MITIGATING THE DANGERS OF CONCRETE JUNGLES WITH BIOTECTURE

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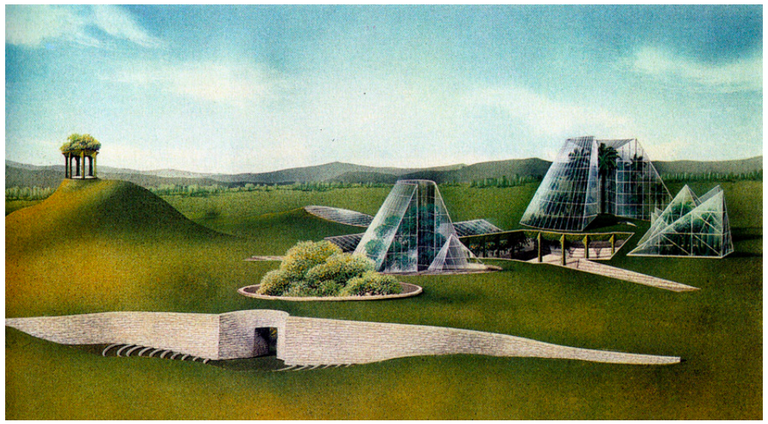
Graduate Thesis
Drexel University
M.S. Interior Architecture & Design
2021



"The Western notion of mass creations as things that stand distinctly as separate entities, in contrast, to nature I think has exhausted its intellectual and ethical capital."

- EMILIO AMBASZ

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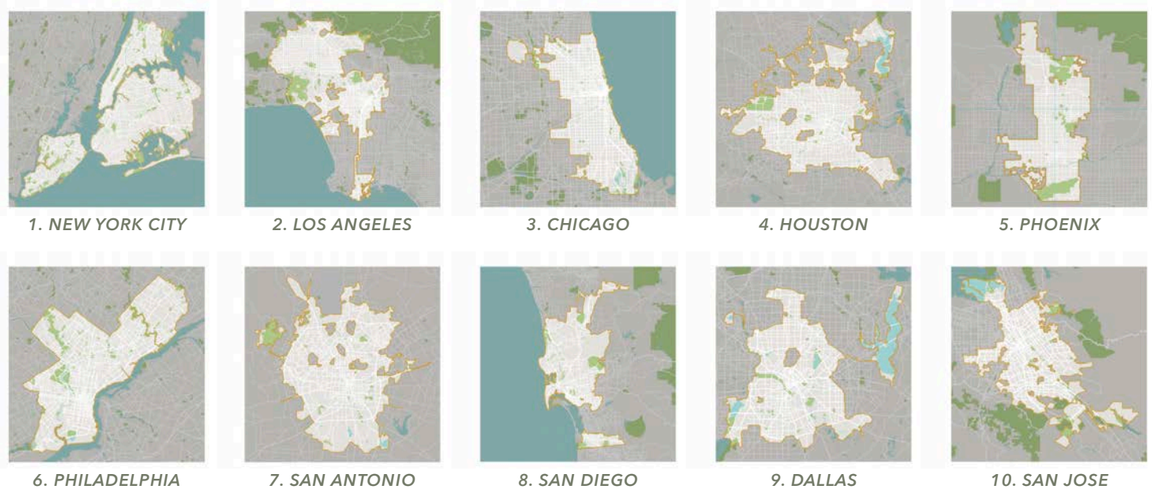
INTRODUCTION

TEN LARGEST U.S. CITIES, BY POPULATION



1. NEW YORK CITY
2. LOS ANGELES
3. CHICAGO
4. HOUSTON
5. PHOENIX
6. PHILADELPHIA
7. SAN ANTONIO
8. SAN DIEGO
9. DALLAS
10. SAN JOSE

If we look at the ten largest cities (by population) of the United States, we see a glaring similarity; a severe **lack of green space**. And while the human population doubles, the urban population triples. The expansion of these metropolises has **imperialized territory** that once belonged to harmonious ecosystems and created expansive dead zones for most plant and animal wildlife. Of the several consequences this surge in urbanism has caused, the existential threat to Earth's **biodiversity** and **climate change** are arguably two of the most significant environmental issues. The bulldozing of natural terrains also has a dire impact on the **human psyche**. Studies have shown that a connection to nature is essential for our wellbeing and childhood development. As disheartening as the current state of our urban planning standards are, there are architects like Ken Yeang and Emilio Ambasz who preach **Biotecture** (biology + architecture) for a better future.

Following in the footsteps of these and so many other green building pioneers, my thesis project will provide an **urban building standard** that brings biology and ecology to the forefront of architecture. Much like LEED or the Living Building Challenge, my work will be formatted as a set of requirements that future projects can take on in order to achieve the proposed level of sustainability. The deliverables will operate on **three different scales**, at the largest it will provide ideal spacing plans of 'green' blocks within an existing city. On the intermediate scale it will tackle the requirement of each of those blocks. And lastly on the smallest scale it will consider the individual building, and how we can continue nature-integration into interior space. I will provide prototypes of each scale.

This thesis project is by no means a solution to the issues of today's urban planning, but merely a first step towards building a **harmonious relationship** between the natural environment and human development.

PART I - TOPIC

Literature Review

Introduction

Based on construction and operation standards of today, buildings are a threat to the survival of life on earth. They increasingly deplete our natural resources and deteriorate our ecosystems. However, it is not too late to reverse this damage and prevent future generations from having to experience similar conditions; it starts with blurring the lines between living and non-living systems, and letting wild terrain grow back into our abiotic, or non-living, cities. By addressing these hazards using new building methods like biotecture, the synthesis of biology and architecture, we can slowly start to make way towards a fully sustainable way of life. As a species, we have an ethical responsibility to the other living beings within our ecosystems to coexist without jeopardizing their ability to survive. It is by reintegrating organic constituents into the non-living systems in which we currently operate, that we can achieve this vision of essential symbiosis.[1]

On average in the United States, there are currently 4 times as many buildings constructed than are demolished every year. In certain years, new and existing structures have accounted for almost 40% of the nation's total energy consumption and carbon dioxide emissions, as well as 13% of the nation's water consumption. In addition, American spend about 90% of their time indoors, where the effects of environmental pollutants can be two to five times stronger (up to 100 times stronger in special circumstances) than in an outdoor setting. Certain construction materials and methods have been proven to cause cancer, asthma and mental

[1] (TEDxTalks, *Saving the world by ecological design | DR. KEN YEANG | TEDxNitteDU* 2018)

illness.[2] This time spent indoors has also greatly limited regular access to the natural environment, which has also had observable adverse effects on human wellbeing.[3]

Review of Literature

Environmental Side Effects of Human Ignorance

In the 2009 report on *Buildings and their Impact on the Environment: A Statistical Summary,* the United States Environmental Protection Agency provides several statistics that give an unmistakable image of how harmful the construction and operation of buildings can be to the environment. As shown in **Figure 1** below, buildings accounted for 72% of the nation's total electricity consumption in 2006 and is expected to average at around 75% annually by 2025, of which 51% of these totals are attributed to residential building use. Furthermore, **Figure 2** below breaks down the makeup of an average American house hold's energy consumption. [4]

FIGURE 1: Buildings' contribution to national totals (Annual maximums as of 2009)

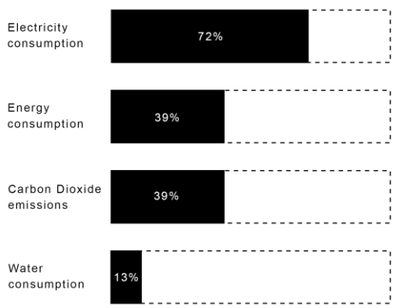
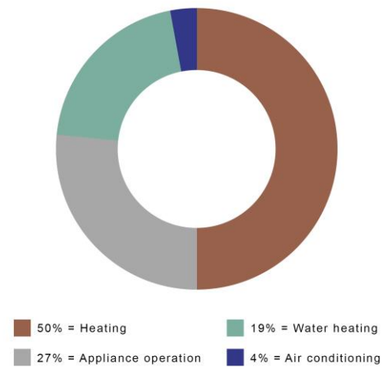


FIGURE 2: Average American household's energy consumption



[2] (EPA, *Buildings and their Impact on the Environment: A Statistical Summary* 2009)
[3] (Louv, *Last child in the woods* 2008)

Cities with populations of one million people or more have shown a consistent mean air temperature of 1.8° - 4.5° F warmer than its surrounding areas (the difference in the evening has been recorded to be as high as 22° F). This is known as city heat island effect, and it has been proven to cause spikes in air conditioning usage, air pollution, greenhouse gas emissions, and even heat-related illnesses and mortality. [4] In terms of water, the public demand for water in the United States has tripled between 1950 and 2000, though the population has doubled in that same time period. At the time that this report was written (2009), 26 billion gallons of water were being used daily in the US, 13% of which (3.38 billion gallons) can be attributed to building occupant use. Similar to the disproportionate increase in demand for water, urban development overtaking rural land area has quadrupled from 1945 to 2002, growing at twice the rate of population growth in the country.[4]

A similar scholarship, *An Evaluation of Environmental Impacts of Construction Projects* by Adnan Enshassi, Bernd Kochendoerfer, and Ehsan Rizq suggests that the negative impacts of buildings proven by the US EPA is a force that can be felt worldwide. In a study of the Gaza Strip, an area experiencing constant construction projects on the coast of the Mediterranean Sea, this research finds that the construction industry has massive direct and indirect effects on the environment that can be categorized into three subgroupings: ecosystem, resources, and public health.[5]

Ecosystem impact involves hazards that effect the complex, yet vital, network of living species in proximity to the project site and beyond. This includes non-biodegradable waste,

