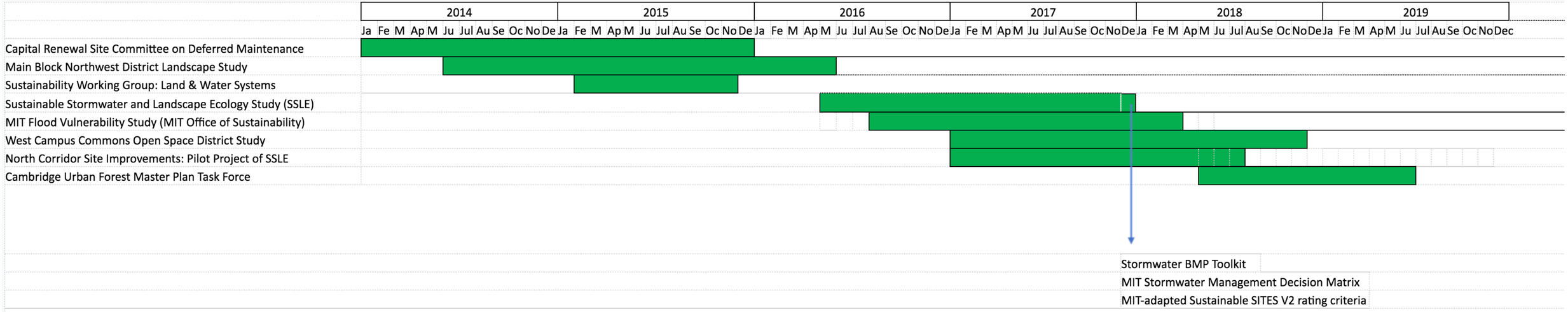
Designing a resilient, urban landscape

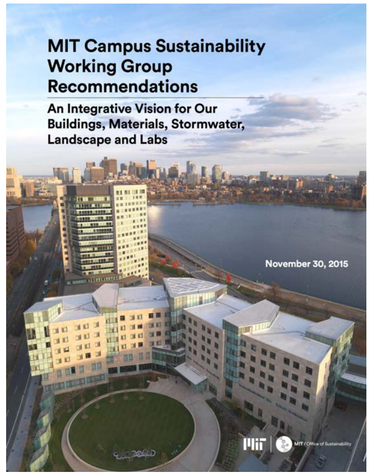
From a semi-industrial landscape to a densely populated center of innovation, our campus landscape has undergone dramatic evolution since MIT moved across the Charles River to Cambridge in 1916. Currently, approximately 64 percent of MIT's campus is composed of impervious surfaces, such as roofing and paving. Green spaces provide areas for recreation and habitats for local wildlife. They also clean the air by absorbing carbon dioxide and provide natural water management, actively mitigating the effects of climate change.

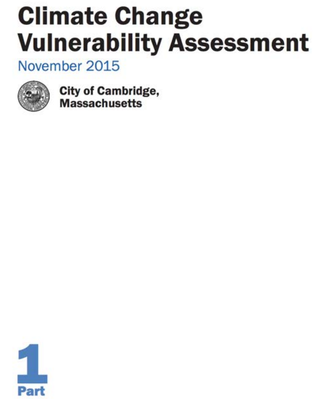
A CULTURE OF INNOVATION AND EXPERIMENTATION

Five years of MIT overlapping studies and projects – each effort building on the last and shaping the next

In the regional context of Cambridge and Boston as municipal leaders in climate change readiness







1 Part

The CCVA Report

A CULTURE OF INNOVATION AND EXPERIMENTATION

With the Charles River Lower Basin a shared resource and regional recreational destination

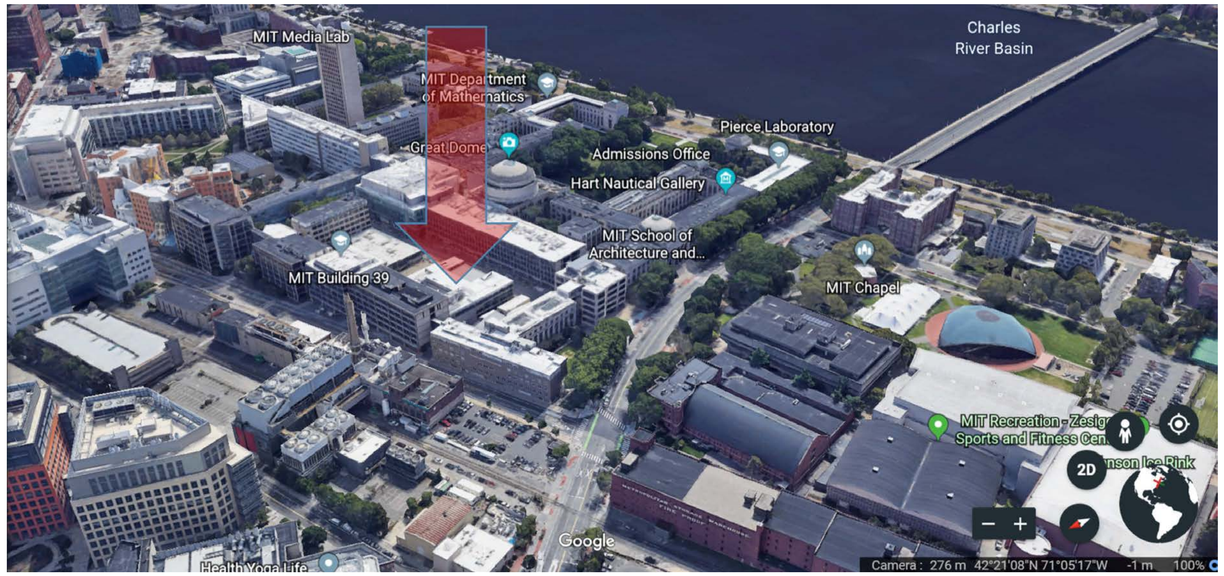
DEFINING RESILIENCY FOR AN URBAN CAMPUS

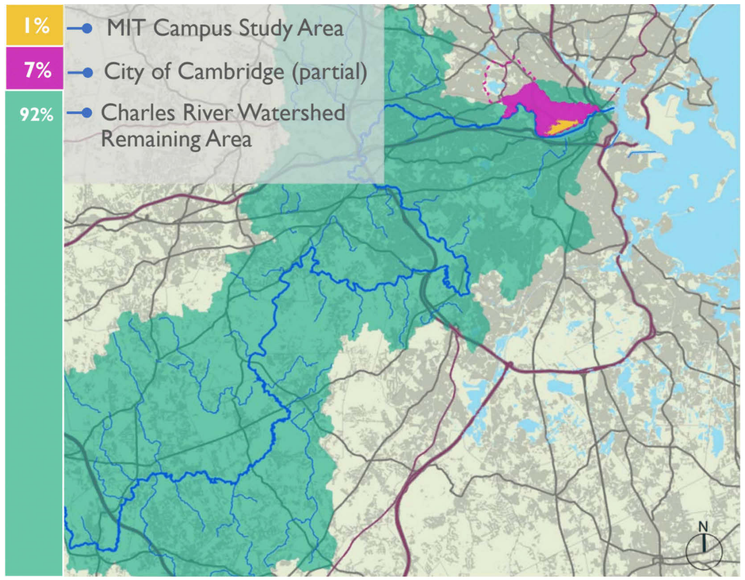
MIT enjoys a prominent location fronting 1.5 miles of the Lower Charles River Basin

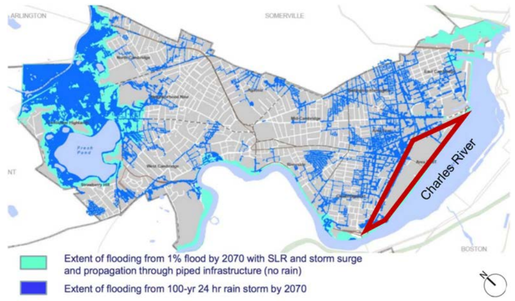
A dense, urban campus: 168-acres, >12M sf of buildings, > 65% impervious surfaces, 23,000 population

Projected local climate change risks include:

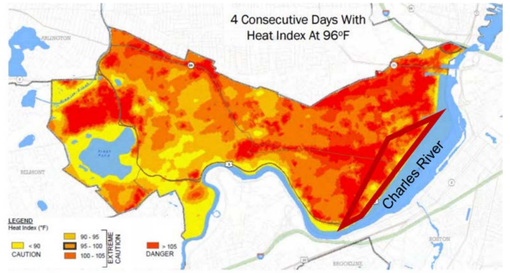
- Increased inland flooding from precipitation events and overtaxed drainage networks
- Rising temperatures contributing to urban heat island effect and prolonged heat waves
- Drought







Cambridge Climate Change Vulnerability Assessment (CCVA)
Flood Projections



"Feels-like" temperature variability on a day when heat index is 96°F (90°F with relative humidity 50 – 55%)

Cambridge Climate Change Vulnerability Assessment (CCVA)
Projected 2070 Temperature Extremes

DEFINING RESILIENCY FOR AN URBAN CAMPUS

Climate readiness: the campus defined as “layers of resilience”

FY2018 MITOS Annual Report to the President — **Sustainable Campus Systems**

Layers of Resilience

COMMUNITY

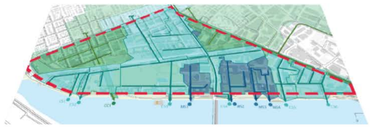
23,000+ people

A healthy, resilient, and prepared community fulfills MIT’s mission

BUILDINGS

140+ buildings

Where research, education, and knowledge transfer happen



UTILITIES

15+ utilities

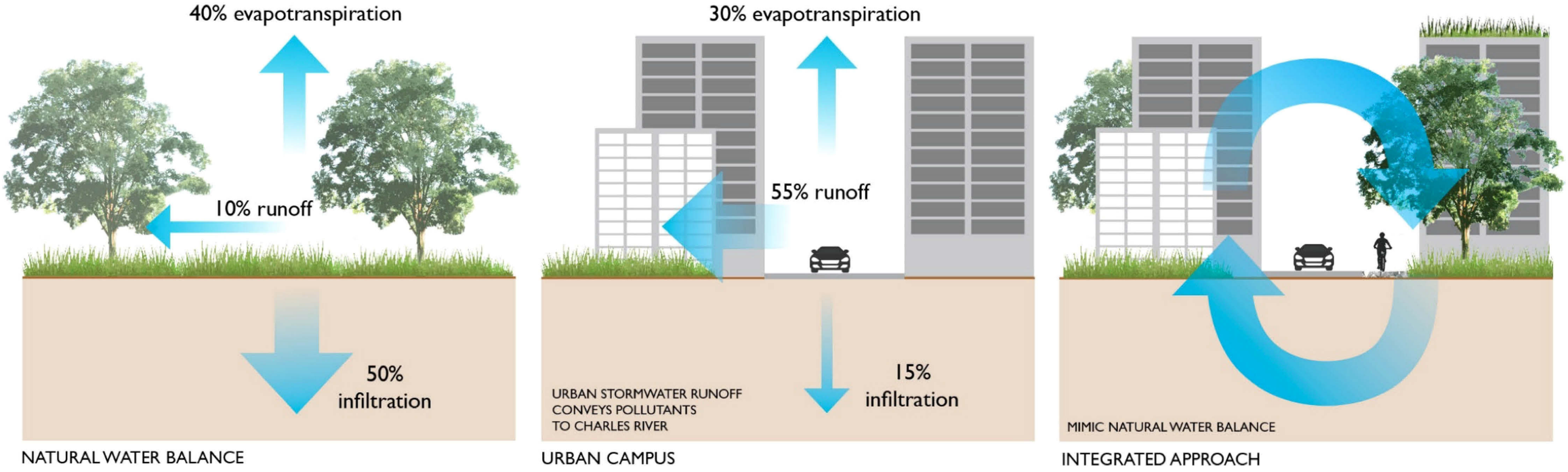
Protecting vital infrastructure (i.e. steam, electric, water, etc.)

SITE

168+ acres

Capacity of soil and trees to absorb floodwater and mitigate heat

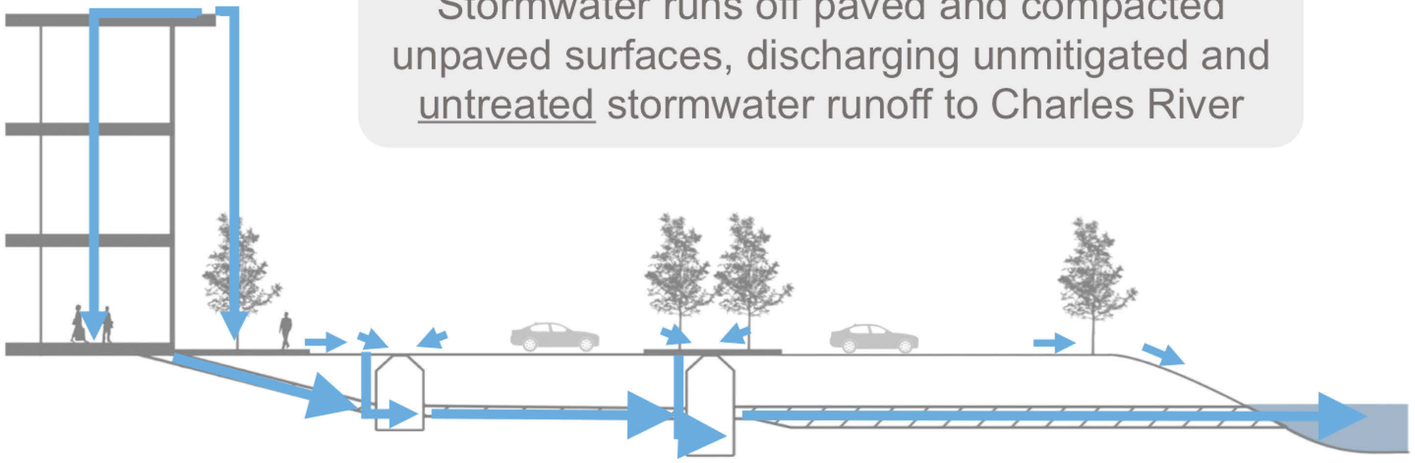
INTEGRATE STORMWATER AND LANDSCAPE TO RESTORE WATER BALANCE



Re-establish the natural water balance using a landscape-integrated stormwater system to move towards climate resilience and a better, more livable city.

IMPLEMENT GREEN INFRASTRUCTURE TO ADDRESS AGING UTILITY CHALLENGES

Stormwater runs off paved and compacted unpaved surfaces, discharging unmitigated and untreated stormwater runoff to Charles River



Landscape is not considered part of the stormwater management approach

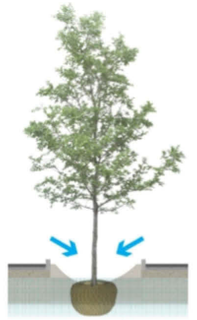
Gray infrastructure will exceed its capacity with climate change and larger storm events

Stormwater from paved and compacted surfaces is absorbed and cleansed by landscape and soils

Grey infrastructure provides "overflow" to River

Reliance on gray infrastructure is relieved

Landscape and soils provide capacity to address stormwater



HARNESS THE PERFORMANCE POWER OF TREES AND SOIL

How do we apply THIS traditional campus model of trees in lawn to other parts campus?

slows rainwater
15-30%

cools urban areas
6-19°F

per rain event absorbs
100 gallons H20

reduces building
energy use 10-30%

40% reduced runoff
over impervious surface

absorbs
48 lbs CO2/yr

stores 1.1-2" water/ft for plants

per rain event
infiltrates 2.5" water/ft

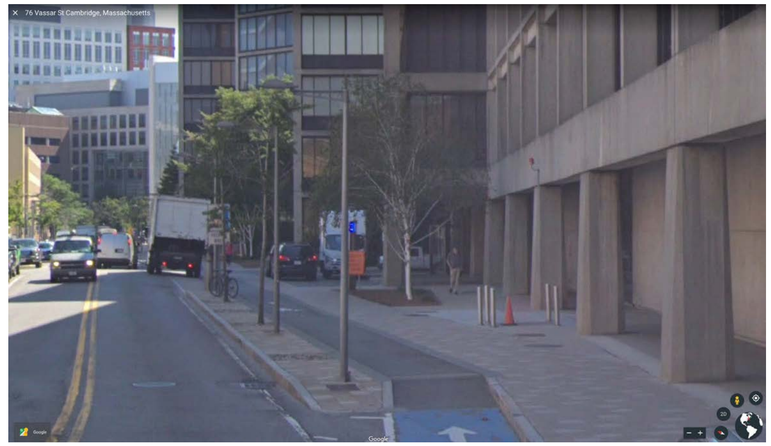
low heat flux
reduces urban heat island

stores more carbon than atmosphere or trees over pervious surface

absorbs phosphorus
from stormwater

HARNESS THE PERFORMANCE POWER OF TREES AND SOIL

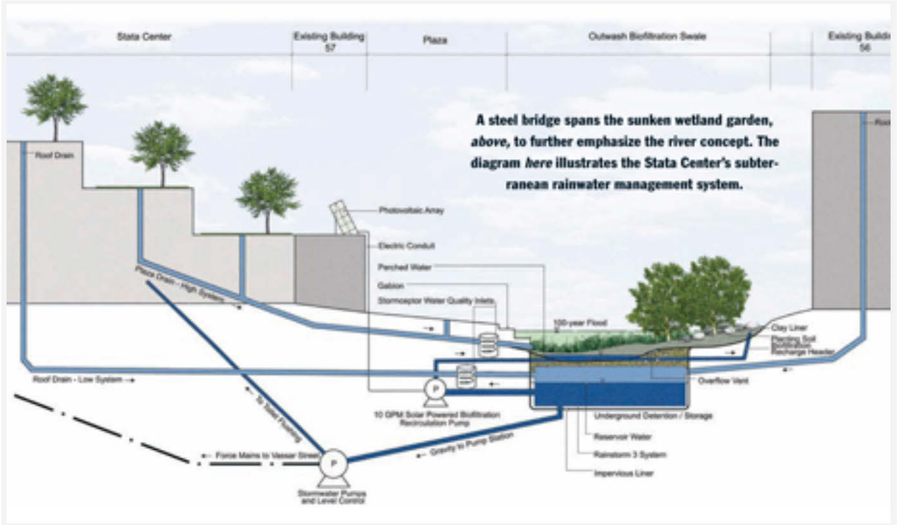
When we've got a lot of THIS?



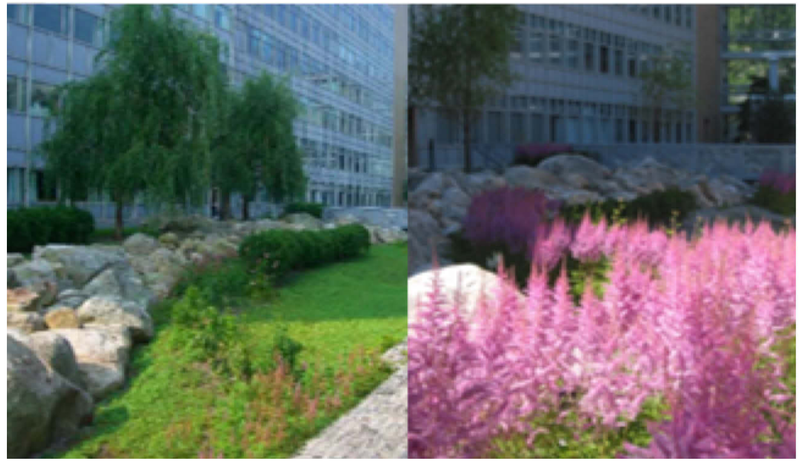
EVOLVING PERFORMANCE GOALS: THE “STATA SWALE” SITE (2008)

MIT’s first stormwater management showpiece, developed in 2009 with the MIT Stata Center

A big impact, and a big footprint – hard to find this much space exclusively for managing stormwater!