[4] (EPA, *Buildings and their Impact on the Environment: A Statistical Summary* 2009)

noise, air and water pollution, dust and toxic generation, hazardous emissions, invasive land use, and disruptive operations with vegetation.[5]

The resources category considers the various natural resources used throughout the course of any construction project, including energy, land, materials and water. Construction practices are responsible for about half of any high-income nation's total energy use, and are a major contributor to greenhouse gas emissions (20-30% of totals) in both developed and developing nations.[5]

The public health grouping revolves around the impact of construction projects felt by humans. Of these effects, 'social disruption' was ranked as the most severe. This includes conditions such as road closures causing traffic disruption as well as disruption of the peace at home (during typical hours of sleep) or work due to construction noise and vibration. Site hygiene was ranked the second most noticeable effect, encompassing the health of laborers' who are exposed to that waste on a consistent basis. The sanitation of construction machinery, the filth produced by dust and chemicals, as well as gas and vehicle emissions that on-site workers breathe contribute heavily to this category.[5]

In a New York Times article titled *Humans are Speeding Extinction and Altering the Natural World at an 'Unprecedented' Pace,* author Brad Plumer pulls insight from a 1,500 page UN report on the worldwide decline of biodiversity to conclude that human activity has had devastating effects on several of earth's other species. About one million plant and animal species are at risk of extinction, posing an imminent threat to countless ecosystems. 20% of native plant and animal species to major land habitats (like the African savannas and South

[5] (Enshassi, Kochendoerfer, & Rizq, *An evaluation of environmental impacts of construction projects* 2014)

American rain forests) have already died out due to human intervention such as farming, logging, poaching, and mining.[6]

Up to now, most of the general public has overlooked environmental protection movements and disregarded them as efforts to save nature for its own sake, but this UN report is one of the first to clearly distinguish the toll that natural degradation can and will have on the human species. Food shortages and lack of access to clean air and water are basic human needs that are already being disrupted. From a human-centric perspective, it is crucial to restore and slow the rapid degradation of natural habitats because they provide fundamental environmental benefits to humanity that can be equated to $24 trillion worth of work per year. For example, rainforests absorb an immense amount of carbon dioxide and slows the rate of global warming, wetlands purify drinking water, coral reefs sustain tourism and fishing, and exotic tropical plants serve as a source of medicine.[6]

The Importance of Nature for Human Wellbeing

Richard Louv is a respected author and journalist who writes about the importance of a human connection to nature, especially in regards to children. In his book *Last Child in the Woods: Saving our Children from Nature-Deficit Disorder,* Louv gives insight into a major problem that our technology-driven society is facing today through the lens of child advocacy. Through conversations with researchers, scientists, parents, and children, and scientifically researched facts and studies, Louv discovers and addresses an alarming disconnect between American children of the past few decades and the natural environment. He links a lack of exposure to nature, to major developmental issues such as depression, attention-deficit disorder,

[6] (Plumer, *Humans Are Speeding Extinction and Altering the Natural World at an 'Unprecedented' Pace* 2019)

obesity, social anxiety, and identity confusion.[7] Time spent indoors also creates the temptation of digital and lazy play, where children stare at screens and are fed entertainment made by somebody else, such as a video game designer, or a TV show director.[7] Ideally, according to Louv, children would be spending more time outdoors where their creative minds can be nurtured and exercised by playing with humble, natural materials.[7] Outdoor play has additional proven benefits for child development such as strengthening the imagination, nurturing spirituality and an awareness of surroundings, and teaching social skills such as self-control, helpfulness and conflict resolution.[7]

The book *Ecotherapy: Healing with Nature in Mind,* psychotherapist Linda Buzzell and psychologist Craig Chalquist continues the conversation, that was started by their peers in 1995. This conversation marries the worlds of psychology and ecology to create a new vision of planetary and human health. Buzzell and Chalquist take the next step in this emerging field by researching the psyche-world connection further and exploring new hands-on methods in the area of healing. The practice of ecotherapy is centralized around the notion that humans are inseparable from our surrounding environment, and that healthy interaction with the earth is extremely nurturing to our species.[8]

In a collaborative effort, Cecily Maller, Mardie Townsend, Anita Pryor, Peter Brown, and Lawrence St Leger authored the paper, *Healthy Nature Healthy People: 'Contact with Nature' as an Upstream Health Promotion Intervention for Populations,* which addresses the untapped potential of public green space as a means of public health promotion and illness prevention. This paper offers empirical, theoretical, and anecdotal evidence of nature's abundance of benefits towards human health and wellness. It suggests the higher prioritization of public parks and gardens in city planning as they have the potential to be utilized as community-wide free health boosters. A boon to lower income populations who may not have access to formal or affordable healthcare. If such a project were to be successful it would require collaboration between several sectors, from public health and social services, to urban and environmental managers.[9]

Using Biotecture to Heal the Human / Nature Relationship

Eco-Architect Ken Yeang is a strong force in today's green building movement. He strongly believes that the organic constituent (that is ever-present in every existing ecosystem) needs to be introduced into the realm of architecture which currently only operates to please the physical constituent.[10] In his TEDx Talk, *Saving the World by Ecological Design,* he firmly states that his goal as a practicing architect is to 'make cities breathe' to which his solution is to remake our cities as constructed ecosystems. Some of the attributes of any ecosystem that need to be considered in construction include (but not limited to) biological structure, biodiversity, and biointegration.[10]

Biological structure is the definition of the designed form. Yeang believes that a woven relationship between biotic and abiotic, or living and non-living, area is most ideal. Random patches of green space scattered around an otherwise concrete jungle eliminate the essential possibility of travel from one habitat to another for several species.[10] This ties into biodiversity, which is another key aspect of Yeang's practice. He achieves this by creating a biodiversity matrix for every project which involves establishing the location of different habitats, identifying the target native flora and fauna that the project wishes to reintroduce to the area. Ideal

[7] (Louv, *Last child in the woods* 2008)
[8] (Buzzell & Chalquist, *Ecotherapy: Healing With Nature In Mind* 2009)
[9] (Maller, Townsend, Pryor, Brown, & Leger, *Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations* 2006)

ecological design successfully biointegrates 4 major infrastructures; nature, humans, water, and the built environment. Biointegration is perhaps the most integral factor of ecological design. It explains if we are able to integrate everything we do, with the environment, we would not have any environmental issues today.[10]

In contrast, Jacob A. Littman of the University of Massachusetts Amherst, in his thesis, *Regenerative Architecture: A Pathway Beyond Sustainability*, offers regenerative architecture as a valid solution. It engages the natural environment as the medium for, and generator of architecture.[11] Littman posits the notion that today's building technologies are ethically obsolete and degenerative, that a successfully regenerative project recognizes and utilizes the natural condition of a site as building blocks of the architecture. The primary focus of this method is conservation and performance through intentional reduction of environmental impact. Littman goes on to define nine core principles of regenerative architecture, from whole systems design integration into place and landscape, to community and experience of place. Understanding the project site is vital to a regenerative project, so Littman also synthesized a holistic place analysis criteria standard, involving all aspects of the surrounding land from vegetation and wildlife, to the buildings & infrastructure.[11]

Architect and industrial designer Emilio Ambasz is another powerhouse in the sustainable building movement. He was one of the first to introduce the green building philosophy in the mid 1900s.[12] Ambasz's self-appointed primary task as an architect is to reconcile growing man-made nature with the organic one we have been given. With every

[10] (TEDxTalks, *Saving the world by ecological design | DR. KEN YEANG | TEDxNitteDU* 2018)
[11] (Littman, *Regenerative Architecture: A Pathway Beyond Sustainability* 2009)
[12] (GSAPP, *Emilio Ambasz* 2016)

project, he aims to give back the entirety of a building's footprint to the community in the form of a garden. (See **Figure 3**).

Figure 3: Acros Fukuoka by Emilio Ambasz

His projects prove that it is possible to have a garden and building fill an entire plot as vertical layers, so that neither must compromise territory to make space for the other. As a guiding principle, he believes we need to conceive of a new philosophical definition of nature, that includes architecture as one of its inseparable components.[12]

Another giant in the green building movement is Patrick Blanc, a botanist at the French National Centre for Scientific Research. He is the creator of the 'greenwall' that so many architects use today. His chapter *Vertical Gardens: The New Challenges* in the book *Green*

[12] (GSAPP, *Emilio Ambasz* 2016)

Cities in the World introduces the unique and recurring hurdles of green wall applications to high-rise buildings. 40 years since the first greenwall, he continues to push for its application to the ever-growing frontier of vertical architecture. Some challenges posed by high-rise buildings include extreme climactic variance, and the sheer immensity of the scale and dimensions of the site, as well as how to support such wide-spread life.[13]

Conclusion

In conclusion, the research above shows that the construction methods of today does two things: depletes the natural environment and builds a powerful barrier between humans and nature. The survival of living species on earth is at risk, but there is still hope of a new path forward that involves the symbiosis of all living species, Biotecture. It brings stronger and more sustainable ecosystems to our current architectural building methods, resulting in the immersive integration of our living and non-living systems, which has the power to save the future of our planet.

[13] (Blanc, *VERTICAL GARDENS: THE NEW CHALLENGES* 2015)

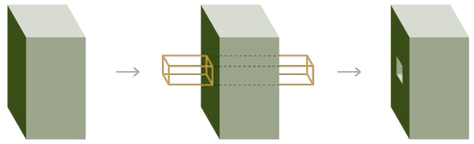
PART II - DESIGN AGENDA

Design Agenda Statement

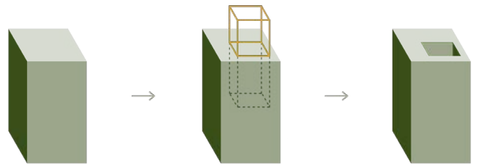
HOW TO ACHIEVE THE BIO BLOCK

This project challenges the traditional layout of an urban building with design strategies like **voids**, **atriums**, **carvings** and **double facades** to maximize exposure to nature and create exterior experiences within interior boundaries. The 'interior' spaces of this project should allow occupants to forget that they are indoors.