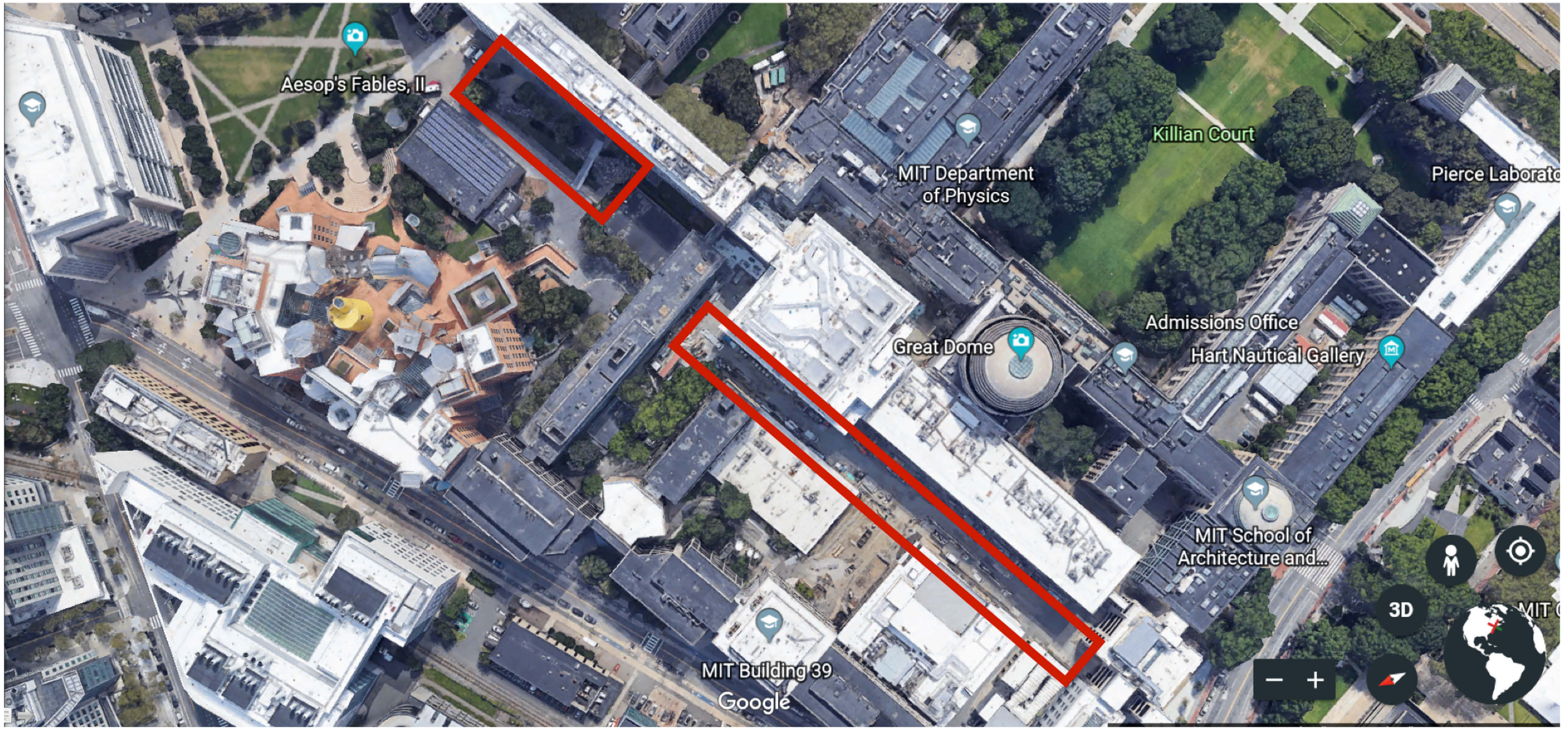


Stata Center Underground Detention image courtesy of Judith Nitsch



10 YEARS LATER: EVOLVING PERFORMANCE GOALS

North Corridor (2018) – Mid-construction – c. 2018



10 YEARS LATER: EVOLVING PERFORMANCE GOALS

North Corridor (2018) – Sasaki Study of Northwest District

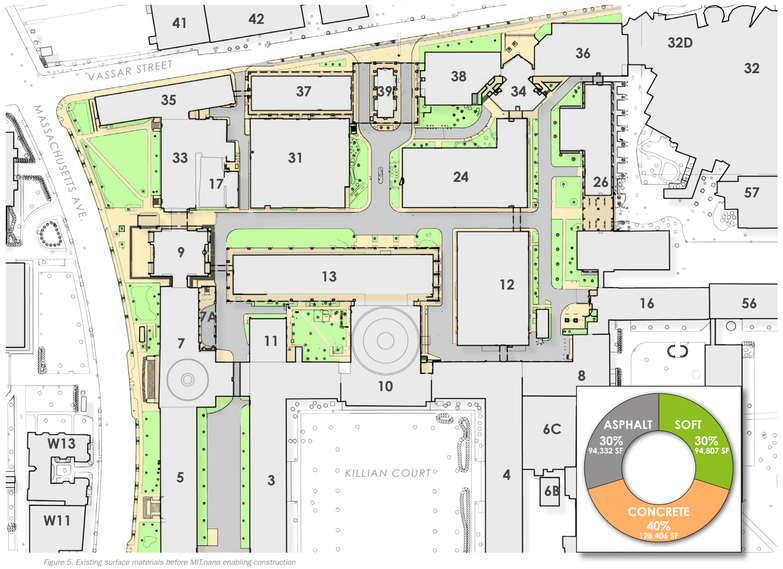


Figure 5. Existing surface materials before MIT.nano enabling construction

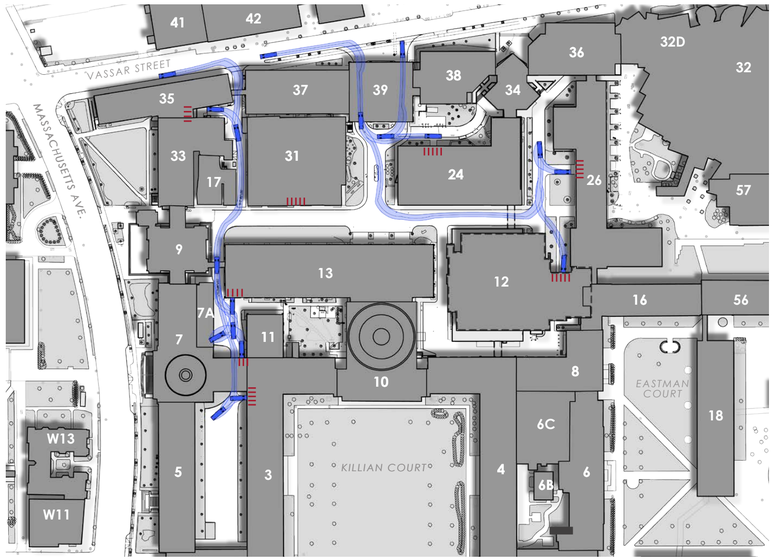


Figure 6. Required Access for a 30' delivery truck

Figure 13. Preferred areas for gathering spaces based on hours of sunlight, Autumnal Equinox

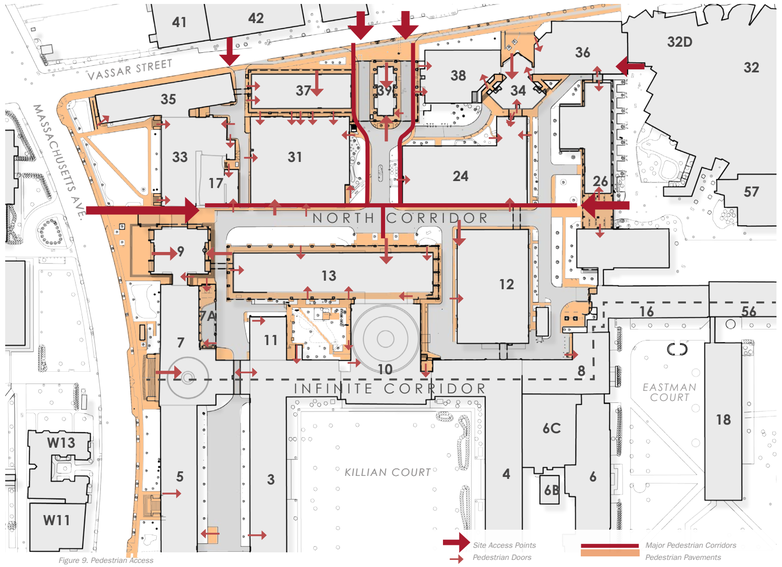
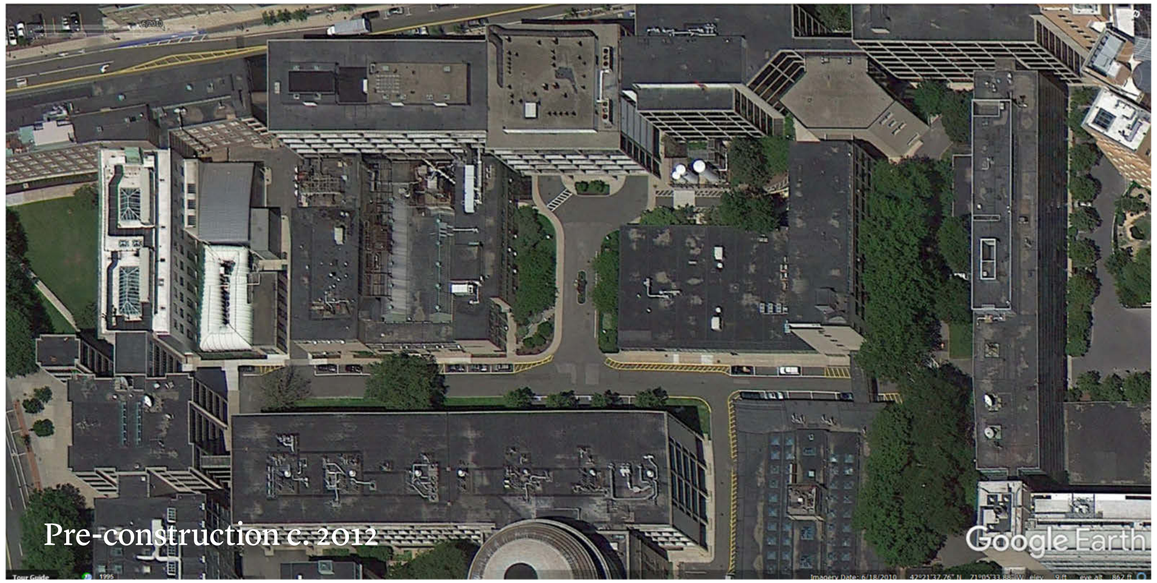


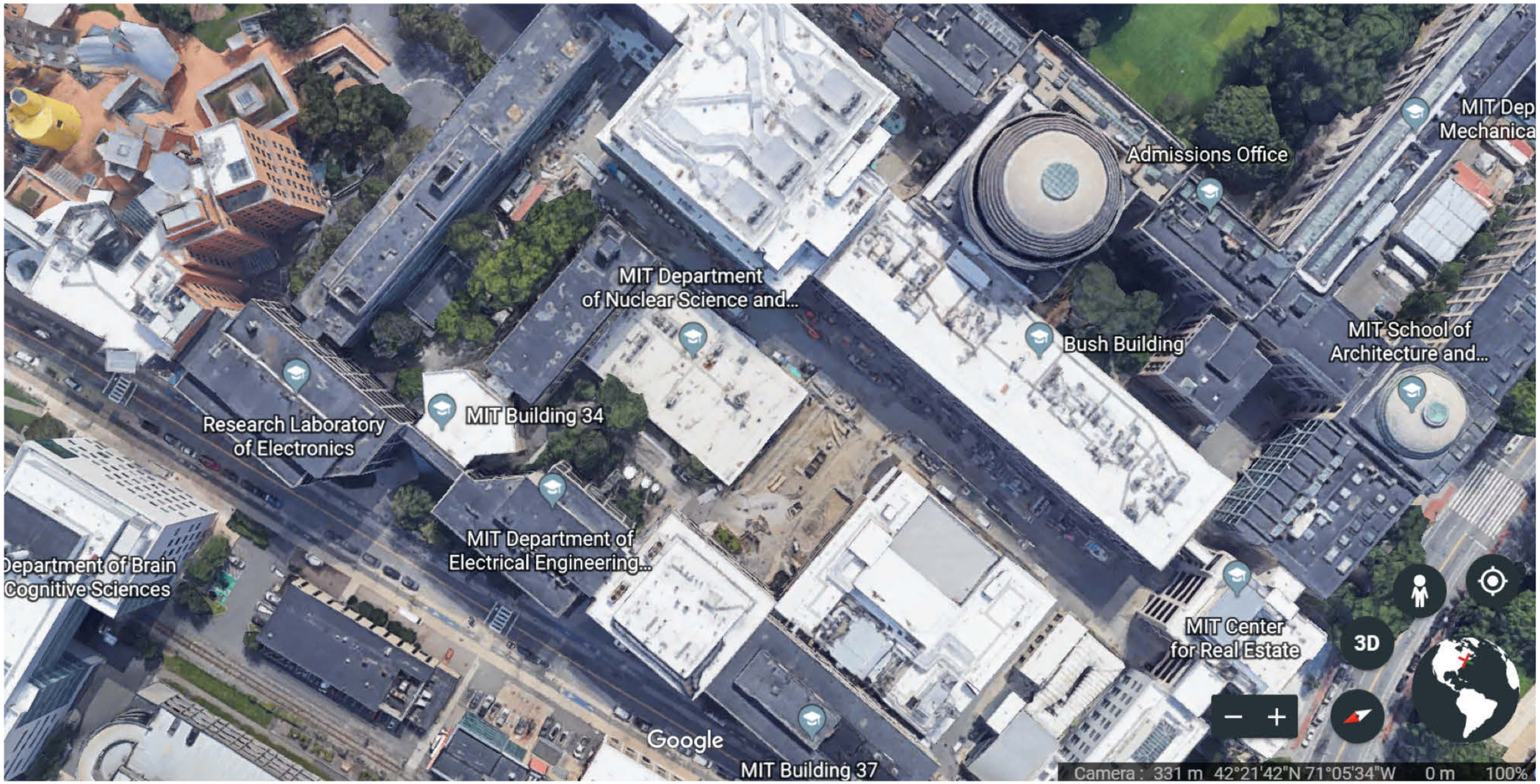
Figure 9. Pedestrian Access

10 YEARS LATER: EVOLVING PERFORMANCE GOALS

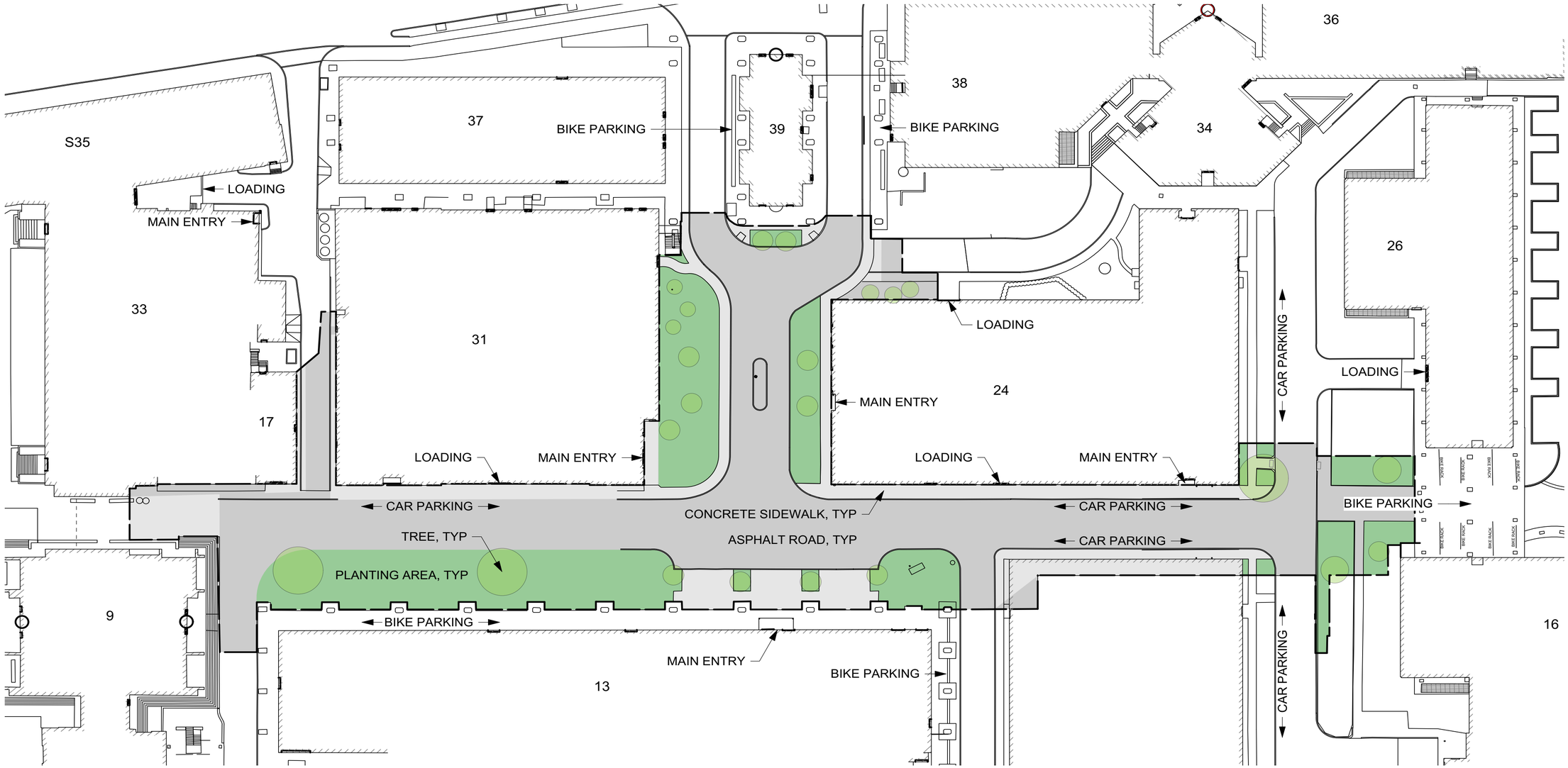


10 YEARS LATER: EVOLVING PERFORMANCE GOALS

North Corridor (2018) – mid-construction



NORTH CORRIDOR BASIS OF DESIGN



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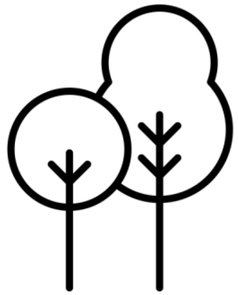
NORTH CORRIDOR BASIS OF DESIGN

SUSTAINABLE STORMWATER AND LANDSCAPE ECOLOGY PLAN

KEY PRINCIPLES	GOAL STATEMENTS
	Reduce Flood Risk
	Reduce Urban Heat Island Effects
Foster Resilient Campus	Reduce Potable Water Demand
	Enable Adaptive Management on Campus*
Renew Healthy Campus Commons	Connect and Enhance Open Space Network
	Enhance Health and Comfort of Outdoor Spaces
Reintegrate Natural Systems	Expand and Enhance Urban Tree Canopy
	Create a Habitat Network to Support Biodiversity
Enhance Charles River Watershed	Restore and Mimic Natural Hydrology
	Improve Plant and Soil Matrix
	Reduce the Pollutant Load to the Charles River

NORTH CORRIDOR BASIS OF DESIGN

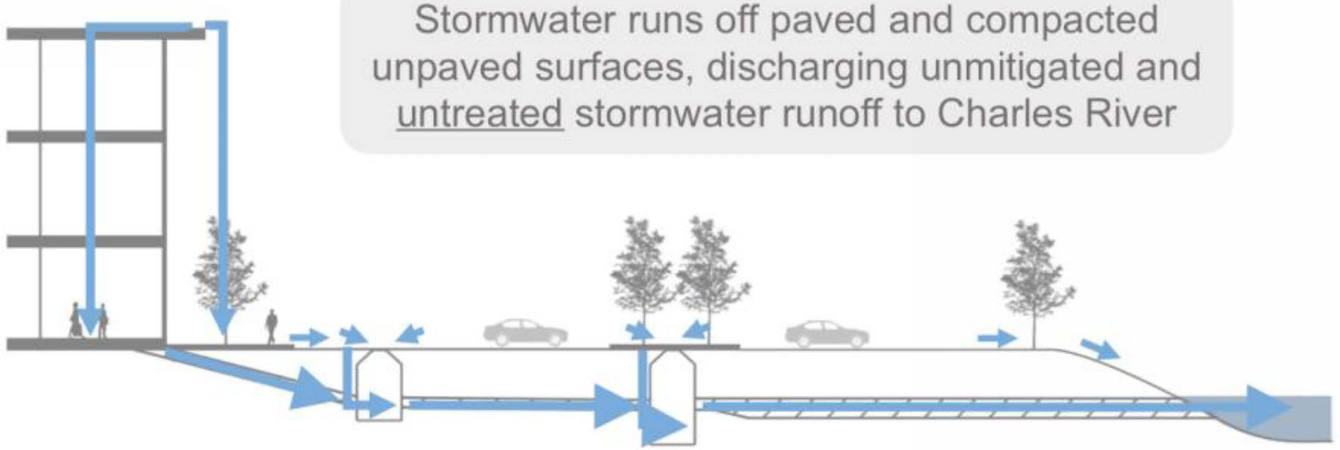


Harness the capacity of trees, plants, and soil communities

Design stormwater management systems design to provide storage and detention capacity that reduces the impact of increasing frequency and intensity of large rainfall events on the existing drainage infrastructure

Align with the City of Cambridge's resilience design standards

WHY GREEN INFRASTRUCTURE?