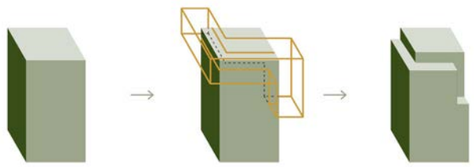
VOIDS



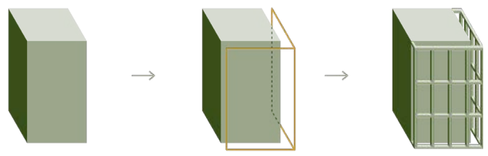
ATRIUMS



CARVINGS



DOUBLE FACADES



PART II - DESIGN AGENDA

Precedent: Bosco Verticale

ARCHITECT	Boeri Studio
LOCATION	Milan
PROGRAM	Residential
SIZE	~200,000 SF

MAJOR TAKEAWAYS

- Prototype for a new format of architectural **biodiversity**
- Services all life forms, rather than only humans Hosts 800 large trees, 300 small trees, 15,000 perennials, and 5,000 shrubs
- Plants equivalent of **300,000 SqFt** of woodland area onto a **30,000 SqFt** plot of urban area

FIGURE 4: Overall Towers

FIGURE 5: Balcony View

FIGURE 6: Corner Detail

FIGURE 7: Site Plan

FIGURE 8: Floor Plan

FIGURE 9: Exterior Elevation

Precedent: The REBEL

ARCHITECT	Studioninedots
LOCATION	Amsterdam
PROGRAM	Mixed Use
SIZE	~150,000 SF

MAJOR TAKEAWAYS

- Primarily residential program with retail, coworking and dining experiences on ground level
- Flexible **grid framework** allows for diverse functions and longevity
- 3-Dimensional grid accommodates insertion of floors, walls and ceilings but can also be kept hollow to create **void forms** and **outdoor space**

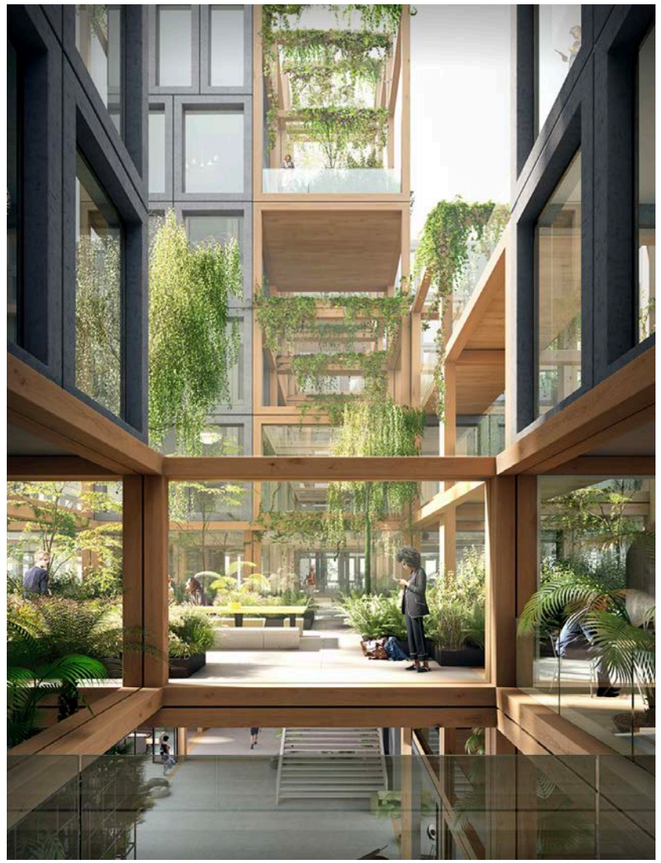


FIGURE 10: Interior Perspective

FIGURE 11: Exterior Perspective

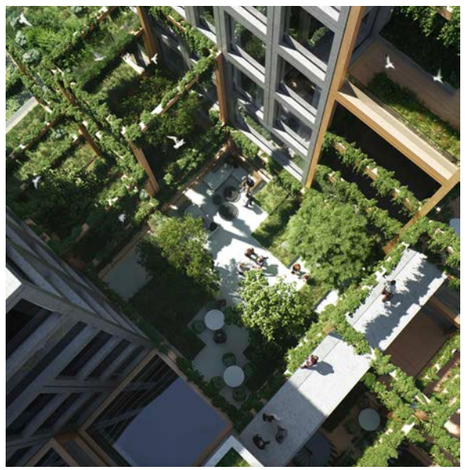


FIGURE 12: Courtyard

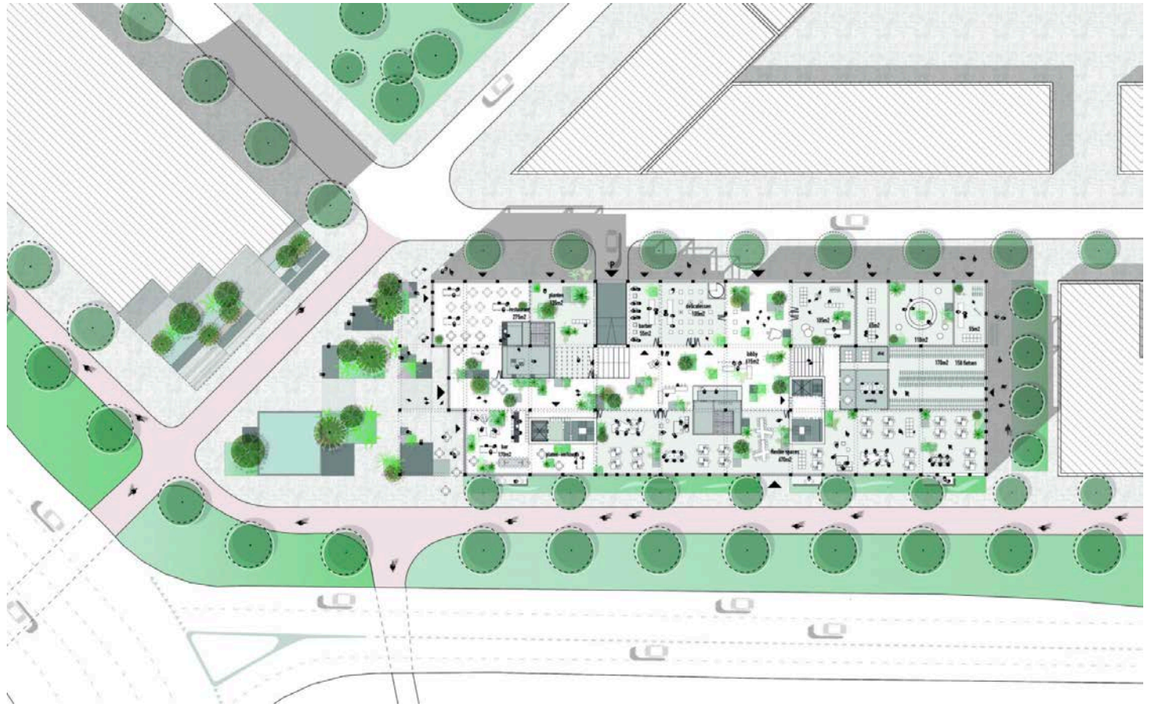


FIGURE 13: Site Plan

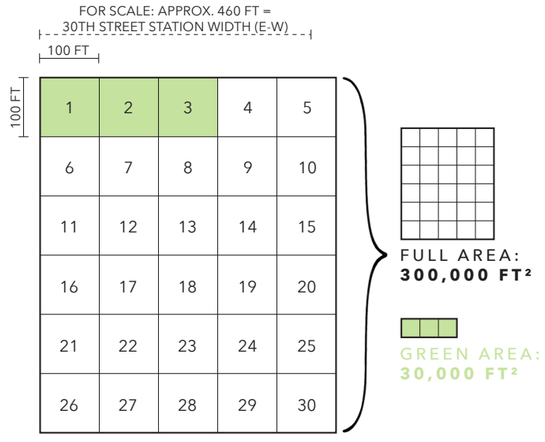
FIGURE 14: Section Perspective

PART II - DESIGN AGENDA

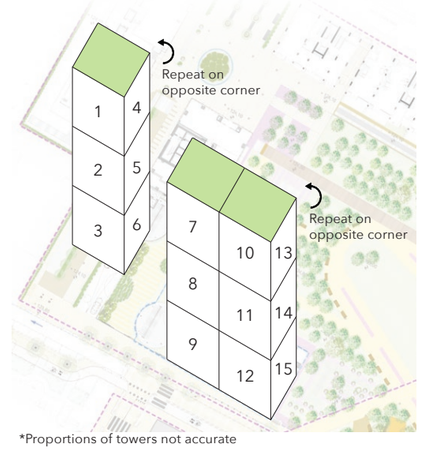
MAPPING: THE BOSCO VERTICALE

Planting 300,000 FT² of Woodland Area onto 30,000 FT² of Urban Surface

DATA VISUALIZATION



VERTICAL APPLICATION DIAGRAM



*Proportions of towers not accurate

SCALE OBJECT: ECOSYSTEM WINDOW BOX

Plant-Your-Own Ecosystem and observe Life in your own Window

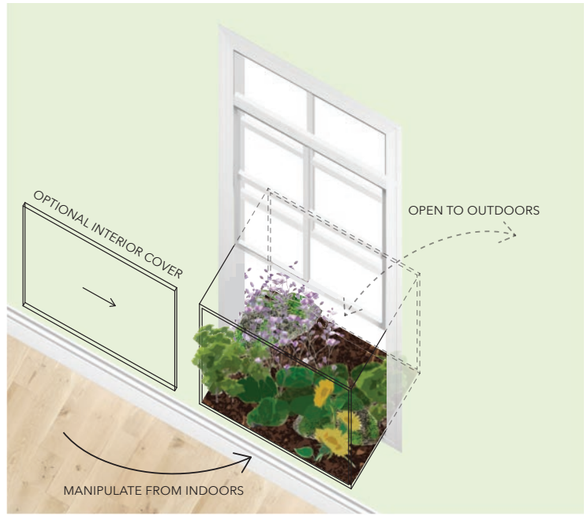
DESCRIPTION

This DIY ecosystem kit takes terrariums and plant boxes to the next level by allowing the caring owner to not only nurture plant life but also observe its interaction with the animal kingdom. The goal of this object is to train its owner to become more comfortable with opening their indoor space to the outdoors, and offer the nourishing and educational experience of growing a fully functioning microecosystem in their own home, office, or anywhere with a sliding, single or double hung window.