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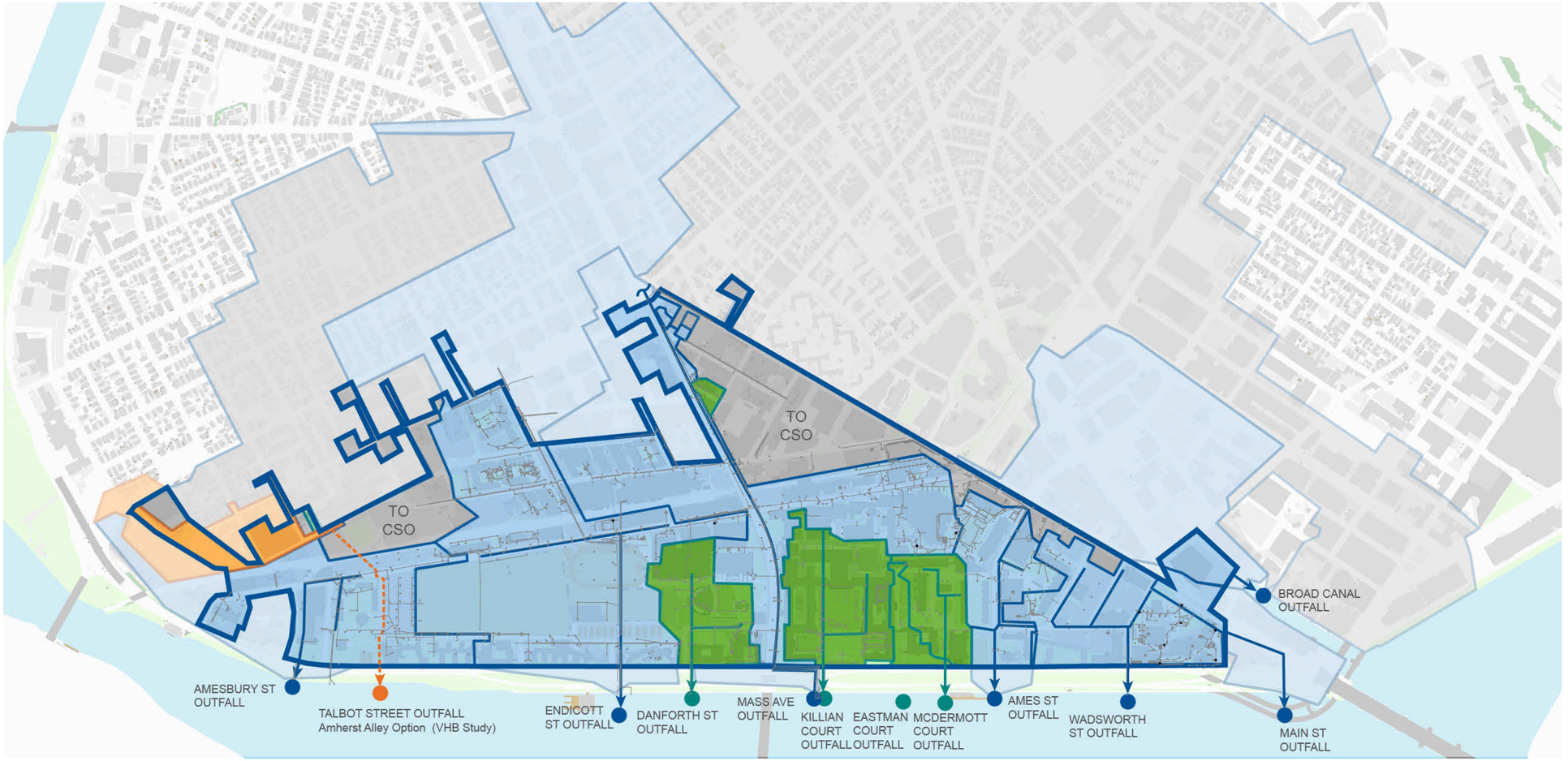
SUSTAINABLE STORMWATER & LANDSCAPE ECOLOGY PLAN
Hydrologic Context

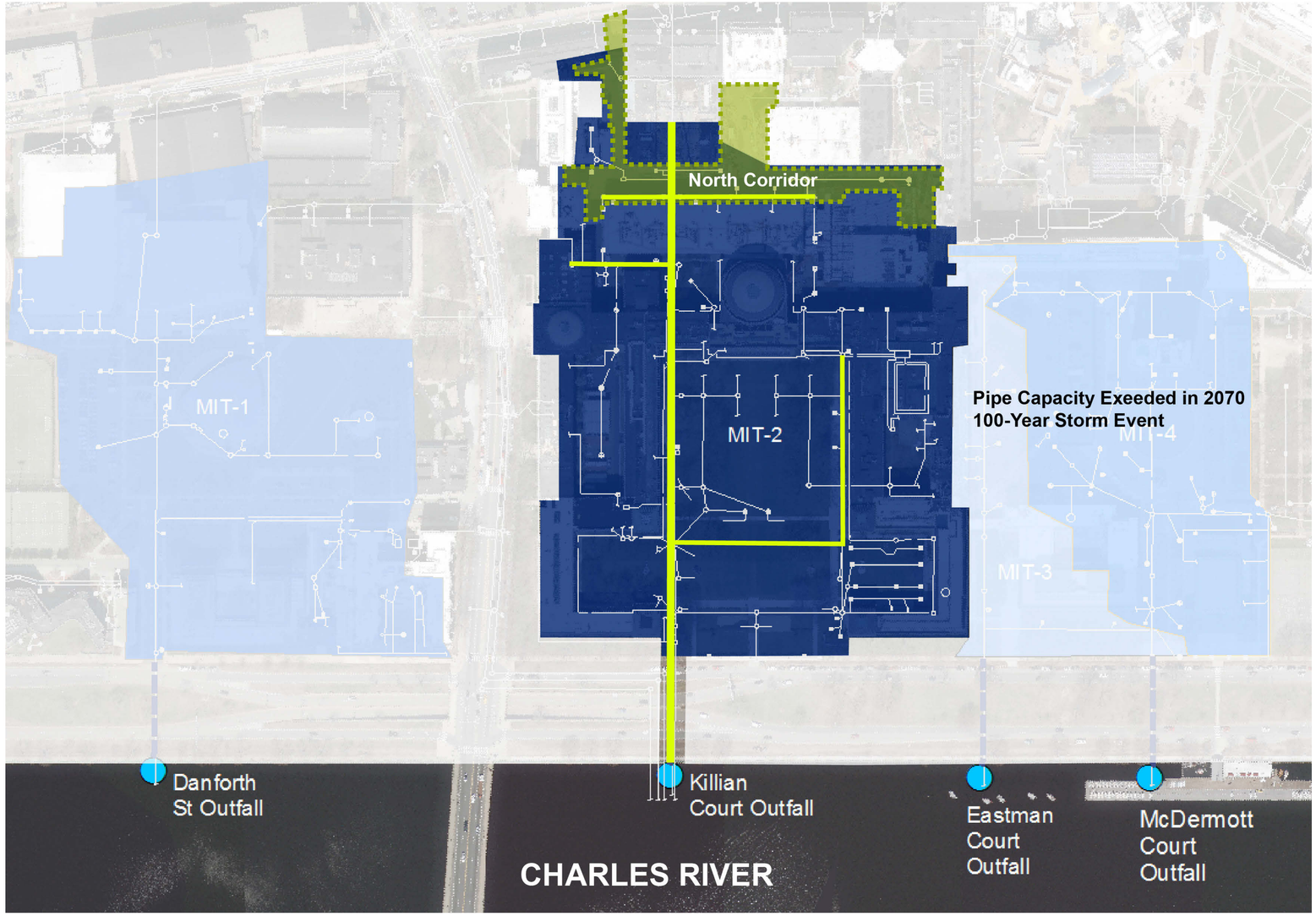


HYDROLOGIC CONDITIONS
MAJOR DRAINAGE NETWORKS

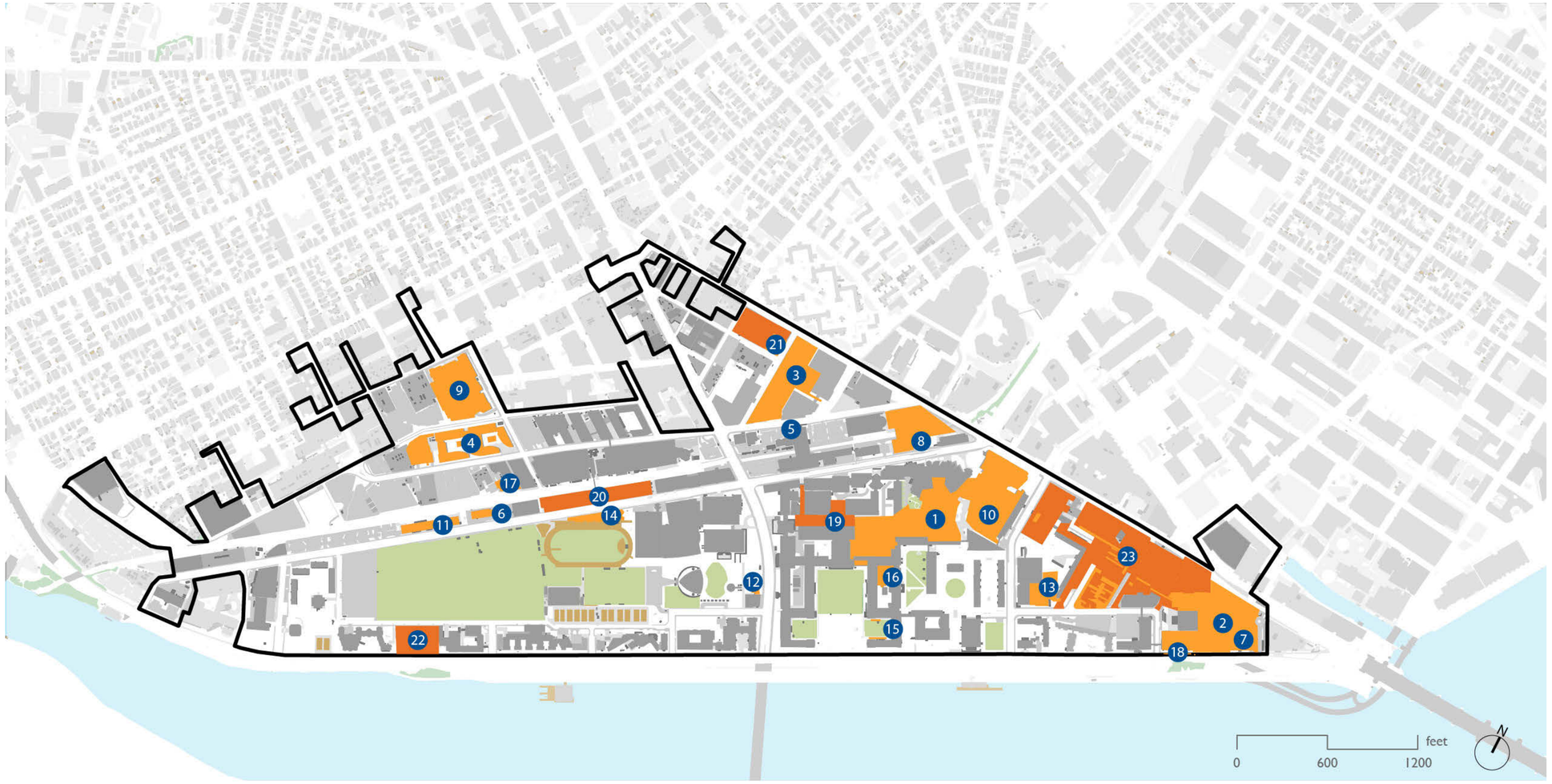
- MIT Storm Trunk Lines
- Cambridge Storm Trunk Lines
- Proposed Storm Trunk Lines
- MIT Watershed
- Cambridge Watershed
- Proposed Watershed

SUSTAINABLE STORMWATER & LANDSCAPE ECOLOGY PLAN

Past, Present, and Future Hydraulic Context



SUSTAINABLE STORMWATER & LANDSCAPE ECOLOGY PLAN
Water Quality Context



HYDROLOGIC CONDITIONS
BMPs AND DRAINAGE AREAS

1 BMP ID

BMP Proposed

BMP Drainage Area

SUSTAINABLE STORMWATER & LANDSCAPE ECOLOGY PLAN
Tools – Existing MIT Stormwater Toolkit

Existing MIT BMP Toolkit

SUBSURFACE INFILTRATION

VOLUME
QUALITY
PEAK RATE

Treats • SOLIDS • NUTRIENTS

POROUS PAVEMENT

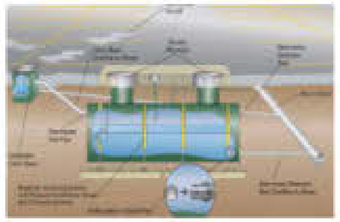
VOLUME
QUALITY
PEAK RATE

Treats • SOLIDS • NUTRIENTS

STORMCEPTOR WATER QUALITY UNIT

VOLUME
QUALITY
PEAK RATE

Treats • SOLIDS • NUTRIENTS



DETENTION TANK

VOLUME
QUALITY
PEAK RATE

Treats • SOLIDS • NUTRIENTS

RAINWATER HARVESTING

VOLUME
QUALITY
PEAK RATE

Treats • SOLIDS • NUTRIENTS

BIORETENTION

VOLUME
QUALITY
PEAK RATE

Treats • SOLIDS • NUTRIENTS

GREEN ROOF

VOLUME
QUALITY
PEAK RATE

Treats • SOLIDS • NUTRIENTS

JELLYFISH WATER QUALITY UNIT

VOLUME
QUALITY
PEAK RATE

Treats • SOLIDS • NUTRIENTS

Existing Treatment at North Corridor (Nano Project)

SUSTAINABLE STORMWATER & LANDSCAPE ECOLOGY PLAN
Tools – Stormwater Matrix

STORMWATER DESIGN CONSIDERATIONS			QUANTITY		QUALITY		RESILIENCE	STORMWATER STRATEGY PRECEDENTS				NORTH CORRIDOR STRATEGIES	
			Control Peak Flow	Retain Volume	Phosphorus Reduction	Total Suspended Solids Reduction	Flooding	Preconstruction - North Corridor (2013)	Permitted for Nano	Constructed at Nano[4] (2017)	Precedent On MIT Campus	Primary	Supplemental
STORMWATER MANAGEMENT STRATEGIES	Quantity	Detention System	High	-	Low	Moderate	Moderate		Not applicable - No discharge to City system therefore no stormwater permits or specific practices were required.		■		
	Quality	Jellyfish	-	-	High	High	-			■	■		
		Stormceptor WQU	-	-	Low	High	-				■		■
		Catch Basin	-	-	Low	Low	-	■		■	■		■
		Source Controls[6]	-	-	Low	Low	-			■	■		
	Quality + Quantity	Reuse Tank	Moderate[1]	Moderate[1]	Moderate[1]	Moderate[1]	Moderate[1]				■		
		Pervious Pavement	High	High[2]	High	High	High				■		
		Subsurface Horizontal Filter	Moderate	High[2]	High	High	Moderate						
		Subsurface Infiltration	High[2]	High[2]	High[2]	High[2]	High[2]				■		
		StormTech Isolator Row	Moderate	Low	High	High	Moderate						■
		Bioretention	Moderate	High[2]	High	High	Moderate				■		
		Landscape Filter	Moderate	High[2]	High	High	Moderate					■	
REGULATORY FRAMEWORK	Required by City of Cambridge Current Regs	Cambridge System[3]	■		■	■							
		MIT System	Not Applicable - Cambridge does not regulate MIT's private outfalls										
	Nano Project as Permitted	Cambridge System[3]	Not applicable - No discharge to City system therefore no stormwater permits or specific practices were required.										
		MIT System[4]											
	North Corridor (Anticipated)	Cambridge System[3]	■		■	■							
		MIT System[5]	Not Applicable - Cambridge does not regulate MIT's private outfalls										
LONG-TERM PLANNING CONSIDERATIONS	Potential Future Regulations	Cambridge System[3]	■		■	■	■						
		MIT System			■	■	■						
	MIT Sustainable Stormwater Initiative	Cambridge System[3]	■	■	■	■	■						
		MIT System	■	■	■	■	■						

Growing the Stormwater Toolkit from Single to Multi-Benefit Tools

STORMWATER DESIGN CONSIDERATIONS			QUANTITY		QUALITY		RESILIENCE
			Control Peak Flow	Retain Volume	Phosphorus Reduction	Total Suspended Solids Reduction	Flooding
STORMWATER MANAGEMENT STRATEGIES	Quantity	Detention System	High	-	Low	Moderate	Moderate
	Quality	Jellyfish	-	-	High	High	-
		Stormceptor WQU	-	-	Low	High	-
		Catch Basin	-	-	Low	Low	-
		Source Controls[6]	-	-	Low	Low	-
	Quality + Quantity	Reuse Tank	Moderate[1]	Moderate[1]	Moderate[1]	Moderate[1]	Moderate[1]
		Pervious Pavement	High	High[2]	High	High	High
		Subsurface Horizontal Filter	Moderate	High[2]	High	High	Moderate
		Subsurface Infiltration	High[2]	High[2]	High[2]	High[2]	High[2]
		StormTech Isolator Row	Moderate	Low	High	High	Moderate
		Bioretention	Moderate	High[2]	High	High	Moderate
		Landscape Filter	Moderate	High[2]	High	High	Moderate

SUSTAINABLE STORMWATER & LANDSCAPE ECOLOGY PLAN
Tools – Stormwater Matrix

Considering Current and Future Regulatory Requirements

STORMWATER DESIGN CONSIDERATIONS			QUANTITY		QUALITY		RESILIENCE
			Control Peak Flow	Retain Volume	Phosphorus Reduction	Total Suspended Solids Reduction	Flooding
REGULATORY FRAMEWORK	Required by City of Cambridge Current Regs	Cambridge System[3]	■		■	■	
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		MIT System[4]					
	North Corridor (Anticipated)	Cambridge System[3]	■		■	■	
		MIT System[5]	Not Applicable - Cambridge does not regulate MIT's private outfalls				
LONG-TERM PLANNING CONSIDERATIONS	Potential Future Regulations	Cambridge System[3]	■		■	■	■
		MIT System			■	■	■
	MIT Sustainable Stormwater Initiative	Cambridge System[3]	■	■	■	■	■
		MIT System	■	■	■	■	■