WHAT'S INCLUDED

- Acrylic Box
- Hardware
- Organic Matter
- Planting Soil
- Succulent Soil
- River Rocks
- Reindeer Moss
- Succulents
- Local Flora Seeds
- Assembly Instructions
- Plant Care Sheet
- Local Ecosystem Matrix

VISUAL EXAMPLE



REINDEER MOSS

RIVER ROCKS

SUCCULENTS

LOCAL FLORA SEEDS

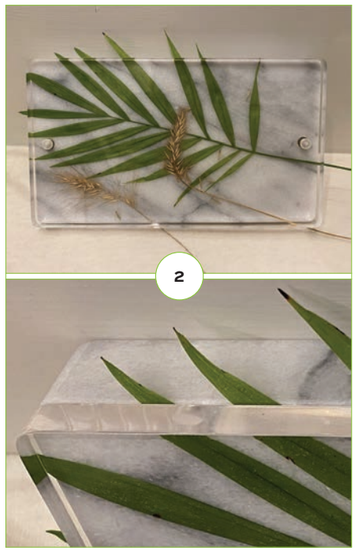
PART II - DESIGN AGENDA

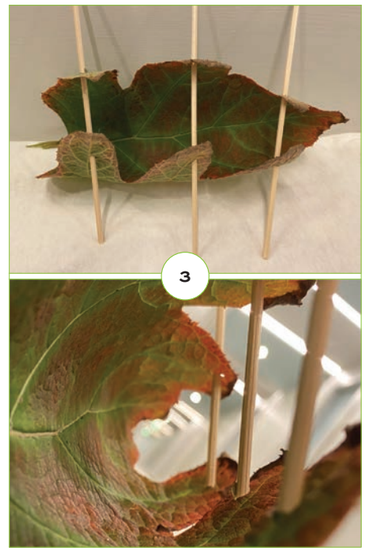
PALETTE

Blending the Living and Non-Living Systems

STUDY MODELS

Blending the Living and Non-Living Systems





PART II - DESIGN AGENDA

Design Probe III: Experience

INTERVIEW TAKEAWAYS

WHAT OR HOW DO YOU FEEL WHEN YOU CONNECT WITH NATURE?

"**Understood**, at **peace**, like I **belong** somewhere, like all of the expectations needed or demanded of me by systems of power in life are truly nothing to me."

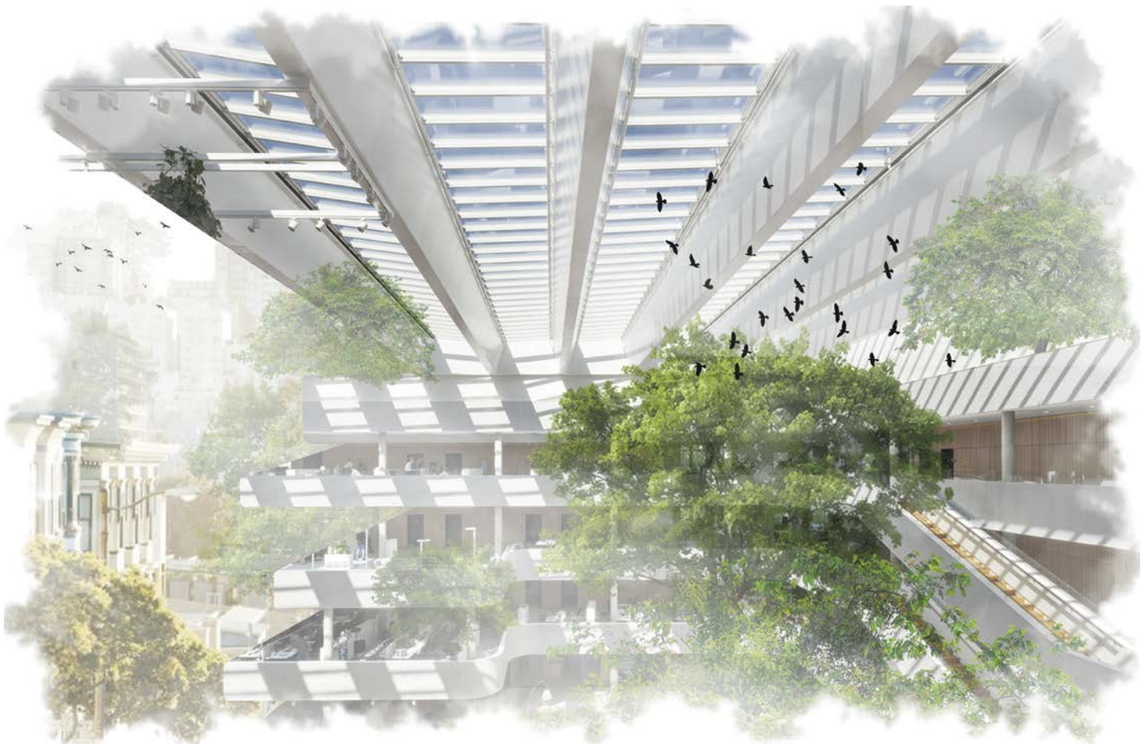
WHEN DO YOU FEEL MOST CONNECTED TO NATURE?

"When I'm in the **sun** listening to music, or in an environment where I'm **listening** to nature too- whether that's silence of a breeze or water."

WHAT DO YOU THINK NATURE HAS TO OFFER US?

"Everything. We can point to any animal or creature or plant on each and learn from them about **sustainability**, **love**, **community**."

CONCEPTUAL COLLAGE



PART III - PROGRAM

Background Information & Contemporary Trends

Case Study Summary

Master List of Spaces

Bubble Diagram of Functions & Adjacencies

The program for Independence Place is **mixed-use**, including private multi-family **residential** and a public **market place**.

The residence welcomes dwellers of all demographics and aims to be completely barrier-free. Inspired by the realization that has come with the COVID-19 lock down that urban homes are in need of better access to the **outdoors** and **nature**, these living units are meant to **connect** the resident with their natural surroundings. Through Biotecutre-driven interior design, how can we design a home within a concrete jungle, that mends the relationship between humans and nature?

The commercial spaces of the project, primarily the market place, aim to maintain **social equity** and sustainability. Architecturally, the market place will provide the bones of a network of **pop-up shops**, that will then be leased out to local small businesses for certain spans of time. This will help small businesses get the exposure they need to **expand** their client pool and **sustain** long-term profits, even after their lease term with Independence Place expires. The constant rotation of businesses represented in the market will also provide a **dynamic and flexible** service for those who come to shop and dine.

PART III - PROGRAM

Background Information & Contemporary Trends

Case Study Summary

Master List of Spaces

Bubble Diagram of Functions & Adjacencies

Case Study Summary: One City Apartments

DEVELOPER	Alterra Property Group
LOCATION	Central Philadelphia
PROGRAM	Residential
SIZE	~200,000 SF

FIGURE 15: One City Rooftop

KEY INFORMANT INTERVIEW TAKEAWAYS

WHAT TYPES OF LIVING UNITS, AND HOW MANY OF EACH, DOES ONE CITY HAVE?

"One City has **219** Studios, **91** One Bedrooms and **13** Two Bedrooms for a total of 323 Units. Our larger 1-bedroom units and 2 bedrooms **rented first**. I believe the reason for this, is because with this space, you are able to live with someone else and **split the cost** of the monthly rent."

WHAT ARE THE DIFFERENT DEPARTMENTS WITHIN ONE CITY? WHAT DO THEY DO?

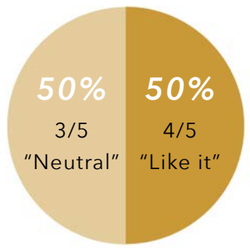
"**Maintenance**: Maintain community and respond to requests. **Leasing**: Tours and paperwork for perspective residents, manage moving logistics. **Management**: Oversee daily operations, tenant relations. **Front Desk**: Customer service, packages, visitor sign-ins."

ARE THERE PLANS FOR THE COMMERCIAL SPACE? WHAT IMPACT WILL THIS MAKE?

"There is currently nothing under contract, but One City would love to see a coffee shop in our 1,000 SF space and a high-end restaurant join our large 8,000 SF space. This will add foot traffic to the corner of Broad and Arch and will help the buildings reputation and google SEO."

USER SURVEY TAKEAWAYS

WHAT IS YOUR GENERAL OPINION ON ONE CITY?



WHAT MADE YOU CHOOSE ONE CITY AS YOUR HOME?

- Location
- Modern Interior Design
- Amenities
- Size of Apartments
- 24 hour Doorman
- Apartment Selection
- Rent Price

IF YOU COULD, HOW WOULD YOU CHANGE YOUR UNIT?

- Better Sound Isolation
- Larger Kitchen
- Larger Living Area
- Modern Windows
- More Storage
- More Sunlight
- Better View

PUBLIC AREAS

FIGURE 16: Exterior

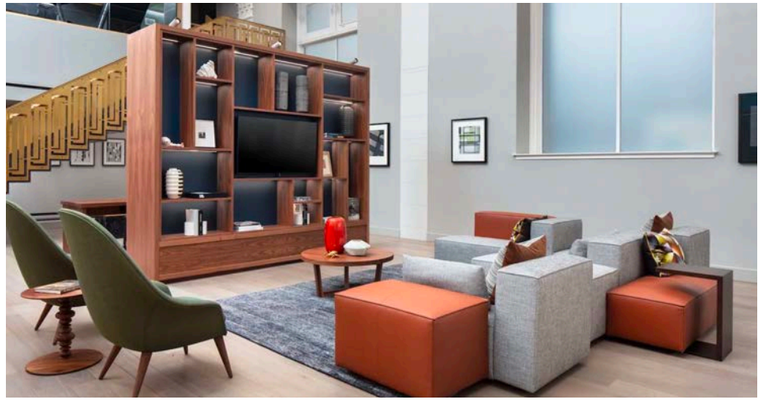


FIGURE 17: Lobby

FIGURE 18: Fitness Center

FIGURE 19: Rooftop Lounge

PRIVATE AREAS

FIGURE 20: 1-Bedroom Unit Kitchen

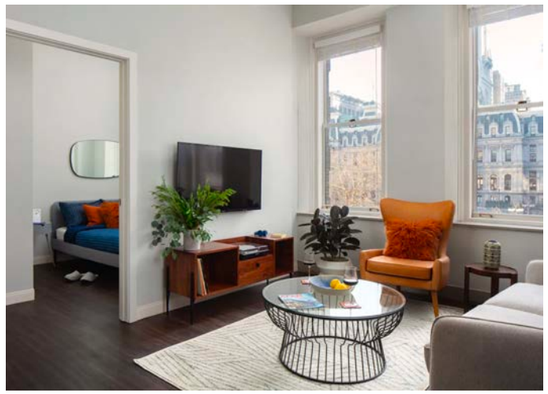


FIGURE 21: 1-Bedroom Unit Living

PART III - PROGRAM

Master List of Spaces

BIO BLOCK PROGRAM CRITERIA

CITY-SCALE PROGRAM CRITERIA

- Maximum of 3-blocks from one public green space to next to ensure walking distance
- Minimum of 1600 ft between plantings of same species to prevent undesired pollination

BLOCK-SCALE PROGRAM CRITERIA

- An equivalent of 100% of the city block's area in square footage is given as green space
- At least one green space is public
- All green spaces are universally accessible
- Space designated for Nature education
- Space designated for Nature service
- Community garden open to public
- Agriculture to supply any dining services of the block
- Energy farming to supply at least 20% of all energy use by the block
- All plant species are native
- All target fauna are non-hazardous to human health and other local species

BUILDING-SCALE PROGRAM CRITERIA

- 50% of all building facades receive planting treatment
- All windows are operable to safety standards
- All interior spaces given access to natural light and views of the outdoors
- Maximum of 25 ft between any two opposite exterior walls (Implement atriums)

INDEPENDENCE PLACE PROGRAM

Public Areas			
Name	**SqFt**	**QTY**	**Total SqFt**
Market Place	5000	1	5000
Public Seating Area	2000	1	2000
Public Restroom	64	4	256
Management Suite	275	1	275
Waiting Area	100	1	100
Service Area	50	1	50
Private Office	100	1	100
Storage	25	1	25
BOH Storage	150	2	300

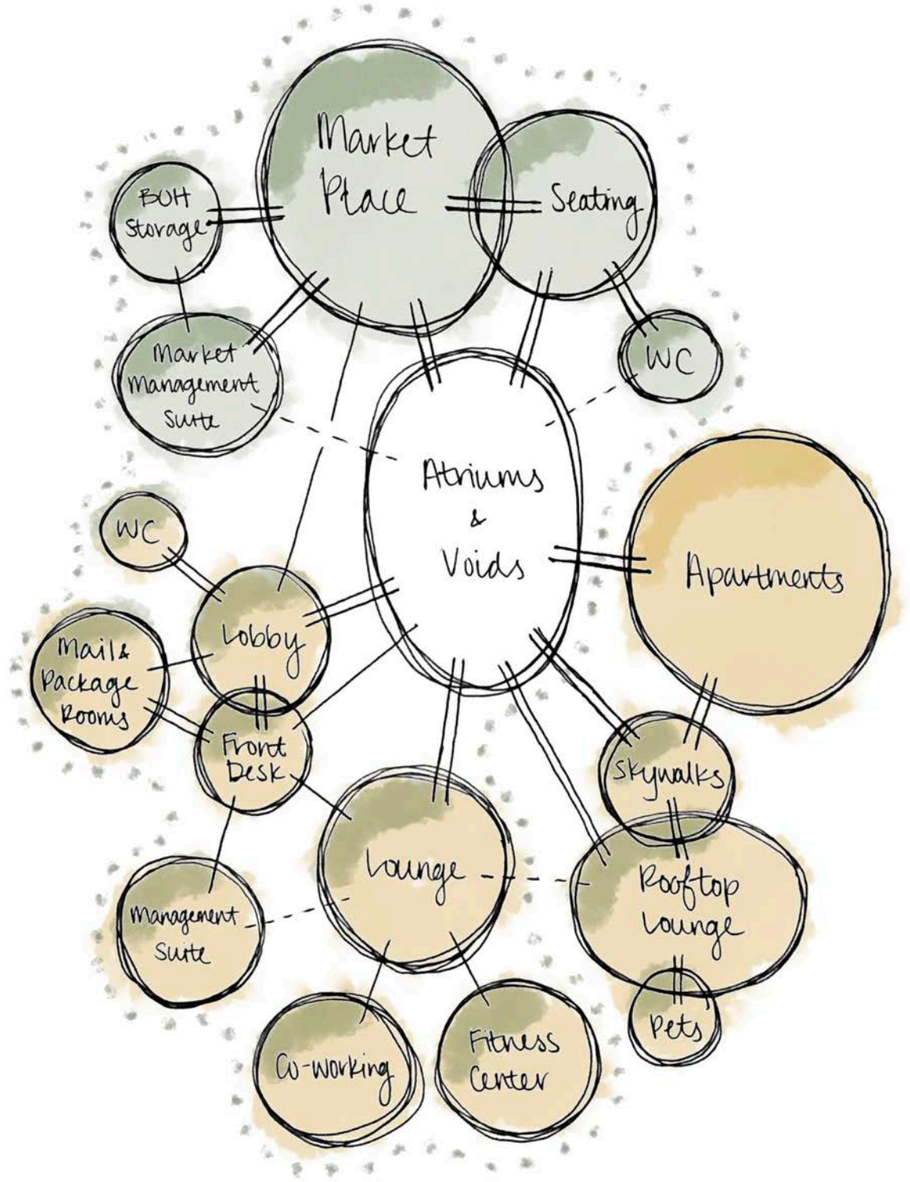
Residential Common Areas			
Name	**SqFt**	**QTY**	**Total SqFt**
Vestibule	30	2	60
Lobby	200	1	200
Front Desk	40	1	40
Co-Working Room	100	4	400
Fitness Center	500	1	500
Rooftop Lounge	5000	1	5000
Pet Area	100	1	100
Public Restroom	64	3	192
Management Suite	275	1	275
Waiting Area	100	1	100
Service Area	50	1	50
Private Office	100	1	100
Storage	25	1	25
Package Storage	50	1	50
Mail Room	50	1	50
BOH Storage	50	2	100
Electrical Room	50	1	50

Residential Units			
Name	**SqFt**	**QTY**	**Total SqFt**
Studio Apartment	526	80	42080
Entry	50	1	50
Kitchen / Dining	80	1	80
Living / Sleeping	300	1	300
Restroom	60	1	60
Closet	18	2	36
1-Bedroom Apartment	594	150	89100
Entry	50	1	50
Kitchen / Dining	80	1	80
Living	200	1	200
Sleeping	150	1	150
Restroom	60	1	60
Closet	18	3	54
2-Bedroom Apartment	824	100	82400
Entry	50	1	50
Kitchen / Dining	100	1	100
Living	200	1	200
Sleeping	150	2	300
Restroom	60	2	120
Closet	18	3	54
3-Bedroom Apartment	992	30	29760
Entry	50	1	50
Kitchen / Dining	100	1	100
Living	200	1	200
Sleeping	150	3	450
Restroom	60	2	120
Closet	18	4	72

TOTAL SQFT (+30% CIRCULATION)	**377,933**

PART III - PROGRAM

Bubble Diagram of Functions & Adjacencies



KEY

Public Areas

Resident Common Areas

Residential Units

Ground Level

PART IV - SITE

Background Information & Context

Site Documentation

Site Analysis Diagrams

Program-in-Site Diagrams

The site of this thesis will operate at the **three nested scales** mentioned before; the city, the block, and the building.

At the largest scale, the **Center City district** of Philadelphia appealed to me as a prototype for the Bio Block building standard because of its highly **developed** urbanism and **density**. It has several zones with little to no green space, along with a few pre-existing parks and gardens that can contribute to the master planning. Also, having lived in the area for two years now, I am personally familiar with the district and can easily conduct on-site research. I decided to use only a district of Philadelphia as the prototypical example of the city-wide scale, because anything larger than the Center City district begins to pose a challenge in graphic representation, and is vulnerable to lost information through its presentation.

On the intermediate scale, after completing the master plan of Center City, I decided to hone in on the block of **6th street & Manning Walk** as the block-scale prototype. This block is located in close proximity to existing **green space** and several **landmarks**, and is also well connected to **public transportation**. In addition, this locations offers many local attractions within walking distance for those residing on the block. It also has a nice balance between built and open space.