1948
FEDERAL WATER POLLUTION CONTROL ACT

1972
CLEAN WATER ACT

1987
CLEAN CONTROL ACT OF 1987

1990
NPDES PHASE I
(Boston & Worcester) Regulates stormwater

1999
NPDES PHASE II
(Cambridge) Regulates stormwater

2016
CLF/CRWA LAWSUIT FILED 02/25/2016

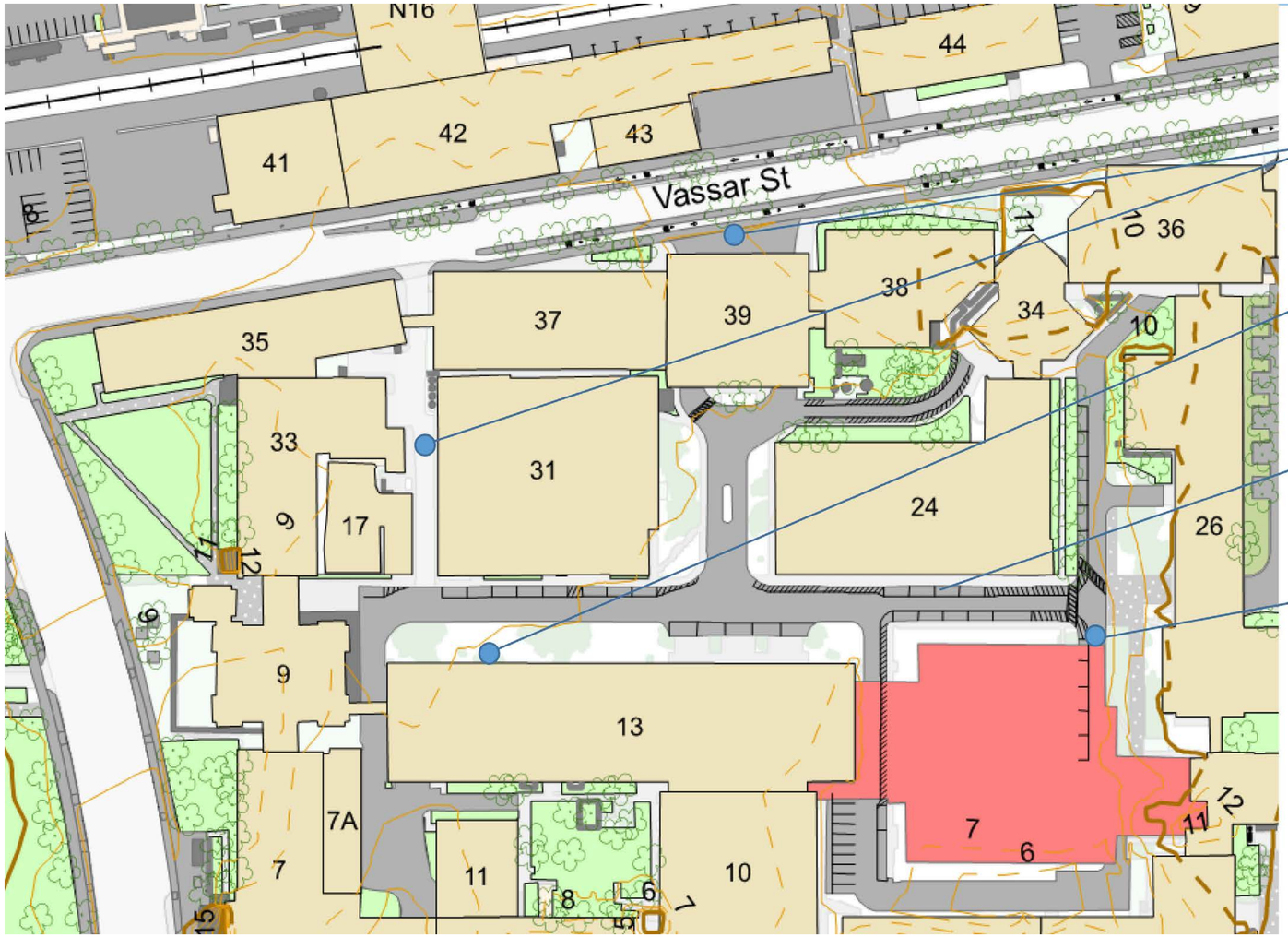
2017
NPDES PHASE II
(Cambridge) Strengthening stormwater requirements

SUSTAINABLE STORMWATER & LANDSCAPE ECOLOGY PLAN
Tools – Stormwater Matrix

Strategizing Stormwater Solutions for Site-Specific Conditions

STORMWATER DESIGN CONSIDERATIONS			STORMWATER STRATEGY PRECEDENTS				NORTH CORRIDOR STRATEGIES	
			Preconstruction - North Corridor (2013)	Permitted for Nano	Constructed at Nano[4] (2017)	Precedent On MIT Campus	Primary	Supplemental
STORMWATER MANAGEMENT STRATEGIES	Quantity	Detention System		Not applicable - No discharge to City system therefore no stormwater permits or specific practices were required.		■		■
	Quality	Jellyfish			■	■		■
		Stormceptor WQU				■		
		Catch Basin	■		■	■		■
		Source Controls[6]			■	■		■
	Quality + Quantity	Reuse Tank				■		■
		Pervious Pavement				■	■	
		Subsurface Horizontal Filter					■	
		Subsurface Infiltration				■		■
		Bioretention				■	■	
		Landscape Filter					■	

NORTH CORRIDOR DESIGN CONSIDERATIONS
Land Cover and Site Functionality



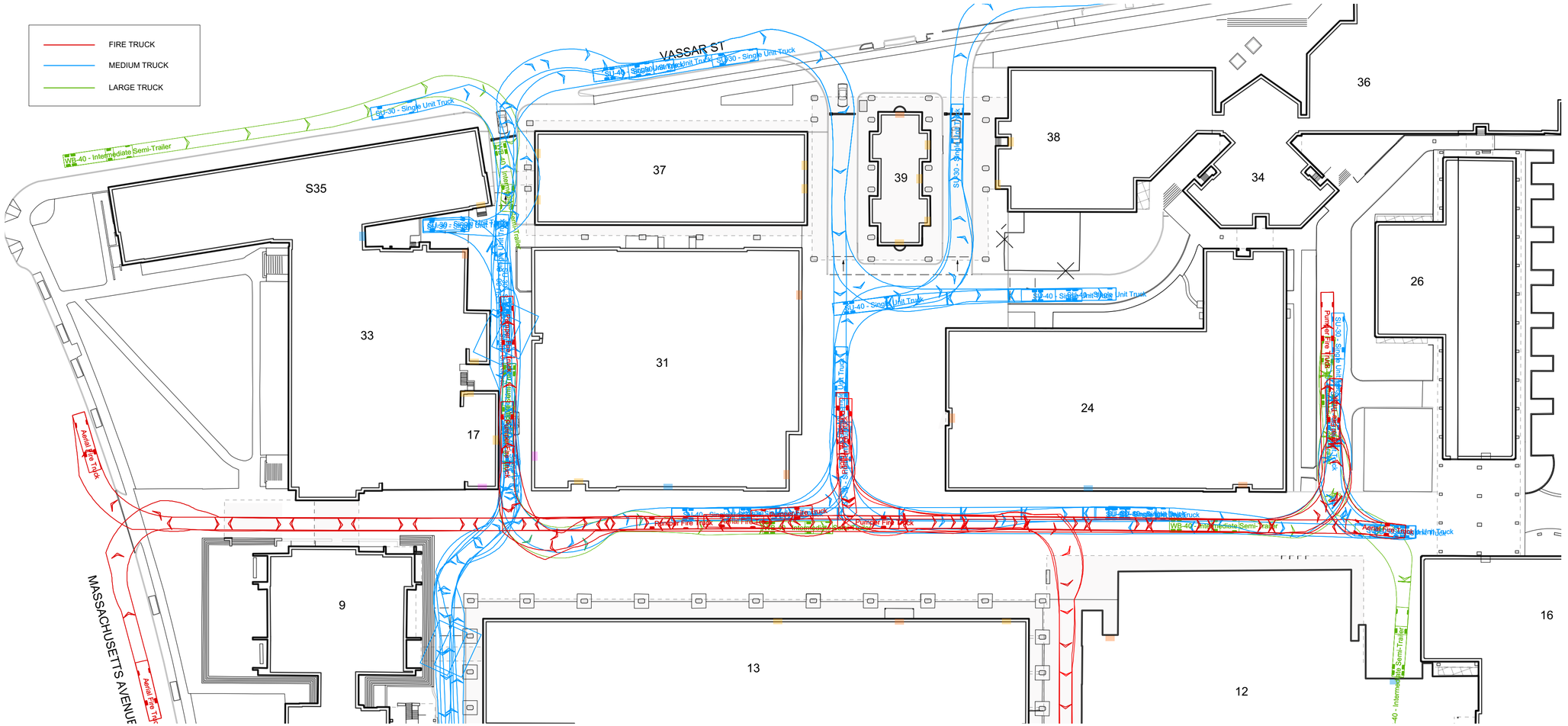
Vehicular Access

Bicycle Parking

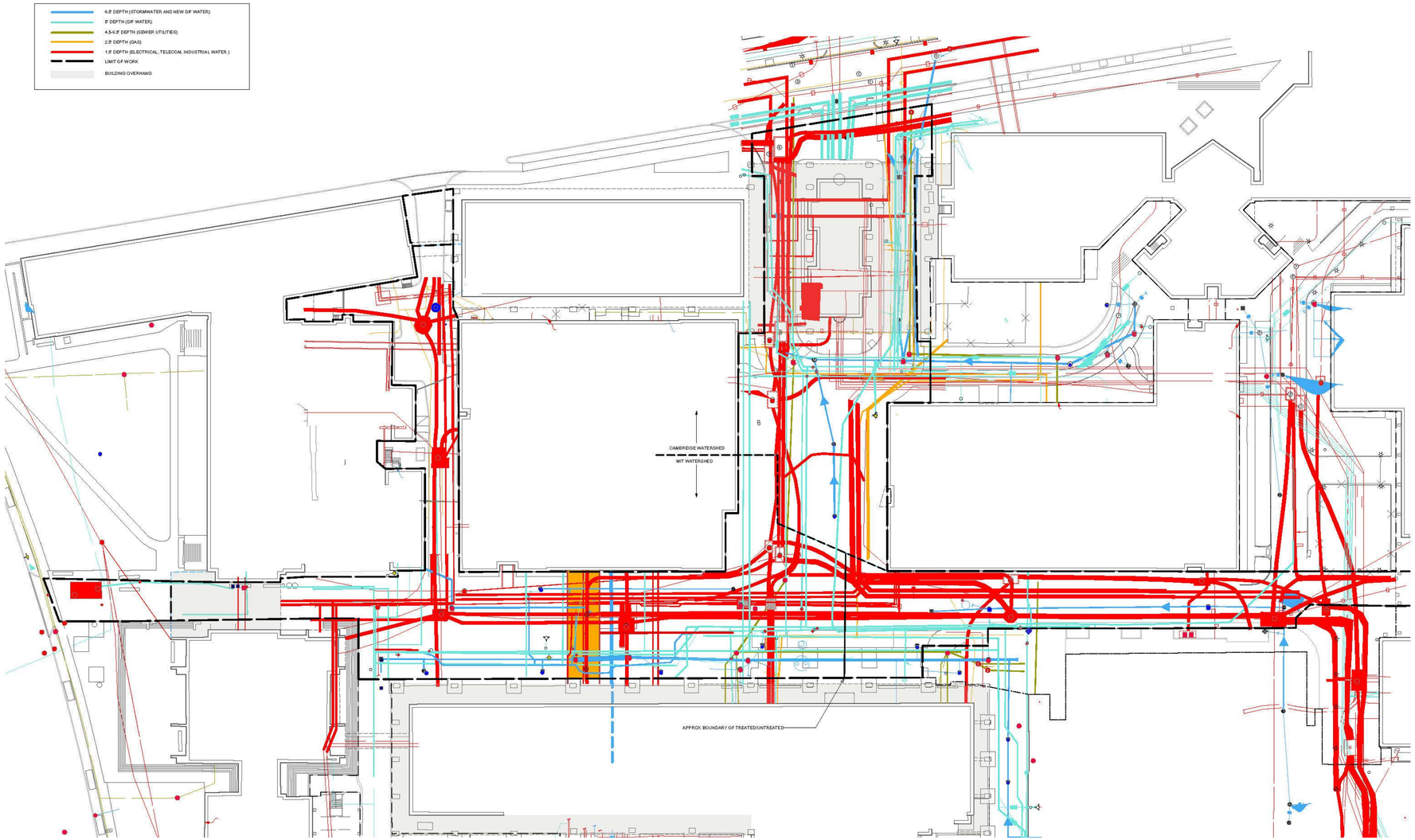
Parking

Loading Docks

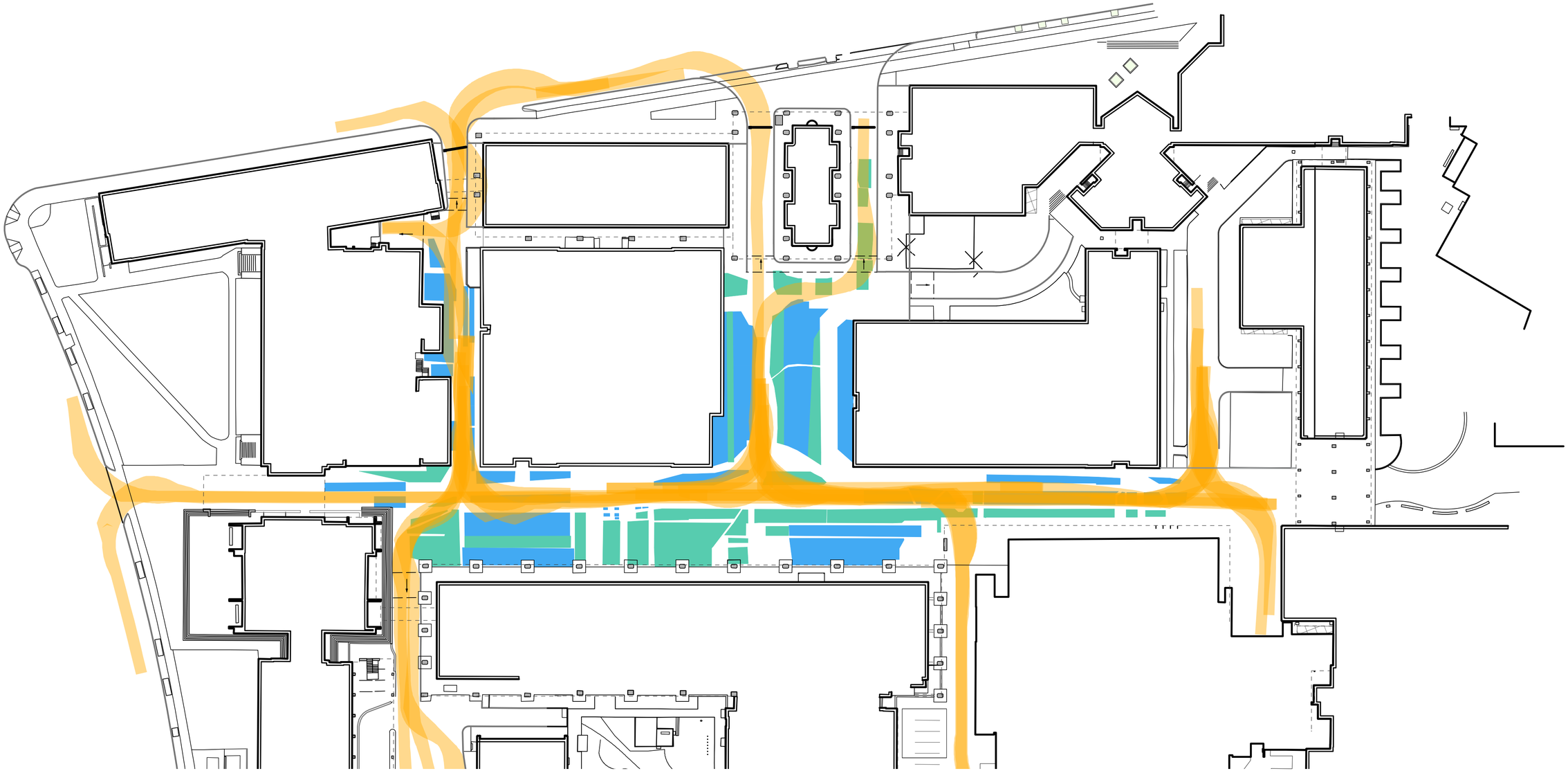
NORTH CORRIDOR DESIGN CONSIDERATIONS
Site Access



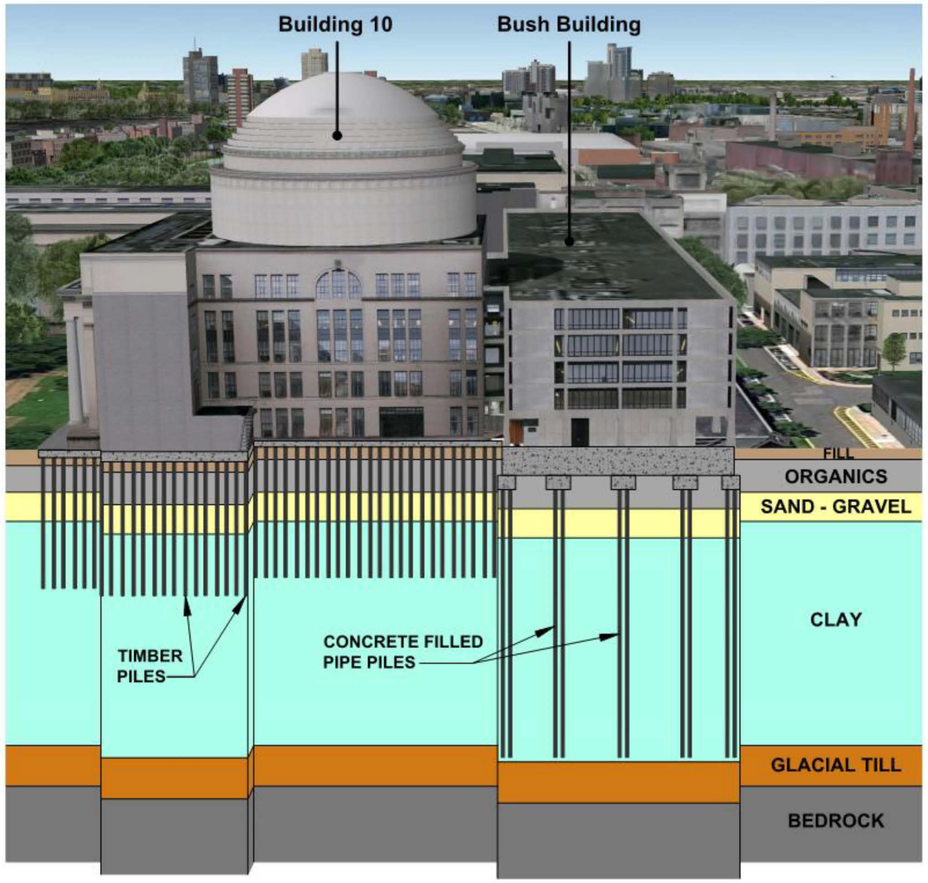
NORTH CORRIDOR DESIGN CONSIDERATIONS
Subsurface Site Utilities



NORTH CORRIDOR DESIGN CONSIDERATIONS
Available Areas



NORTH CORRIDOR DESIGN CONSIDERATIONS
Subsurface Soil and Groundwater Conditions



Thickness in feet		Description
8' - 12'	FILL	MOSTLY HYDRAULIC BUT SOME DUMPED FILL. FILL CONSISTS OF SAND, ORGANIC SILT, SHELLS, BRICKS, STONES, ETC.
2' - 10'	ORGANIC SILT-PEAT	FORMER MUD FLATS AND RIVER BOTTOM CONTAINING SAND, SILT, PEAT AND SHELLS
6' - 19'	SAND-GRAVEL	RELATIVELY PROPORTIONS OF SAND AN GRAVEL VARY WIDELY; GENERALLY VERY LITTLE SILT OR CLAY MATERIALS
38' - 84'	INORGANIC CLAY	THE TOP FEW FEET MAY BE STIFF. CONTAINS LENSES OF SAND AND SILT, AND OCCASIONALLY BOULDERS. COMMONLY CALLED "BOSTON BLUE CLAY".
10' - 17'	GLACIAL TILL	HETEROGENEOUS MIXTURE OF GRAVEL, SAND, SILT AND CLAY; USUALLY VERY DENSE
UP TO 72'	SHALE OR SLATE	OFTEN QUITE WEATHERED AND/OR FRACTURED NEAR UPPER SURFACE