And lastly on the smallest scale, I will design the interior experience of the **Independence Place** towers, a situated on the block mentioned above, as the building-scale prototype. This structure is intriguing in its planning and geometry, and offers the opportunity to build connections between the two residential towers to help create a bond between **indoor and outdoor**.

PART IV - SITE

Background Information & Context

Site Documentation

Site Analysis Diagrams

Program-in-Site Diagrams

CENTER CITY DISTRICT, PHILADELPHIA
(City-scale prototype)

North / South confines:
Spring Garden st & South st

East / West confines:
Delaware river & Schuylkill river

6TH STREET & MANNING WALK
(Block-scale prototype)

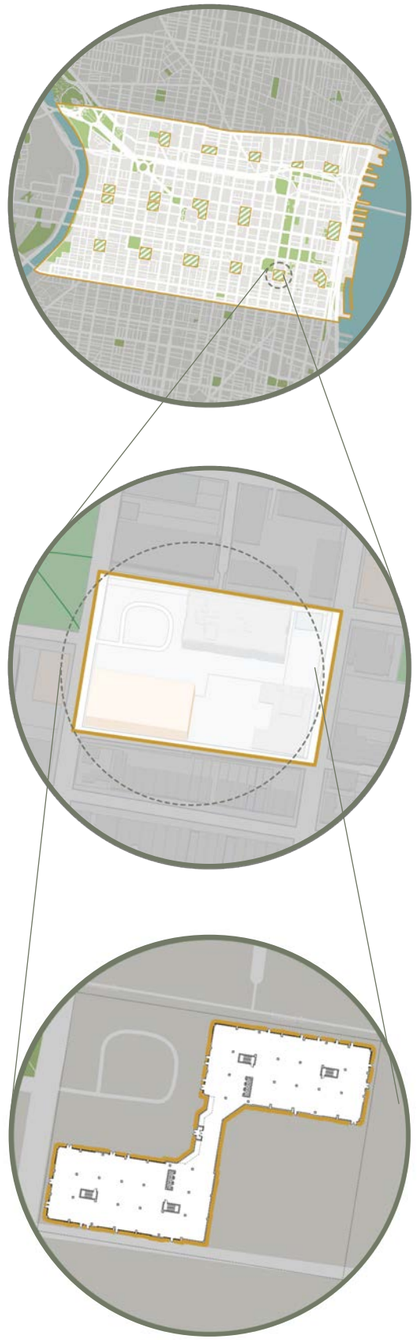
North / South confines:
Locust st & Manning Walk

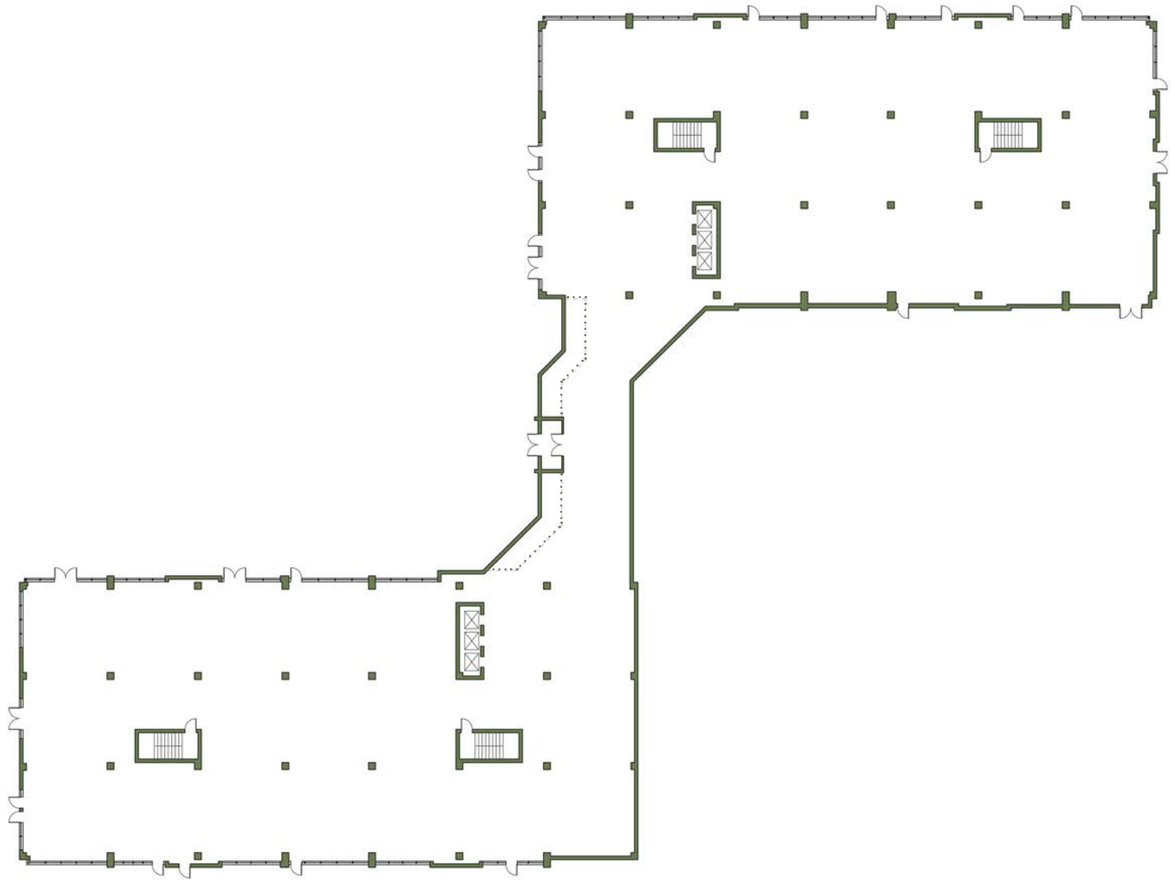
East / West confines:
5th st & 6th st

INDEPENDENCE PLACE
(Building-scale prototype)

Northeast Tower:
233 S 6th St

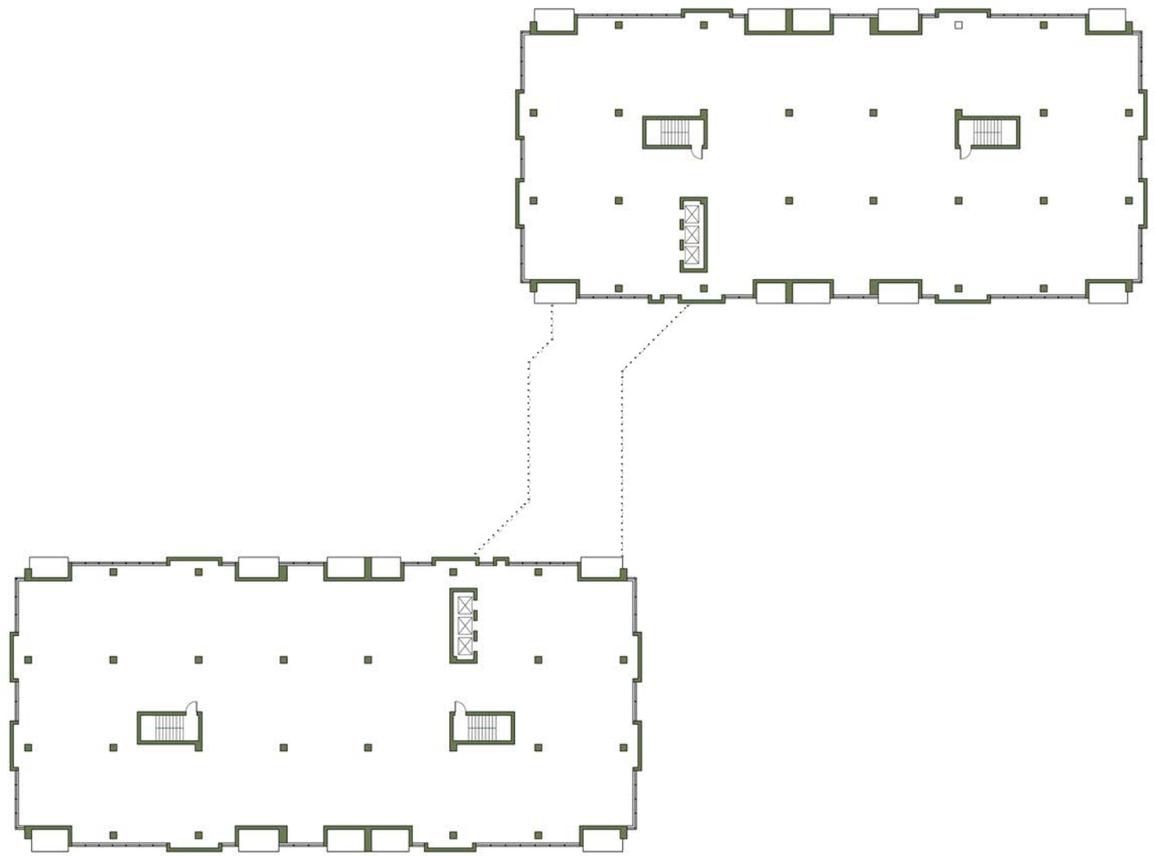
Southwest Tower:
241 S 6th St





INDEPENDENCE PLACE: GROUND LEVEL FLOOR PLAN

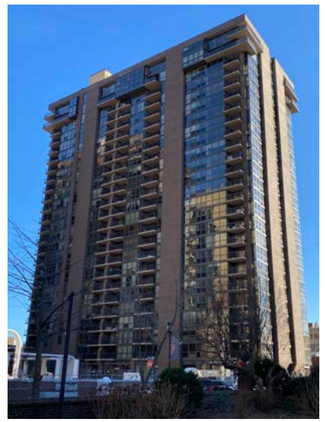
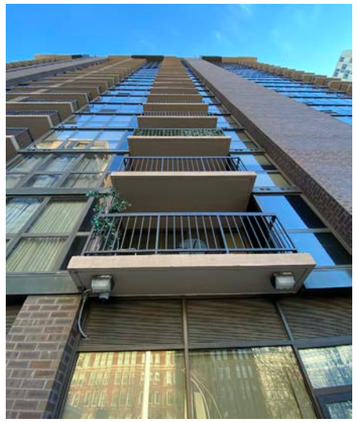
Not to Scale

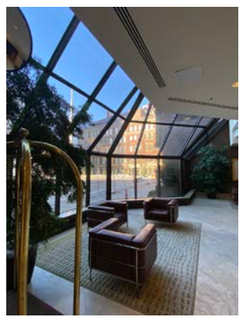


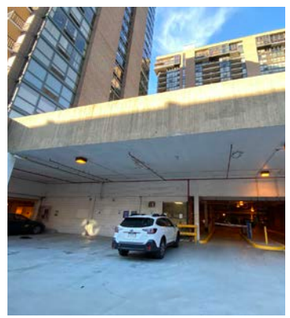
INDEPENDENCE PLACE: UPPER LEVEL FLOOR PLAN

Not to Scale

INDEPENDENCE PLACE: SITE VISIT PHOTOGRAPHY





INDEPENDENCE PLACE: UNIT LISTING IMAGES

FIGURE 22: Living

FIGURE 23: Kitchen

FIGURE 24: Bath

FIGURE 25: Balcony

PART IV - SITE

Background Information & Context

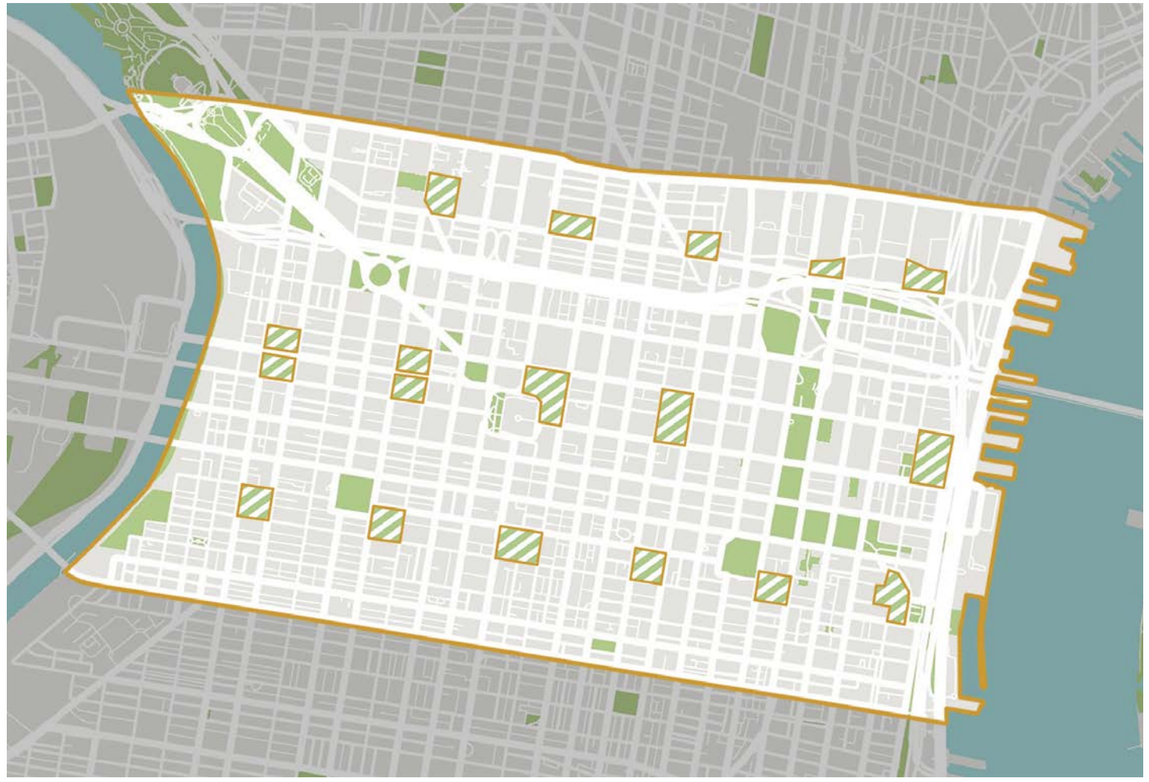
Site Documentation

Site Analysis Diagrams

Program-in-Site Diagrams

Site Analysis Diagrams

CENTER CITY PLANNING & ANALYSIS



KEY

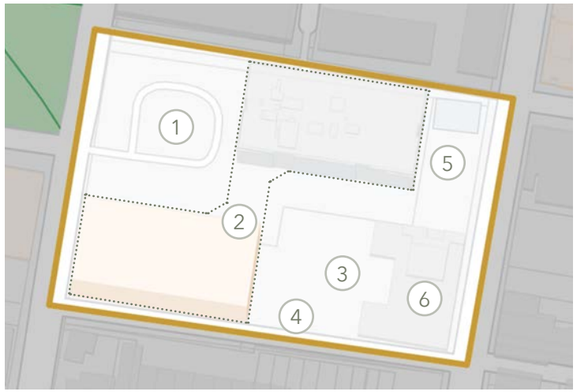
- New Green Block
- Existing Green Space

GREEN BLOCK SPACING CONSIDERATIONS

Minimum of 3 blocks between any two adjacent green blocks (including existing green space) for the following reasons:

- **Walking Distance**: a maximum walk of 1.5 city blocks to closest green space for inner city dwellers, especially those with mobility issues
- **Plant Isolation**: a minimum of 1600ft between blocks to isolate unwanted pollination
- **Insect Migration**: close proximity to ensure travel between blocks of insects

6TH STREET & MANNING WALK BLOCK ANALYSIS



KEY

1 DRIVEWAY
2 CONDOMINIUMS
3 POOL
4 PARKING
5 TENNIS
6 TENANT

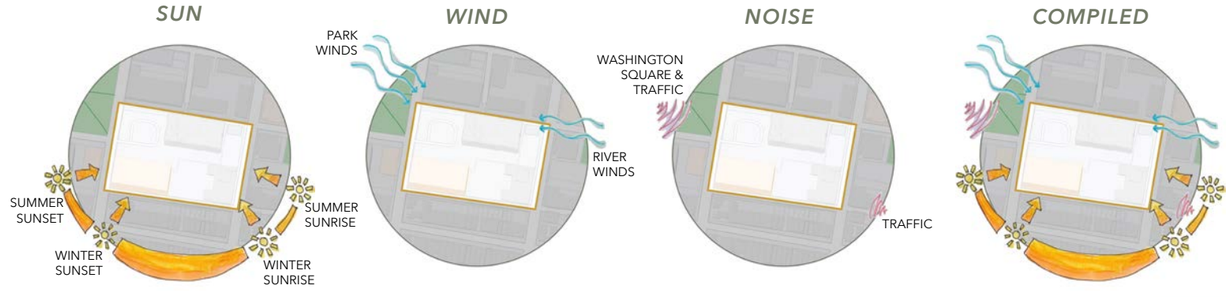
FIGURE 26: Satellite View

NEIGHBORHOOD ANALYSIS

KEY

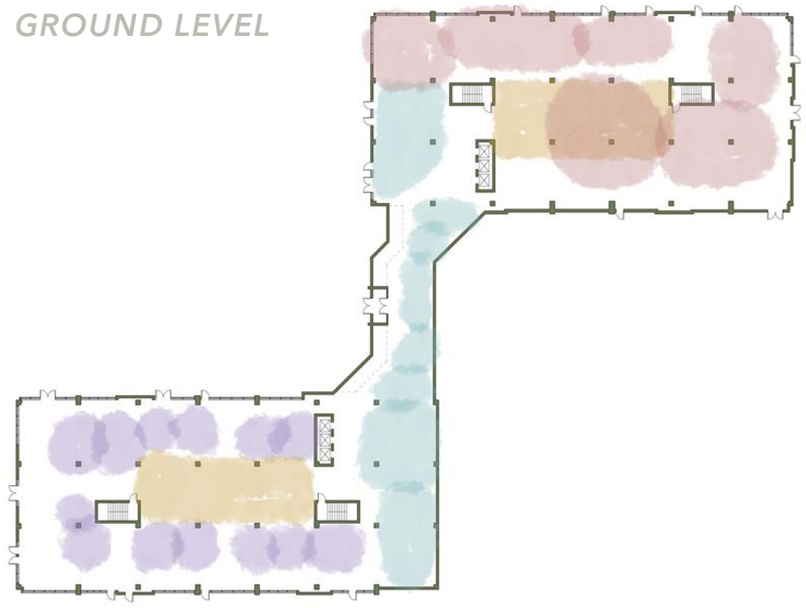
- SITE
- HOSPITALS
- PUBLIC TRANSPORT
- GROCERY STORE
- CONVENIENCE STORE
- HISTORICAL LANDMARK

SUN, WIND & NOISE STUDIES



PART IV - SITE

GROUND LEVEL



UPPER LEVELS

KEY

- RETAIL UNIT
- BOH / SERVICE
- RESIDENT AMENITY
- SKY WALK / GARDEN
- ATRIUM
- RESIDENTIAL UNIT

APPENDIX

Background Research: The Consequences

Design Probe III Interview

Case Study: One City

Site Documentation: Unit Floor Plans

WHAT DOES THE LACK OF GREEN SPACE IN OUR CITIES DO...