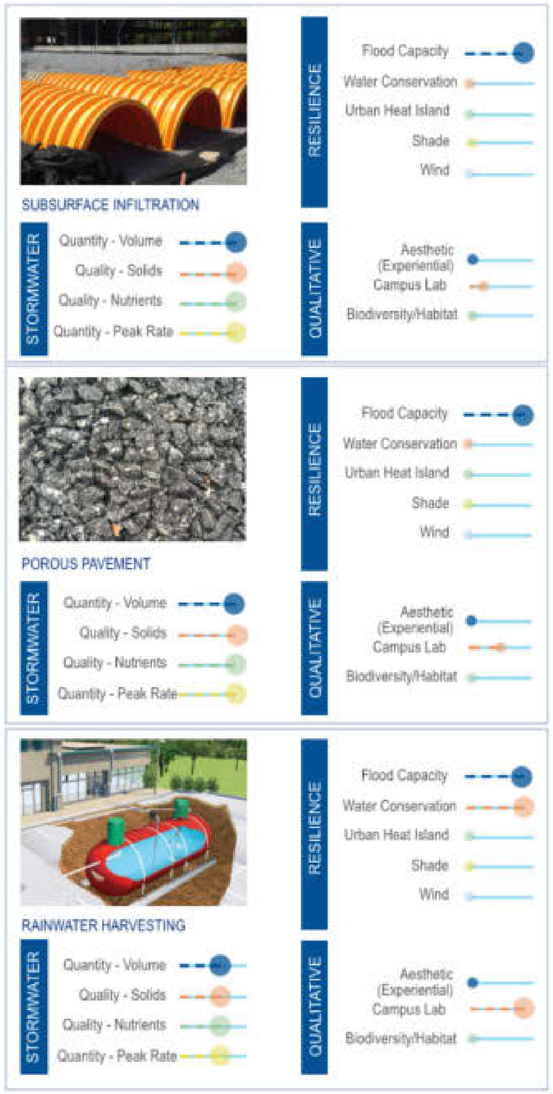
GROUND-WATER DEPTH ±10' - 12'

SUSTAINABLE STORMWATER & LANDSCAPE ECOLOGY PLAN
Tools – Stormwater Matrix

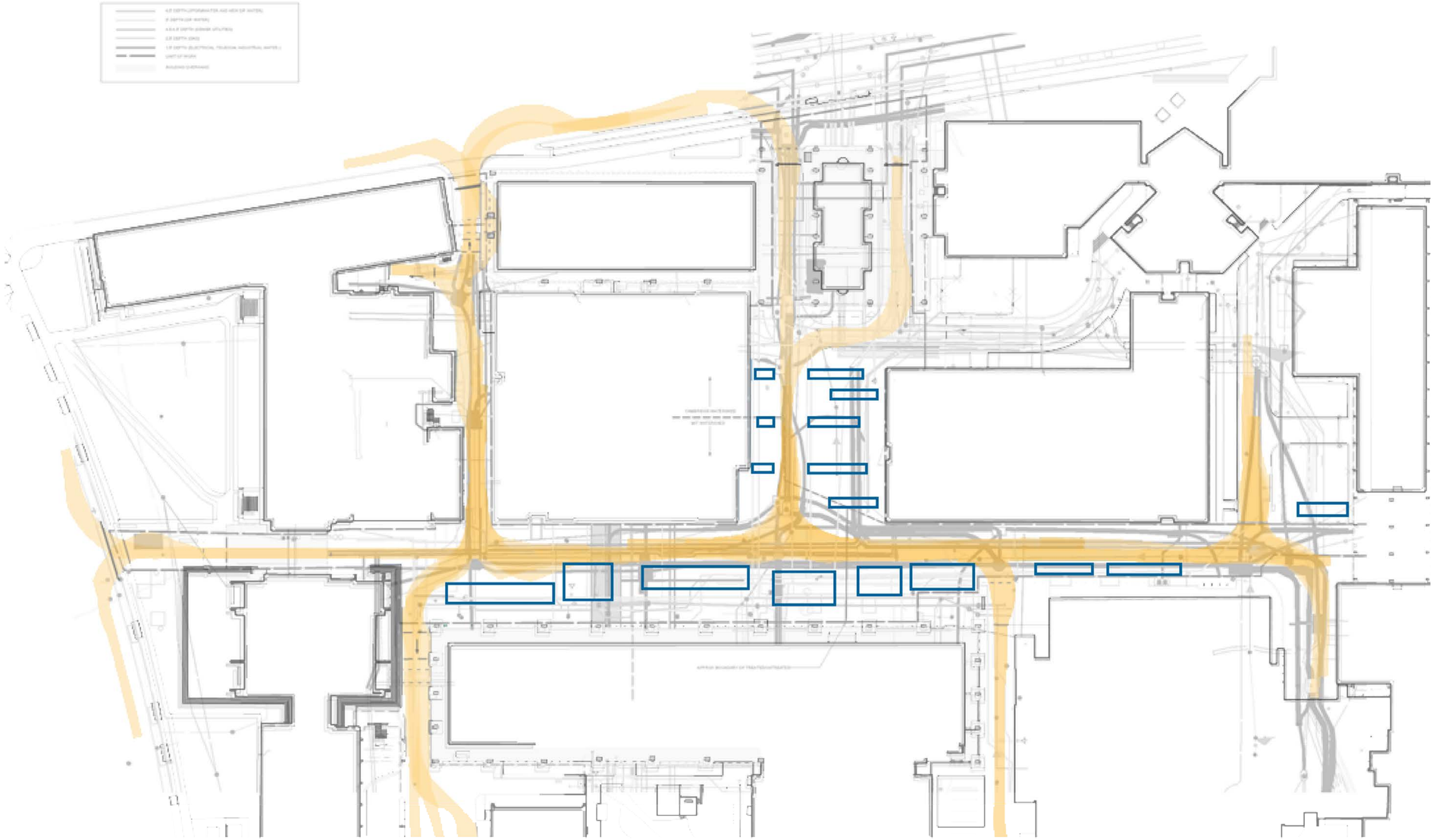
Finalizing Stormwater Solutions for Site-Specific Conditions

STORMWATER DESIGN CONSIDERATIONS			STORMWATER STRATEGY PRECEDENTS				NORTH CORRIDOR STRATEGIES	
			Preconstruction - North Corridor (2013)	Permitted for Nano	Constructed at Nano[4] (2017)	Precedent On MIT Campus	Primary	Supplemental
STORMWATER MANAGEMENT STRATEGIES	Quantity	Detention System		Not applicable - No discharge to City system therefore no stormwater permits or specific practices were required.		■		
	Quality	Jellyfish			■	■		
		Stormceptor WQU				■		■
		Catch Basin	■		■	■		■
		Source Controls[6]			■	■		
	Quality + Quantity	Reuse Tank				■		
		Pervious Pavement				■		
		Subsurface Horizontal Filter						
		Subsurface Infiltration				■		
		StormTech Isolator Row						■
		Bioretention				■		
		Landscape Filter					■	

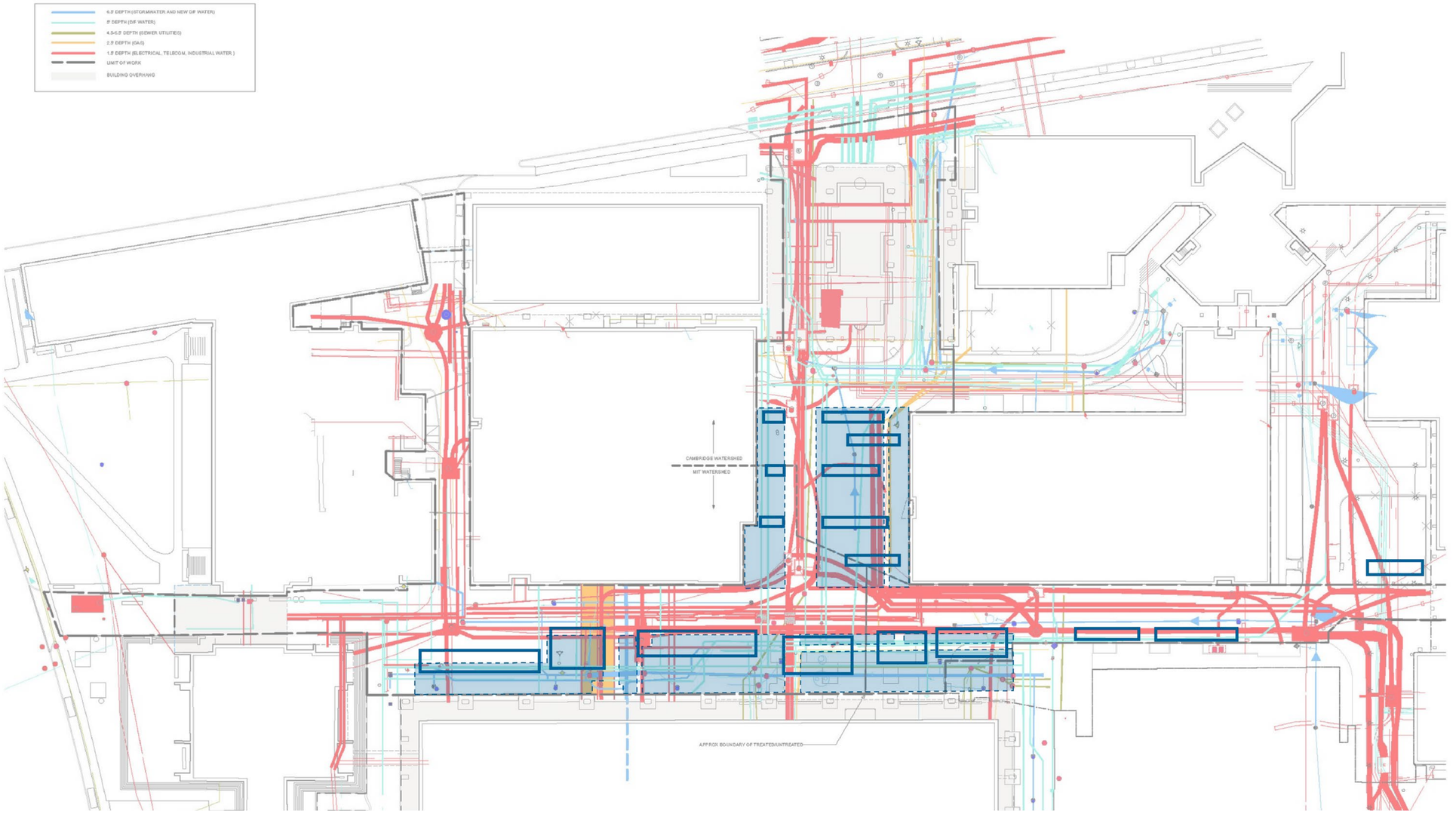
SUSTAINABLE STORMWATER & LANDSCAPE ECOLOGY PLAN
Tools – Proposed MIT Stormwater Toolkit



TAILORING SOLUTIONS TO SURFACE SITE CONDITIONS



TAILORING SOLUTIONS TO SUB-SURFACE SITE CONDITIONS



Putting the Green in Infrastructure: An Urban Campus' High-Performance Landscape

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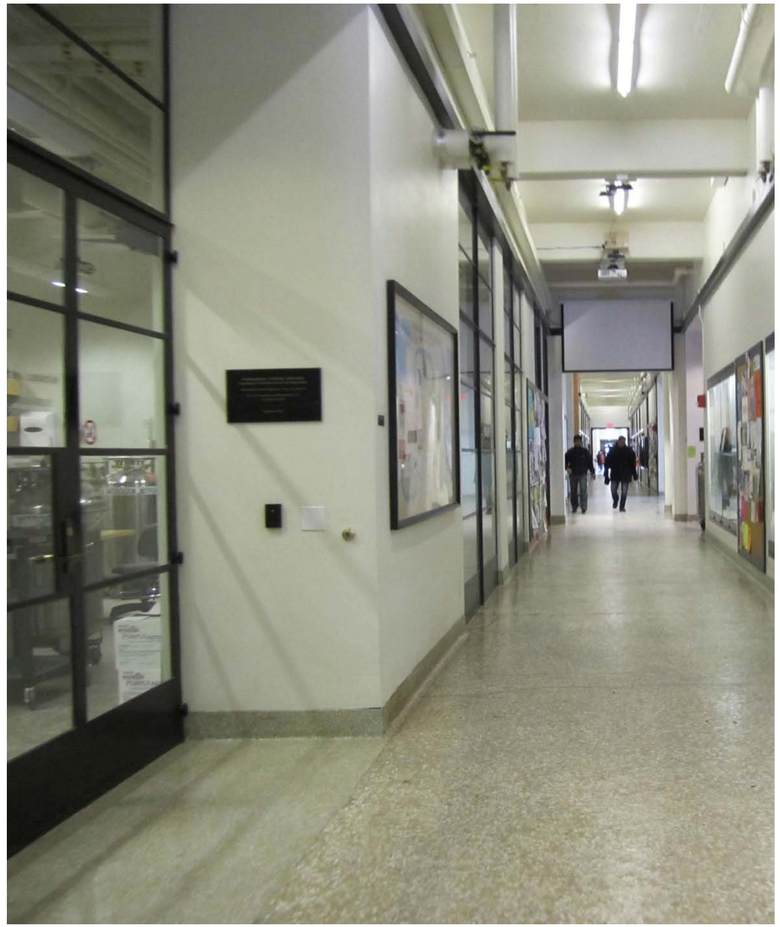
JENNIFER JOHNSON, ASSOCIATE, NITSCH ENGINEERING

ERIC KRAMER, PRINCIPAL, REED HILDERBRAND

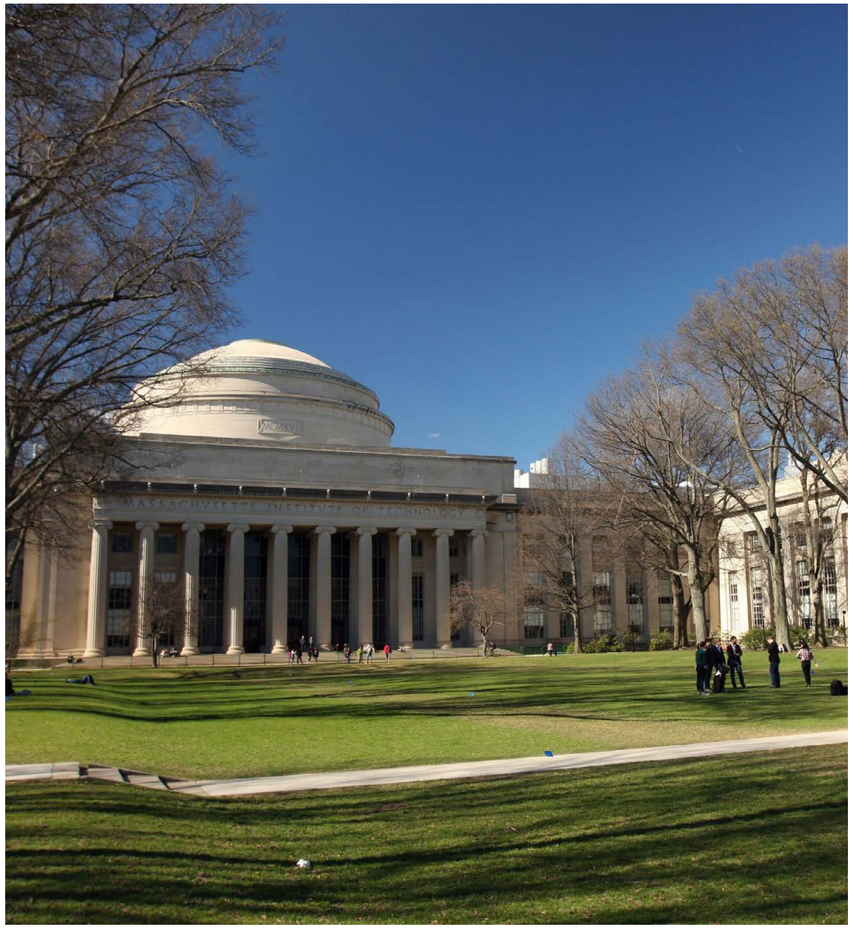

2014
STOP
12 FOOT CLEARANCE
VASSAR ST
2018

INTEGRATE WITH CAMPUS FABRIC

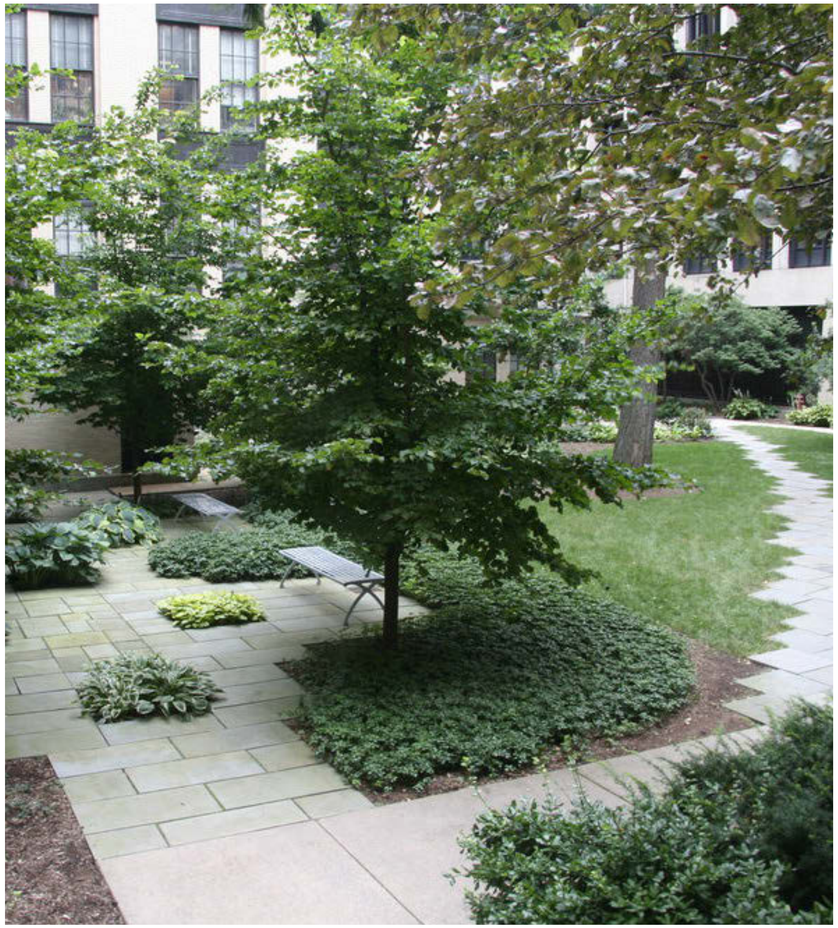
INTEGRATE WITH CAMPUS FABRIC



CORRIDOR

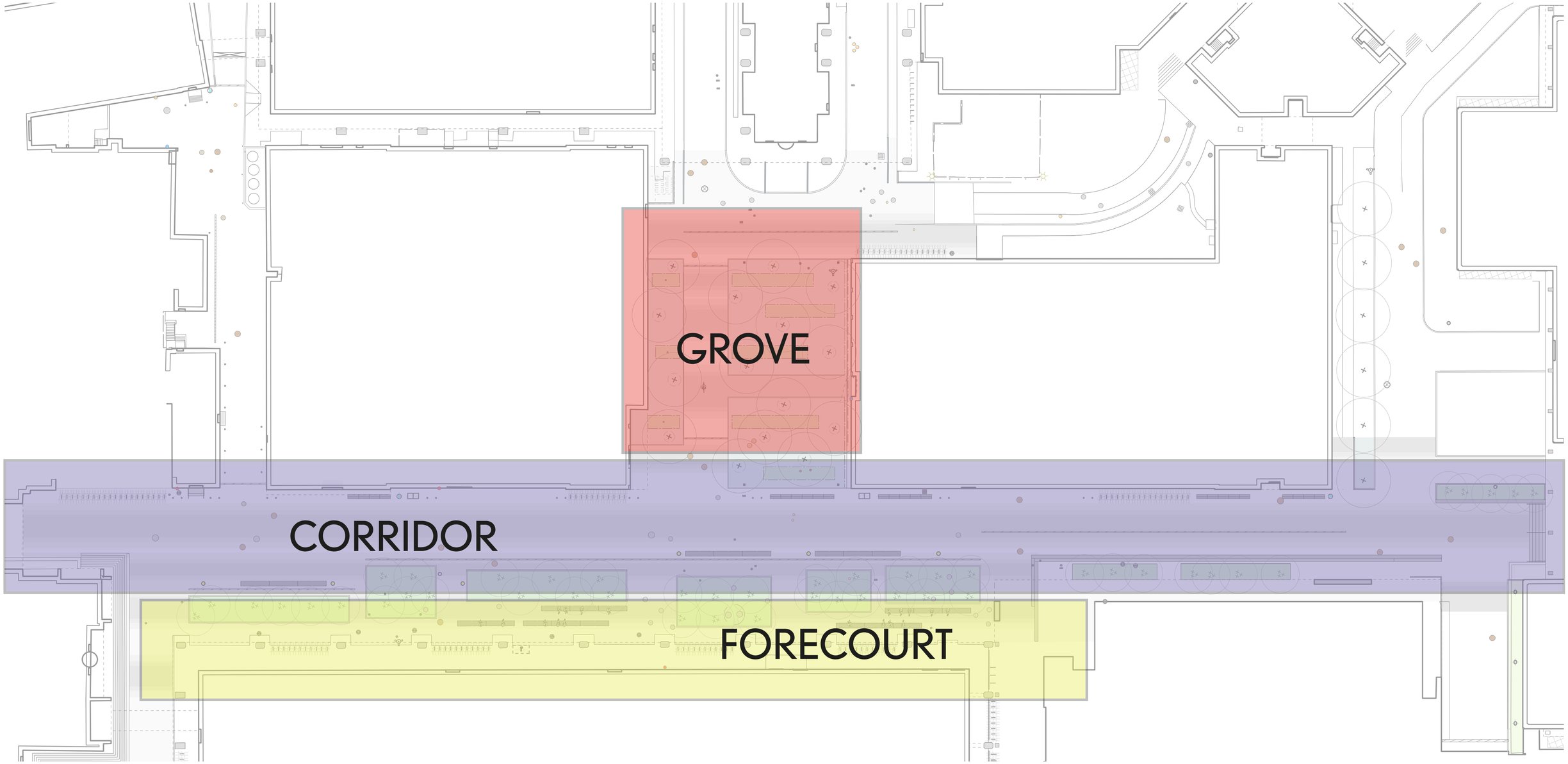


COURT

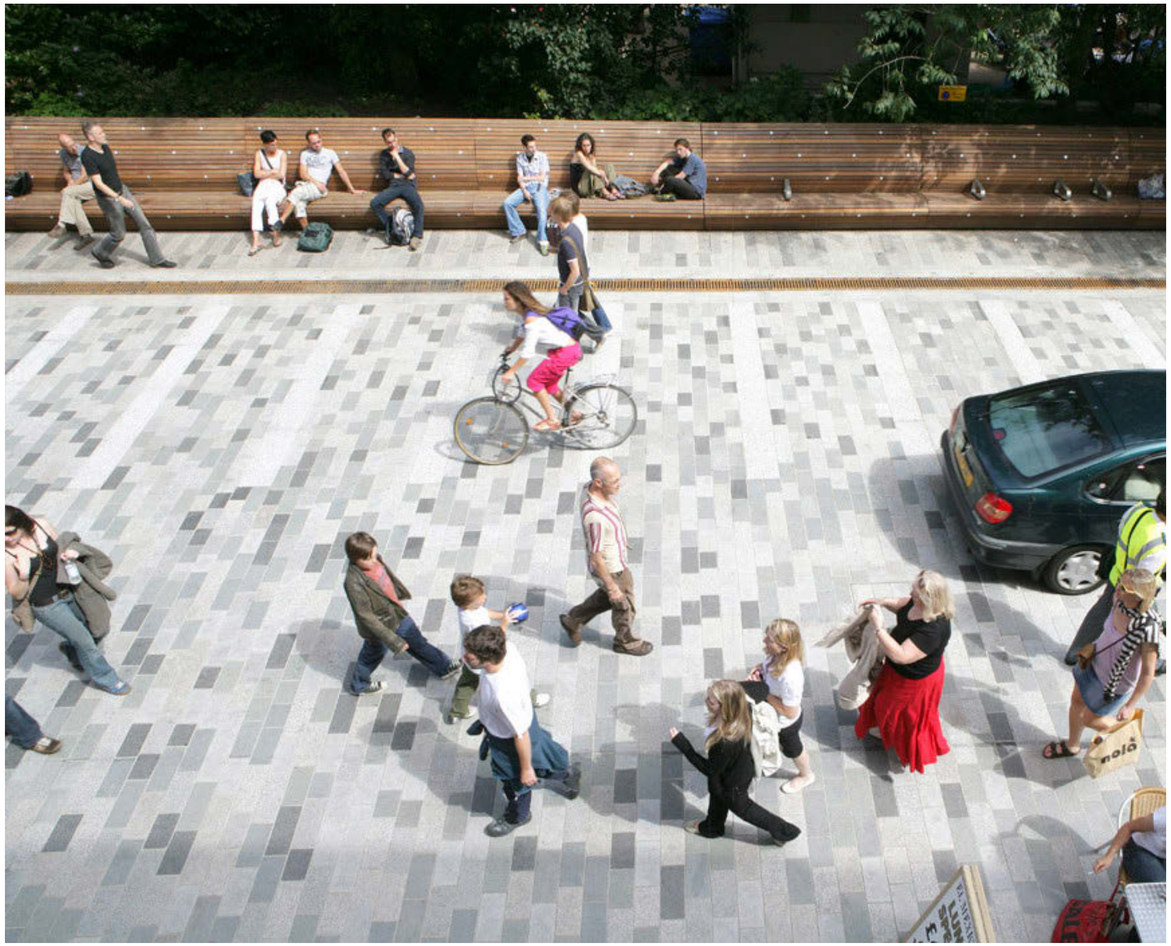


GARDEN / GROVE

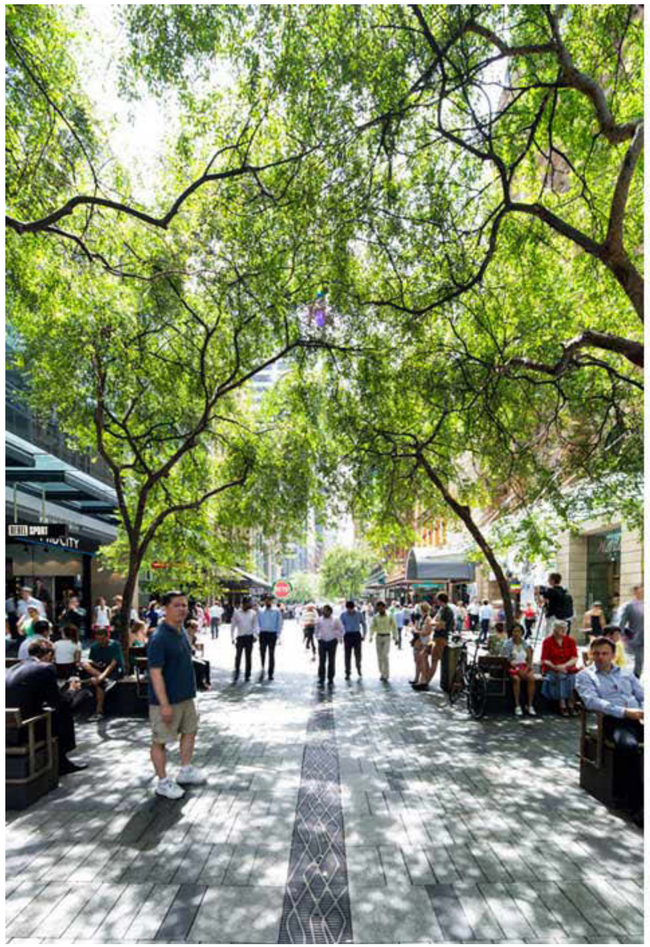
CONNECT AND DISTINGUISH

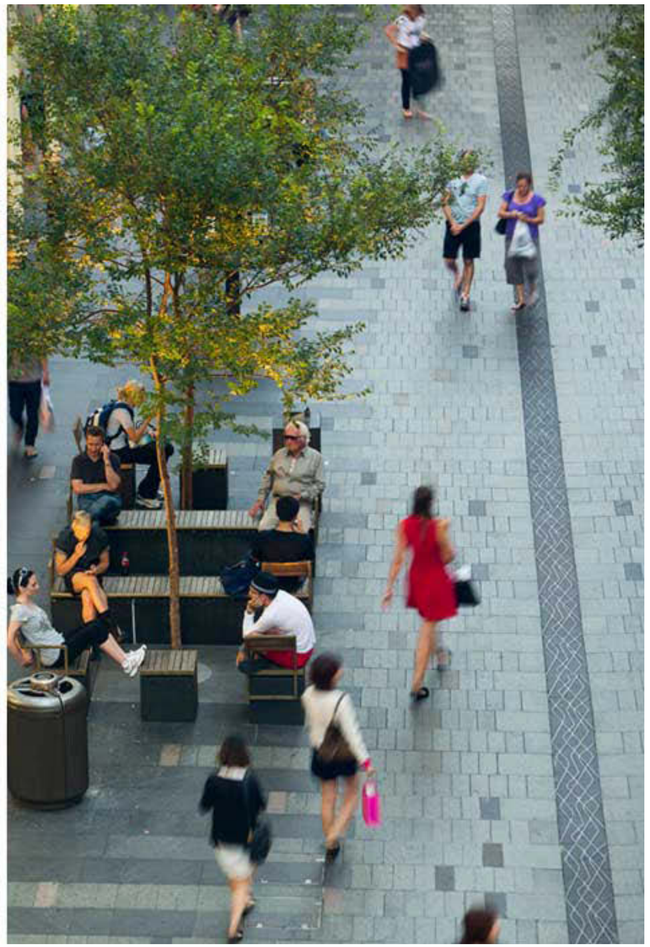


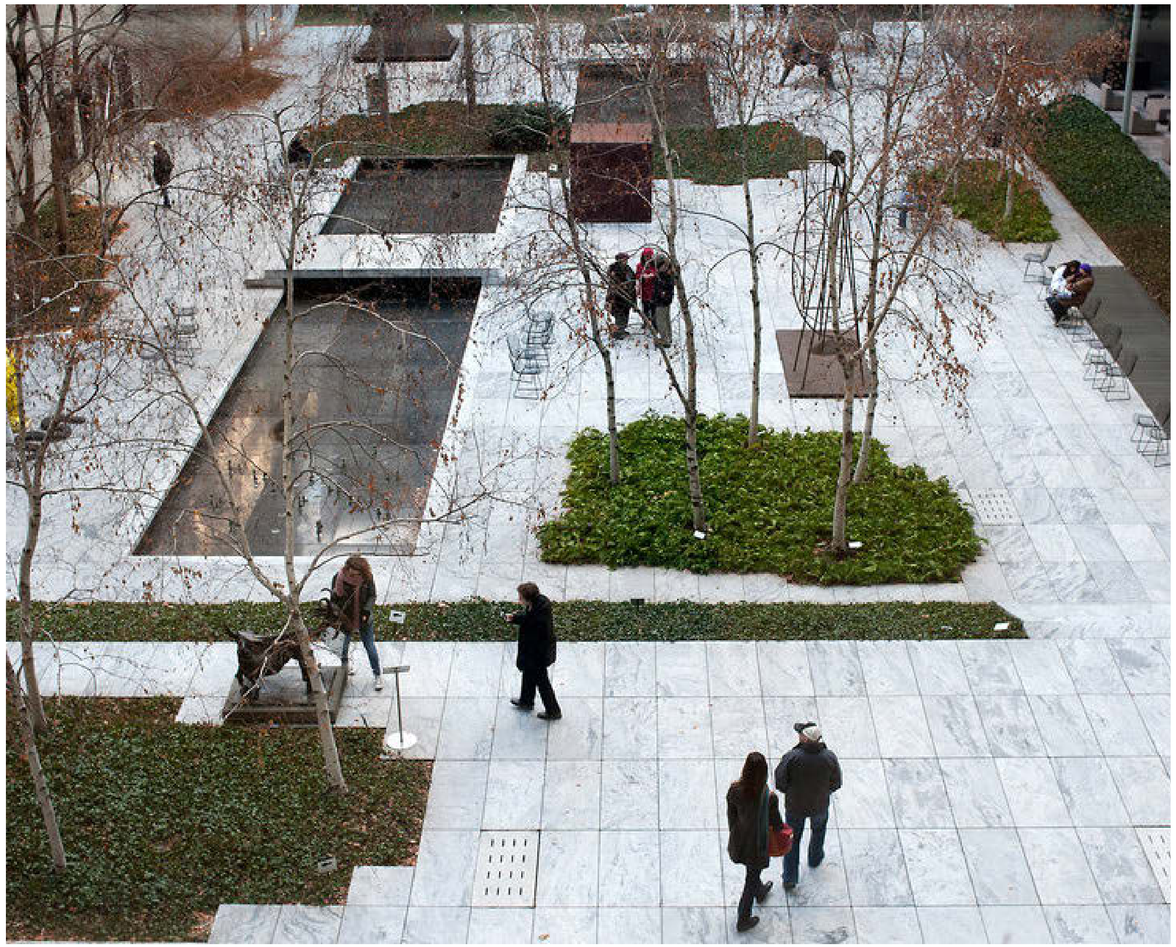
CORRIDOR



FORECOURT

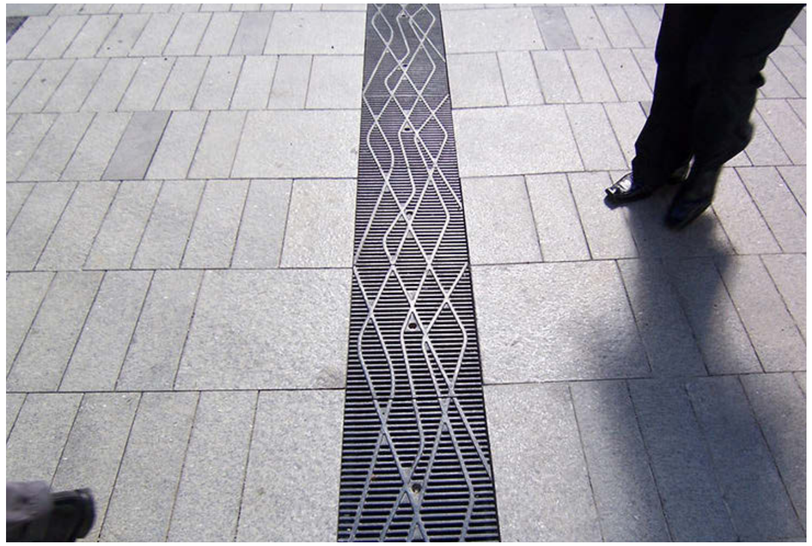






GROVE

RESILIENCE



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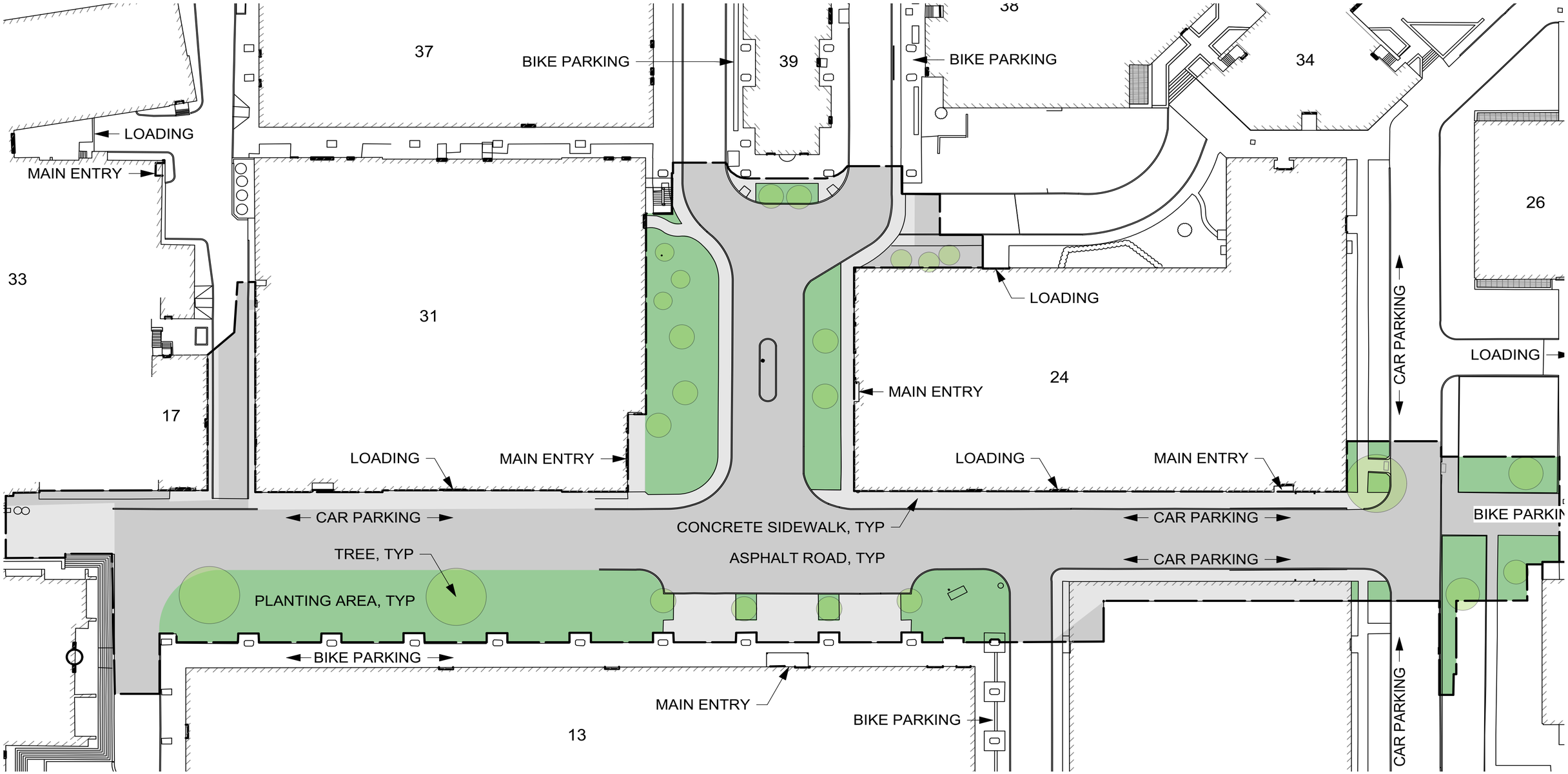
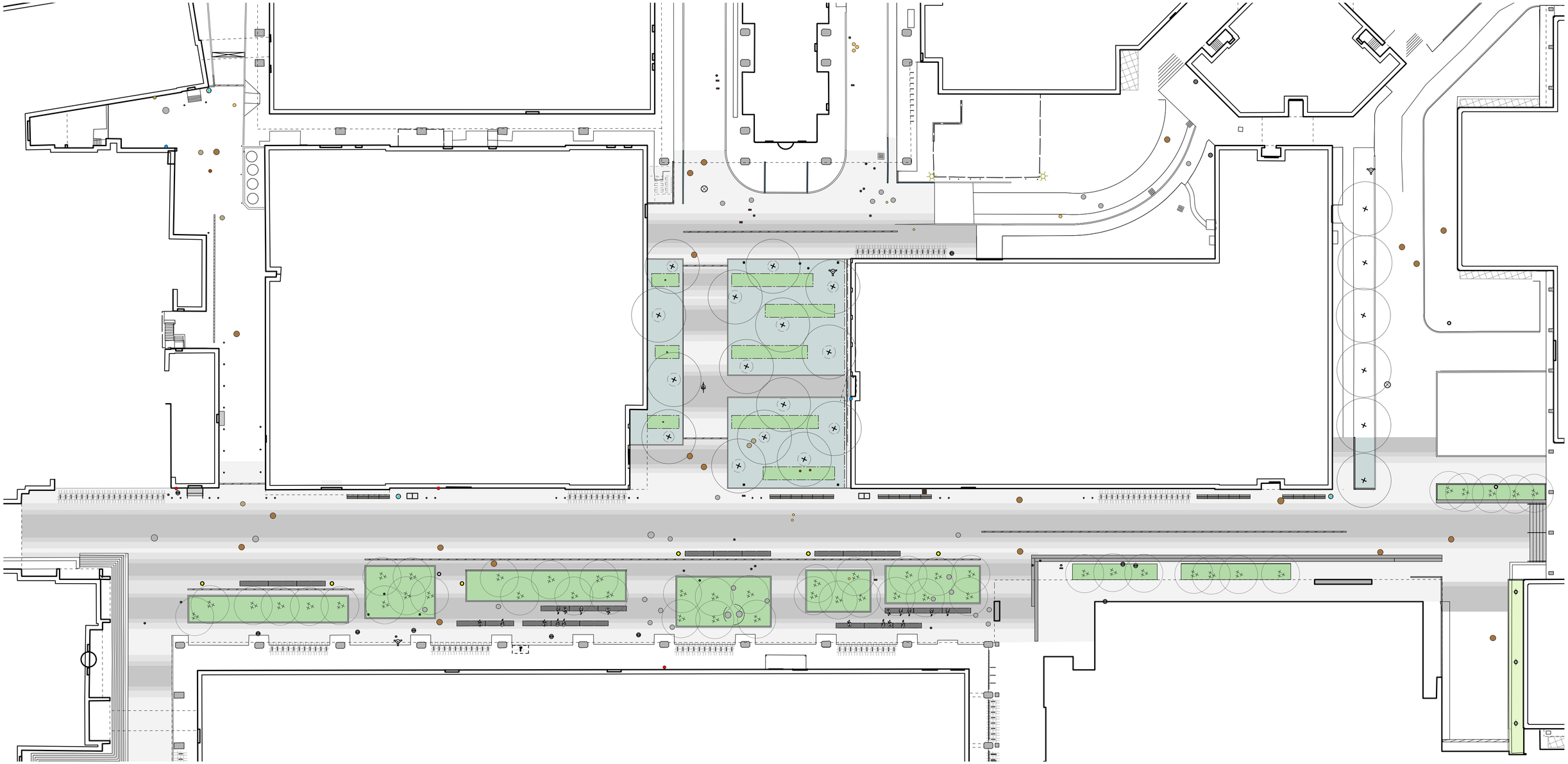
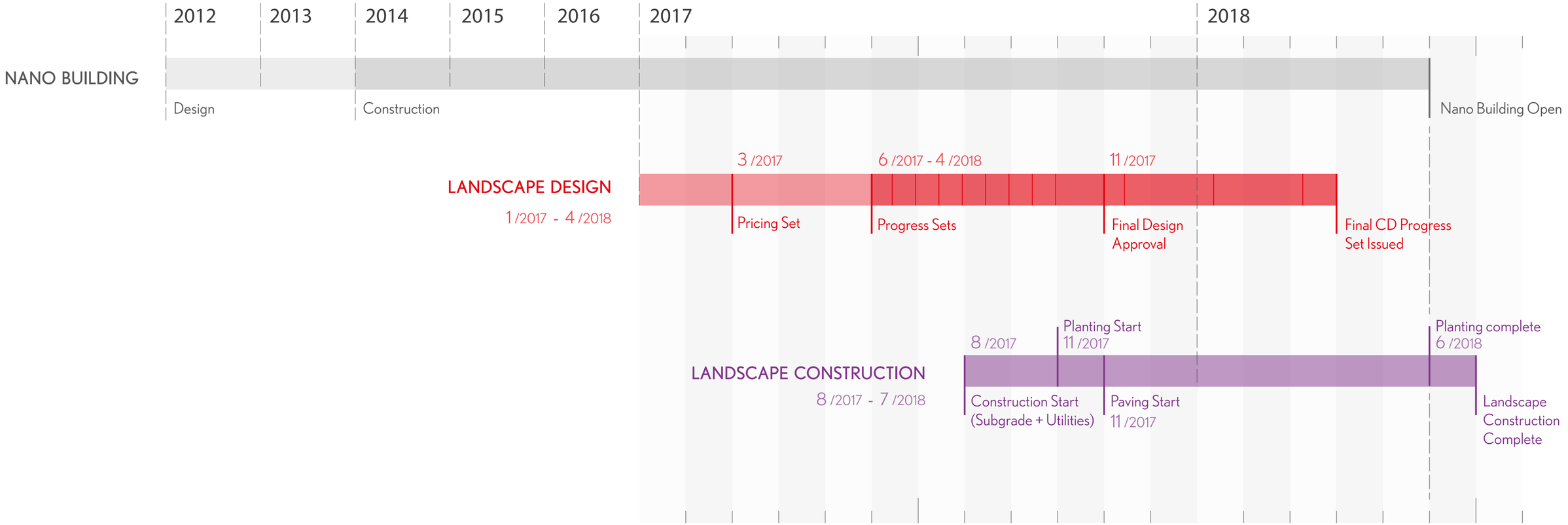


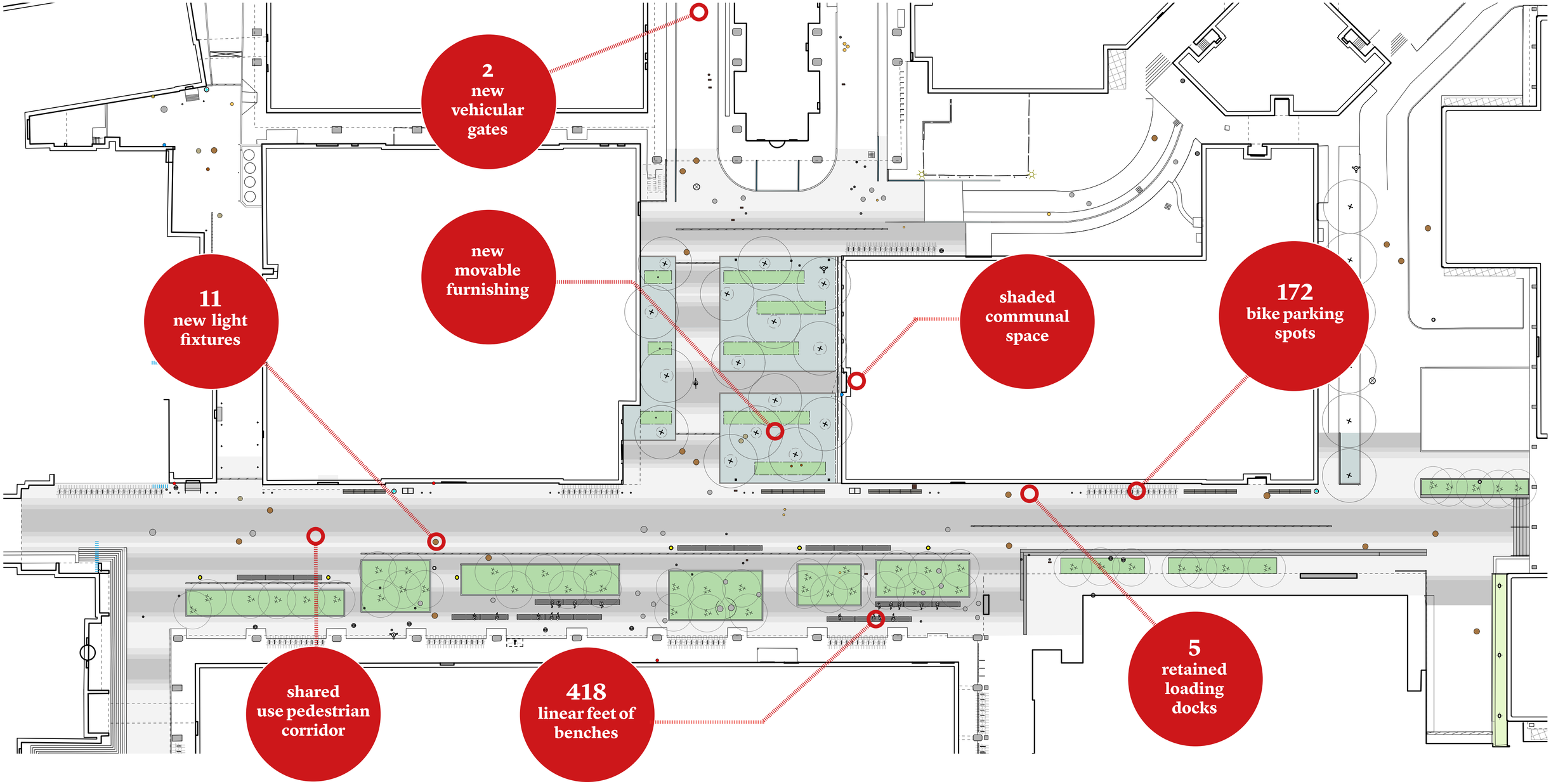
CONNECT AND DISTINGUISH



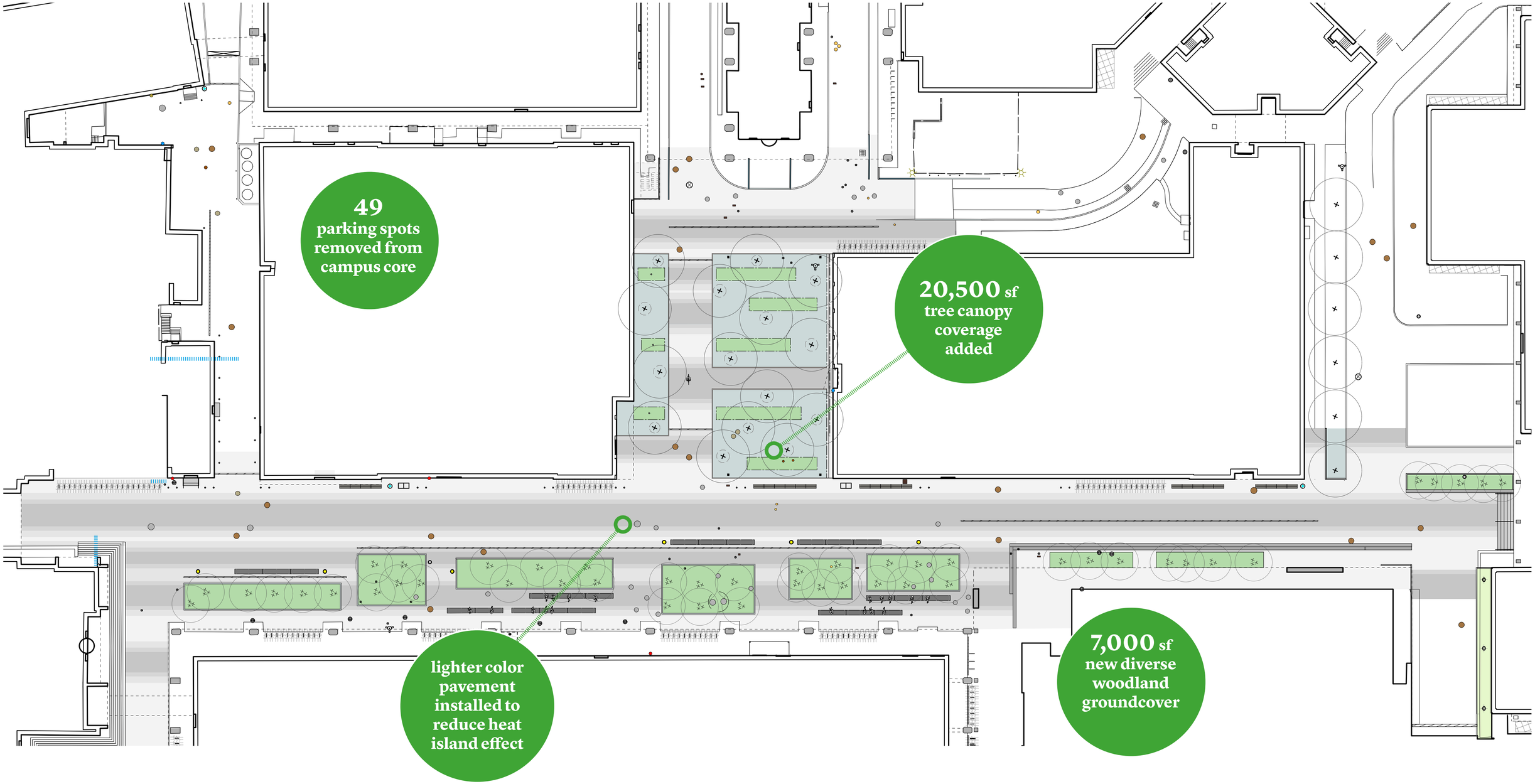
DEFINE THE PROJECT



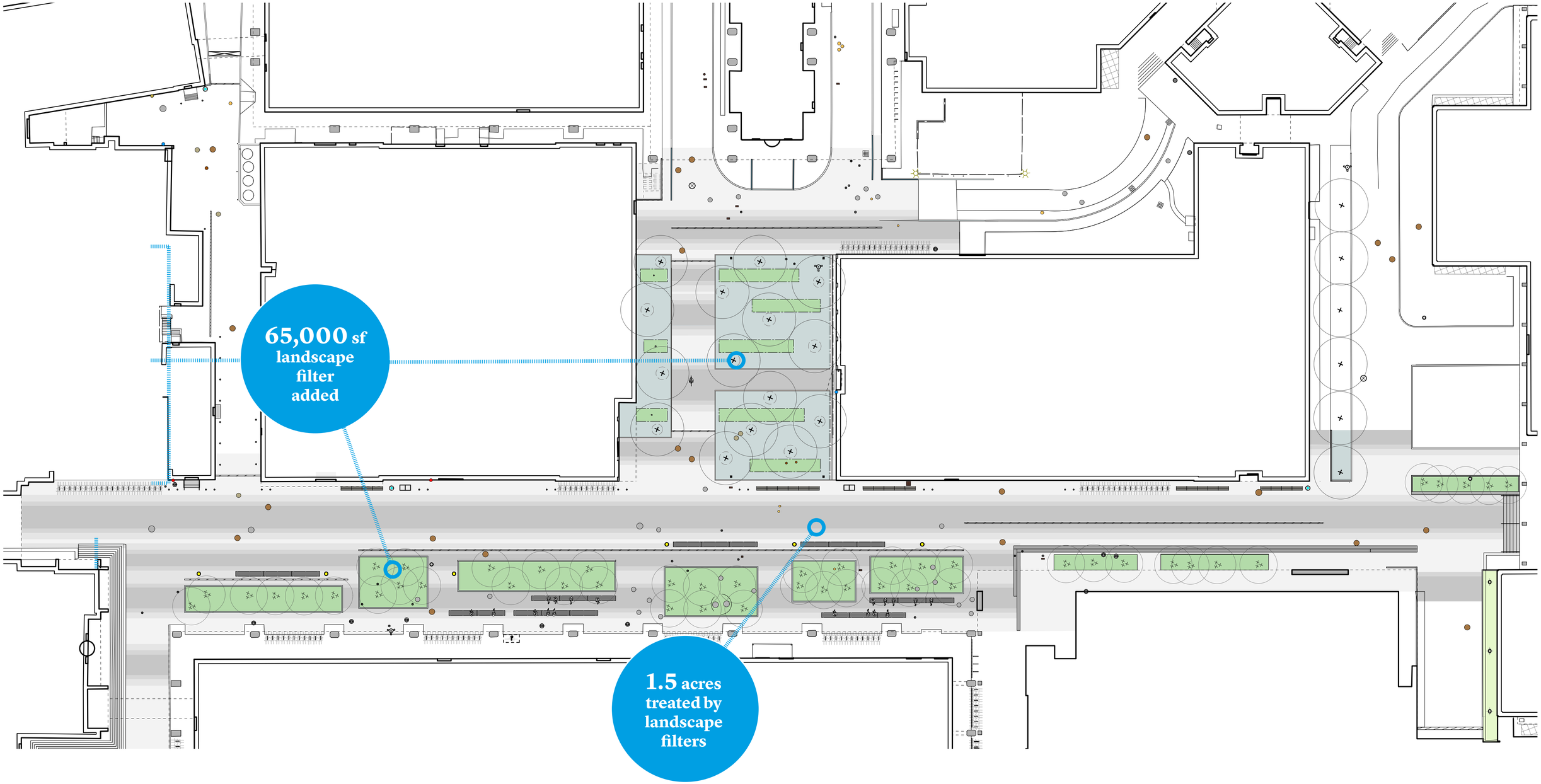
PROVIDE FOR USERS



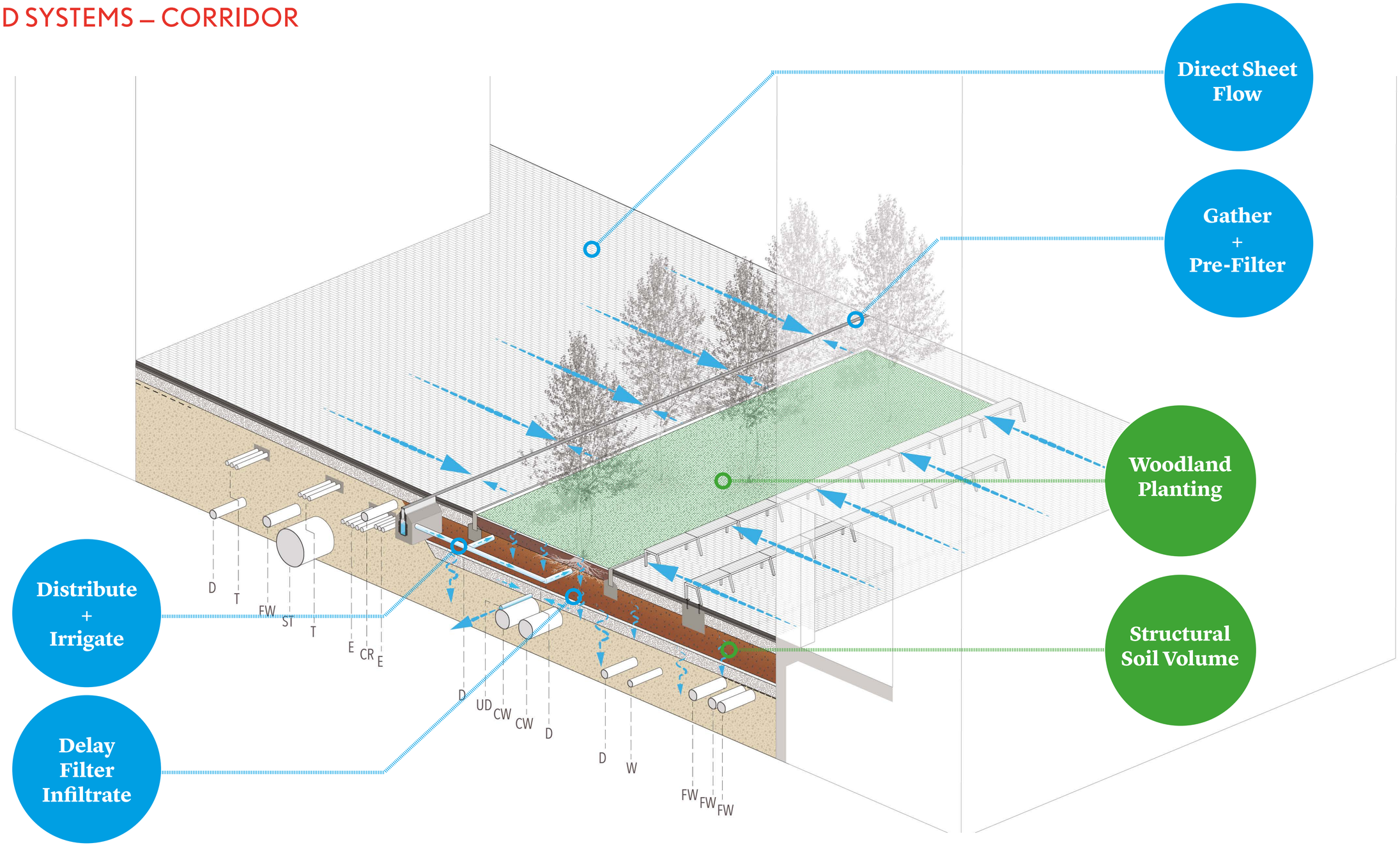
ENHANCE ECOLOGY



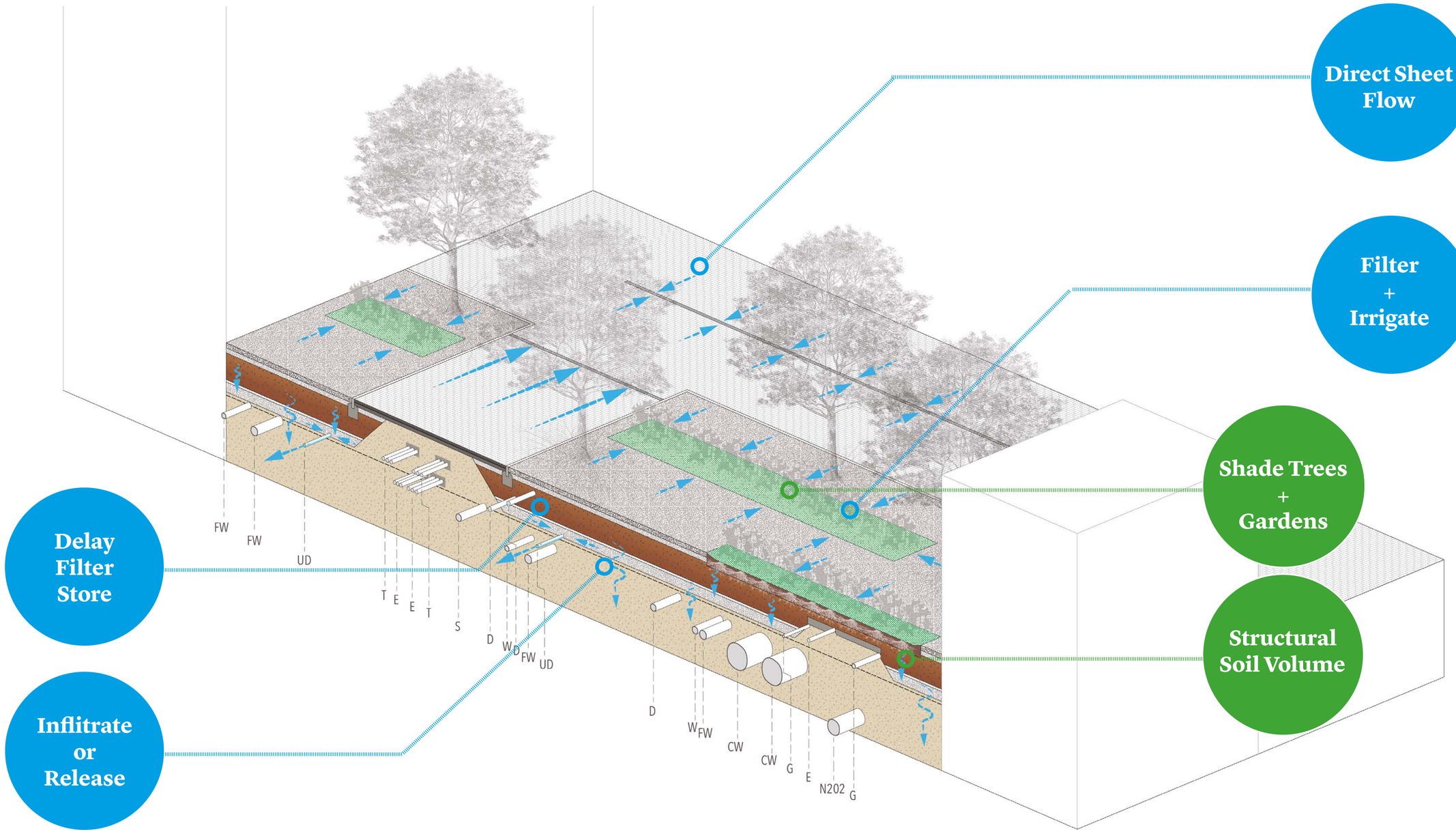
INTEGRATE PERFORMANCE



HYBRID SYSTEMS – CORRIDOR



HYBRID SYSTEMS – COURT



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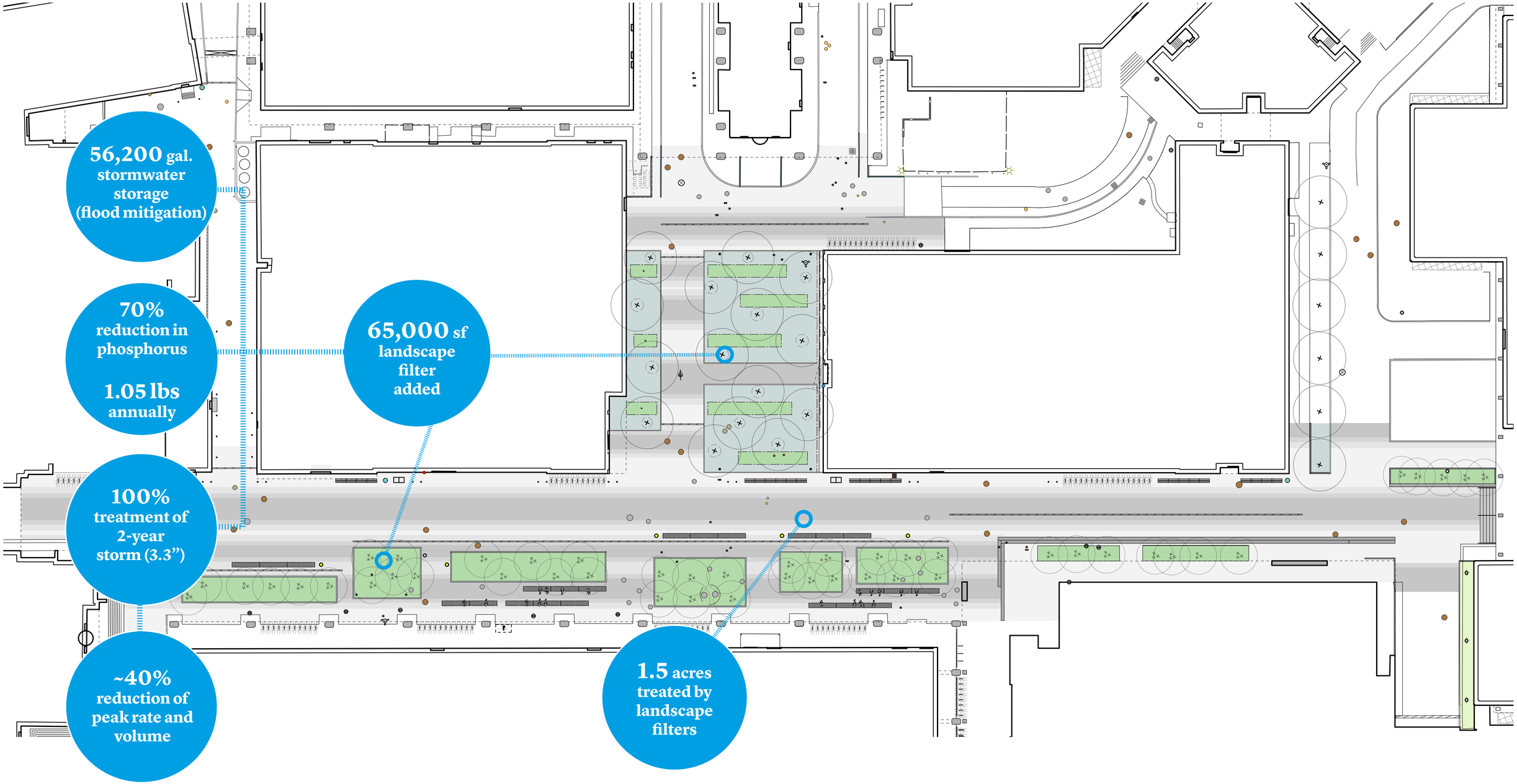
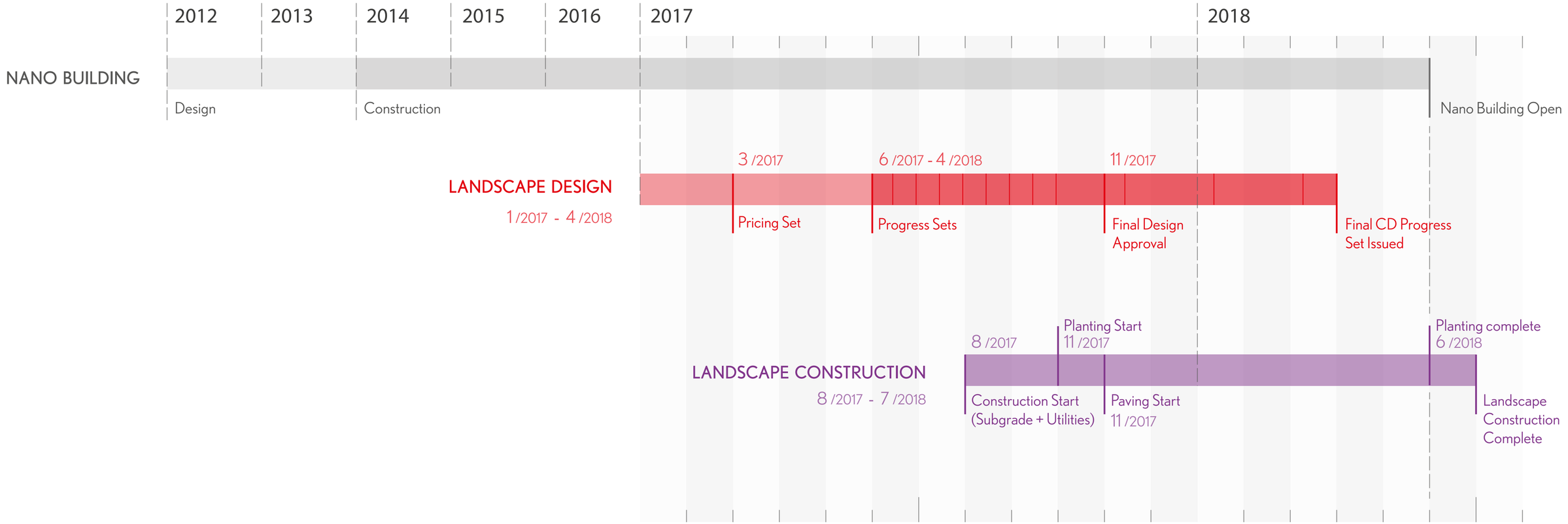
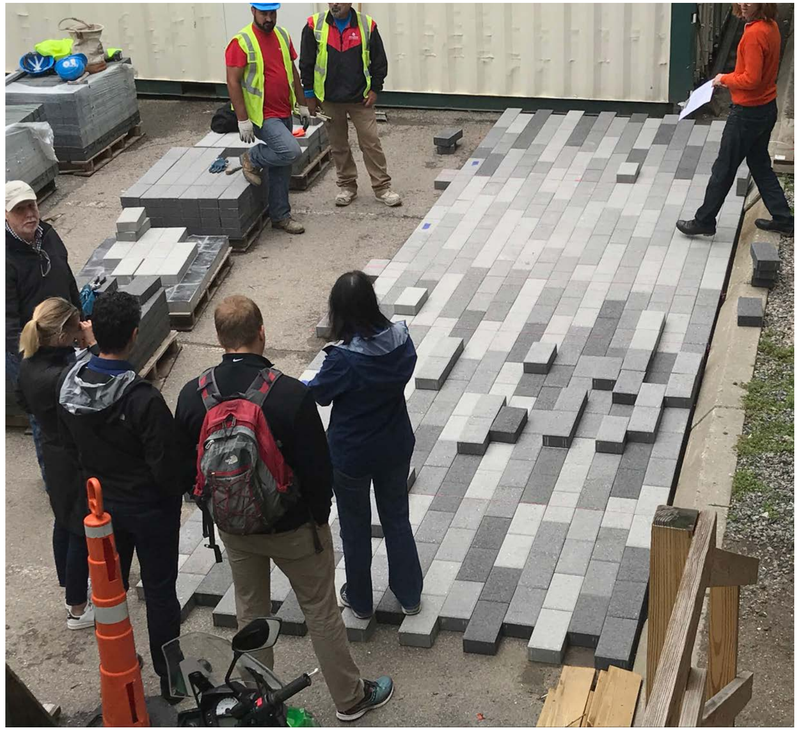


IMPLEMENTATION STRATEGY



IMPLEMENTATION STRATEGY

																	Data Date:	05/07/19
CSI	CSI SECTION	SUBCONTRACTOR	DESCRIPTION	TYPE	Comments	STATUS	Design Information Needed	Submittal Lead time (weeks, per sub)	Submittal Required From Sub	Turner Submittal Review Time (Wks)	Designer Submittal Review Time- (wks)	Date Released Required	Product Lead Time (wks)	ROJ Date (Input)	OK or LATE/HOT	Actual Delivery Date	
		AA Will	Soil - Soil Disposal Package	Product Data		Ongoing	6/4/17	1	6/11/17	0.4	2	6/28/17	1	07/05/17	LATE/HOT		
		AA Will	Specialty - Stormceptor STC900	Product Data			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		AA Will	Specialty - Stormceptor STC900	Shop Drawings			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Sully Mac	Lighting - Light Pole - LT-02 - Mast Lights	Product Data			6/9/17	2	6/23/17	0.4	2	7/10/17	12	10/02/17	LATE/HOT		
		Sully Mac	Lighting - Light Pole - LT-02 - Mast Lights	Shop Drawings			6/9/17	2	6/23/17	0.4	2	7/10/17	12	10/02/17	LATE/HOT		
		Brightview	Utility - Corrugated piping (6", 8", 12")	Product Data			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Corrugated piping (6", 8", 12")	Shop Drawings			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Perforated Corrugated piping (6")	Product Data			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Perforated Corrugated piping (6")	Shop Drawings			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Perforated Distribution Pipe	Product Data			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Perforated Distribution Pipe	Shop Drawings			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Perforated Underdrain Pipe	Product Data			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Perforated Underdrain Pipe	Shop Drawings			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Storm Drain Piping	Product Data			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Storm Drain Piping	Shop Drawings			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Underdrain Piping	Product Data			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Utility - Underdrain Piping	Shop Drawings			6/9/17	1	6/16/17	0.4	2	7/3/17	3	07/24/17	LATE/HOT		
		Brightview	Soil - Compacted Gravel Fill	Product Data			6/11/17	3	7/2/17	0.4	2	7/19/17	1	07/26/17	LATE/HOT		
		Brightview	Soil - Dense Graded Crushed Stone	Product Data			6/11/17	3	7/2/17	0.4	2	7/19/17	1	07/26/17	LATE/HOT		
		Brightview	Soil - Sand and Gravel Chinking Layer	Product Data			6/11/17	3	7/2/17	0.4	2	7/19/17	1	07/26/17	LATE/HOT		
		Brightview	Soil - Sand Drainage Layer	Product Data			6/11/17	3	7/2/17	0.4	2	7/19/17	1	07/26/17	LATE/HOT		
		Brightview	Soil - Structural Sand	Product Data			6/11/17	3	7/2/17	0.4	2	7/19/17	1	07/26/17	LATE/HOT		
		Brightview	Soil - Section Shop Drawings	Shop Drawings			6/18/17	1	6/25/17	0.4	2	7/12/17	1	07/19/17	LATE/HOT		

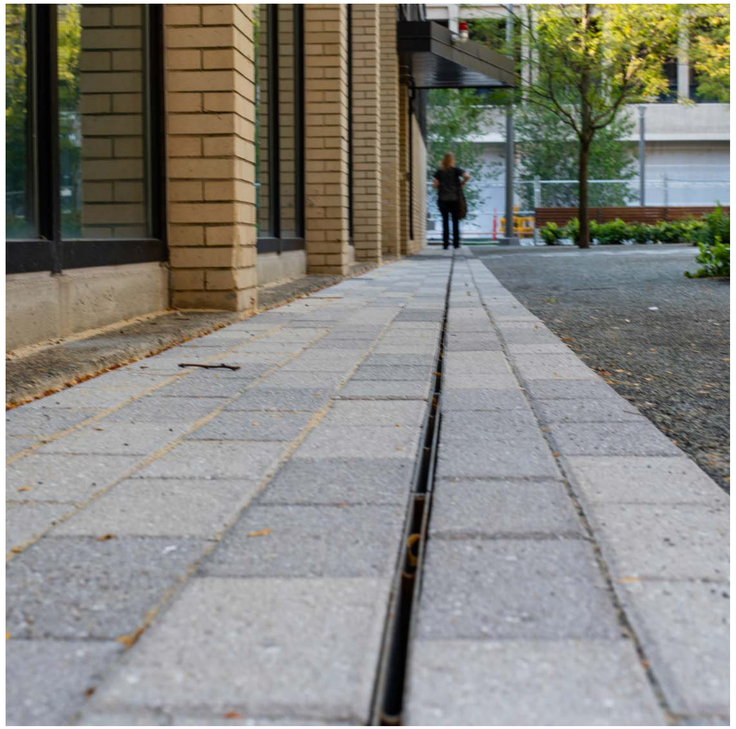


A WORKING LANDSCAPE

A WORKING LANDSCAPE

A WORKING LANDSCAPE

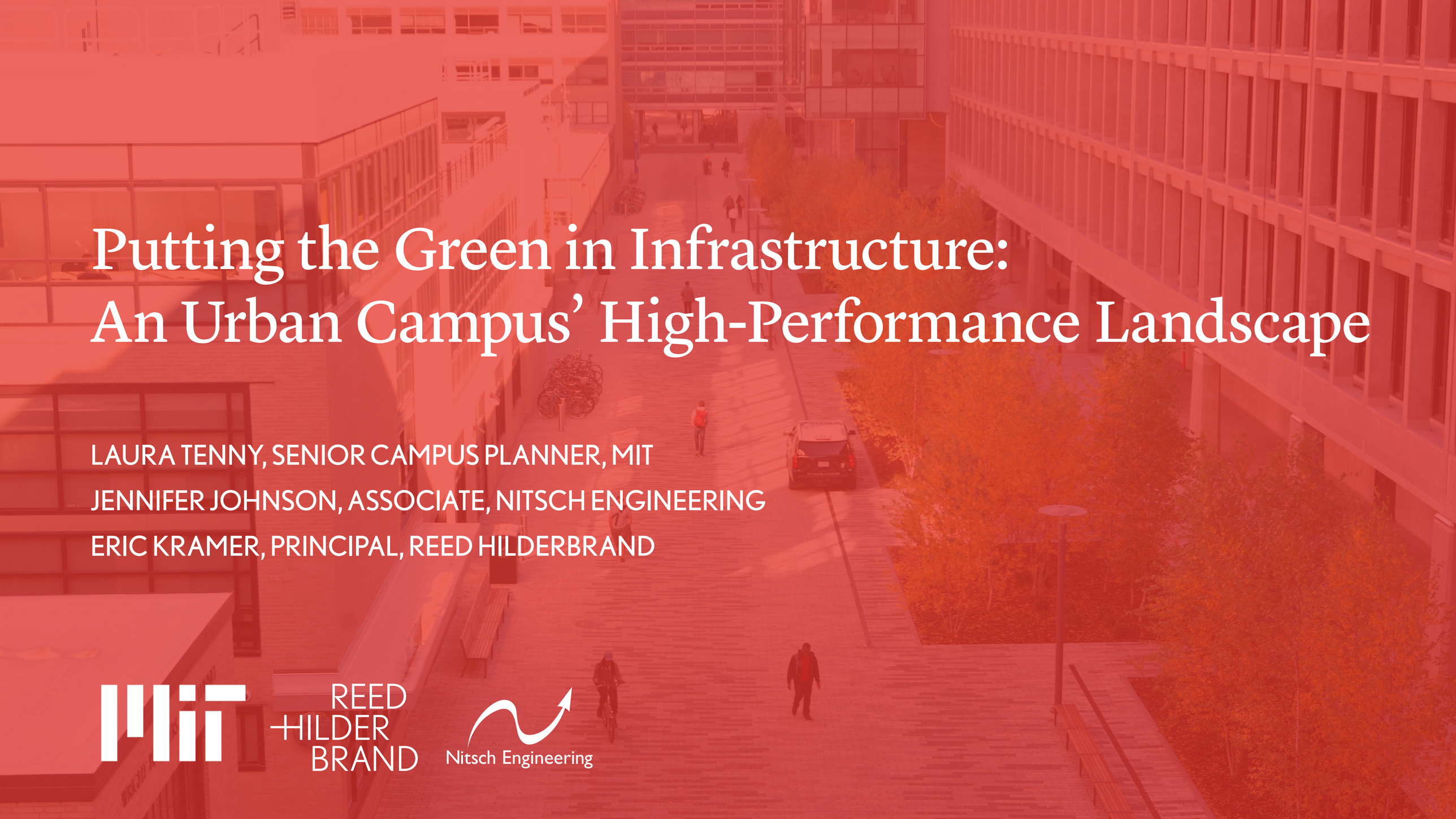
A WORKING LANDSCAPE



A WORKING LANDSCAPE


VASSAR
ST.


NO
PARKING



Putting the Green in Infrastructure: An Urban Campus' High-Performance Landscape

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REED HILDER BRAND

Nitsch Engineering