TO THE EARTH

ENERGY
Influx of Energy Consumption
Increased Demand of Coal
Increased Price of Energy

WEATHER
Change in Local Weather Patterns
Change in Downwind Weather Patterns
Increase in Cloudiness and Fog
Increase in Precipitation
Increase in Thunderstorms

AIR
Heat Islands
Spike in Atmospheric Pollutants

WATER
Disrupted Hydrological Cycle
Stunted Infiltration
Lower Water Tables
Increased Floods
Increased Downstream Water Pollution

FOOD
Influx of Food Consumption
Increased Demand of Mass Agriculture

CONSUMER GOODS
Influx of Durable Goods Consumption
Increased Demand of Industrial Production

TO THE HUMAN

PHYSICAL
Illness
Obesity
Unhealthy Diet

COGNITIVE
Attention Deficiency
Learning Difficulties
Diminished use of the Senses
Lack of Wonder
Lack of Creativity

EMOTIONAL
Emotional Instability
Depression
Loneliness
Anxiety
Stress

SOCIAL
Social Impairment
Weak Ecological literacy
Limited Respect for Natural Surroundings
Inability to cope with Adversity
Species Isolation

IDENTITY
Lack of Identity
Insecurity
Spiritual Confusion

APPENDIX

Design Probe III Interview

SUBJECT: EMMA RUTENBERG

My cousin, graduated from Bryn Mawr College with a degree in Archaeology

WHAT IS YOUR MOST MEMORABLE EXPERIENCE WITH NATURE, AND WHY DO YOU THINK THIS EXPERIENCE HAS STUCK WITH YOU?

"I was a classical and near eastern archaeology major in school, so in summer 2018 I went to Greece for an archaeological museum internship. I could probably choose infinite moments from that trip; every day was something new and beautiful-- the ocean and mountains in every backdrop, the dry climate plants and agave making silhouettes against them, the sound of wind and rain traveling through huge palm leaves, the colors in the sunsets, the thunderstorms and birdsong. Most memorable was watching the sunset one night, not even a special night in particular, but feeling like I was alone in the world. I know it's stuck with me because it was the most peaceful I had felt in years. I remember thinking that in that moment."

WHAT OR HOW DO YOU FEEL WHEN YOU CONNECT WITH NATURE?

"Understood, at peace, like I belong somewhere, like all of the expectations needed or demanded of me by systems of power in life are truly nothing to me. Nature reminds me that connectedness, safety, and moments of quiet and beauty with loved ones are what is *actually* most important in life. (I believe everybody deserves healthcare, housing, food, safety, education, and infinite liberation "just" for existing.) I love thinking about fractals and the way every level of existence mimics the next-- how our nervous systems look like the branches of a tree or networks of rivers and seas from the sky, how splitting our planet in half would look something like an atom, how spirals of pinecones and seashells and galaxies look the same. I'm no math major but math and Fibonacci sequences in nature are incredible. As an archaeologist I've always loved how fractals and reverence of nature, sacred geometry, etc. all show so deeply in ancient cultures everywhere. Rituals, temples, holy books, texts on conceptions of life and death use comparisons to or images of nature, life cycles, seasons, etc. to explain the world, the patterns that govern all of us."

WHEN DO YOU FEEL MOST CONNECTED TO NATURE?

"It depends, sometimes with friends, sometimes by myself. When I'm in the sun listening to music, or in an environment where I'm listening to nature too--whether that's silence of a breeze or water. But definitely when there isn't a lot of other people or distractions and noises around."

WHAT DO YOU THINK NATURE HAS TO OFFER US?

"Everything. There is enough land and resources on the planet for everyone to have a place, let alone the spirituality of belonging here. We can learn from trees and their root systems intertwined beneath them, we can learn from mushrooms and fungi colonies for how they travel and support themselves and spread information, or birds for how they miraculously migrate every year. We can point to any animal or creature or plant on earth and learn from them about sustainability, love, community."

WHAT IS YOUR STANCE ON THE CURRENT RELATIONSHIP BETWEEN HUMANS AND OUR NATURAL ENVIRONMENT?

"An interesting question, but humans are not a monolith. I fundamentally and vehemently disagree with & condone the ways that capitalism and systems of white supremacy force us to be in relationship (or realistically out of relationship) with nature. Capitalism is inherently incompatible with nature, reverence, and respect. It's built on systems of surplus, exploitation, waste, and environmental warfare and racism (such as Flint which was knowingly poisoning Black working class families, such as Native reservations' water sources being tainted by oil pipelines, such as countless examples. A more haunting example would be how the transatlantic slave trade permanently altered shark migration patterns, and in turn ocean circulation and other migration patterns.) Humans need to move past believing that capitalism is redeemable and compatible with the earth and our survival, understanding the way imperialism, colonization, and white supremacy have consistently and historically used the goals of "mastering" the planet, "taming" nature, mining and usurping, poisoning, etc. and have irreparably altered the course of our planet. My stance is one of solidarity extending to indigenous peoples globally who have maintained their practices of reverence and collaboration with nature, none of which are rooted in exploitation but rather honoring and even mimicking nature for efficiency, purpose, and providing enough for survival. Another example would be Native people mastered the arts of controlled fires on the west coast of hundreds of years ago in order to maintain balance in the environment. The U.S. and any government or state official wouldn't even know where to start to understand that kind of connection to the land, which is why the California wildfires to this extent and damage (and terror) is indicative of there being no indigenous sovereignty, and nobody in the systems of power in place who have ever understand what the land needed."

APPENDIX

Case Study: One City

PART I: OBSERVATIONAL RESEARCH

NAME	One City
LOCATION	1401 Arch St Philadelphia, PA
RENOVATION DATE	2020
SIZE	~200,000 SF
OWNER	Alterra Property Group
DESIGNER	BLTa Architects
USERS	Residents

PART II: KEY INFORMANT INTERVIEW

SUBJECT: NICK BOGDONOWICZ

One City Building Manager

WHAT IS THE SQUARE FOOTAGE OF ONE CITY AND HOW MANY OCCUPANTS DOES THAT ACCOMMODATE? IS THAT SIZE/RATIO IDEAL?

"Total square footage 219,809 SF, Occupied SF 139,684."

WHAT TYPES OF LIVING UNITS, AND HOW MANY OF EACH, DOES ONE CITY HAVE? DO YOU THINK THIS NUMBER OF UNITS IS SUFFICIENT?

"One City has 219 Studios, 91 One Bedrooms and 13 Two Bedrooms for a total of 323 Units. Our larger 1-bedroom units and 2 bedrooms rented first. I believe the reason for this, is because with this space, you are able to live with someone else and split the cost of the monthly rent. Our smaller studio apartments we built with the vision of catering to a student/grad student demographic. COVID has slowed this down a bit, but One City continues to network and build rapport with local housing directors."

WHO ARE THE TYPES OF PEOPLE THAT LIVE IN ONE CITY?

"One city is open to any and all that apply and are qualified and approved. Thus far, we have seen mostly young professionals and grad students moving into the building."

WHAT ARE THE DIFFERENT DEPARTMENTS WITHIN ONE CITY? WHAT DO THEY DO?

"Maintenance – Maintain the community and respond to maintenance requests in a timely manner
Leasing – Follow up with prospective residents, tour the community, send out lease paperwork and ensure a seamless move in.
Management – Oversees the day to day operations throughout the lease up from construction, development, tenant relations and overall success of the property.
Front Desk – Customer Service, Packages, Visitor Sign ins and food deliveries."

HOW MANY STAFF MEMBERS ARE THERE FOR ONE CITY? WHAT TYPE OF WORK SPACES DOES THE STAFF REQUIRE?

"The Leasing office has a Property Manager, Assistant Manager and Leasing Professional. Maintenance team consist of Maintenance Manager, Maintenance Tech, Porter and Housekeeper. The Concierge team works around the clock, three 8 hours shifts per day. A total of 5 different front desk associates work at One City."

ARE THERE ANY SPECIAL EQUIPMENT, PLUMBING, LIGHTING, TECHNOLOGY, OR VENTILATION REQUIREMENTS?

"Other than keeping up with City Code, there are no special mechanical requirements. We have emergency backup generators which power emergency lighting in case of an emergency evacuation. One City is registered with the Philadelphia historical society and there are requirements on certain situations such as graffiti removal (Cannot use certain chemicals on stone), Window treatment (Cannot replace any windows or glass unless broken). In refurbishing the building, which was built in 1897, Alterra installed state of the art Samsung HVAC systems which are extremely energy efficient and tie into our IOTIS smart home feature."

WHAT ARE THE MAIN SAFETY ISSUES? ARE THERE ANY SPECIAL SAFETY OR SECURITY ISSUES?

"One City has a total of 42 security cameras through the interior and exterior the property. All exterior access point, as well as the elevators to the residential areas are all key fob access only. As well, we have a 24/7 front desk attendant. Being in the heart of the city at the intersection of Broad street, there is plenty of activity going on outside of the community, but being close to City Hall allows for added police presence as well. I do not see any specific safety issues to this point in the project."

WHAT ARE THE SPACES REQUIRED TO EFFICIENTLY RUN THIS FACILITY?

"We have a leasing office and maintenance office and shop which house all employees. A package room is extremely important for our residents and we are in the process of opening our Luxer One smart package room."

WHAT ACTIVITIES TAKE PLACE IN THE PUBLIC AREAS? WHAT WORKS? WHAT DOESN'T?

"In the common areas, we love to hold resident events (COVID pending), residents can study/work in a safe and quiet environment, the fitness center is very popular which includes state of the art equipment and virtual interactive classes through well beats. On our roof top we have fire pits and grills for enjoying a delicious meal with friends or relaxing by the fireplace with the city skyline as your backdrop. Every amenity space we have works and up to this point I do not have any complaints."

IF YOU COULD, IS THERE ANYTHING YOU WOULD ADD TO ONE CITY TO ATTRACT MORE RESIDENTS?

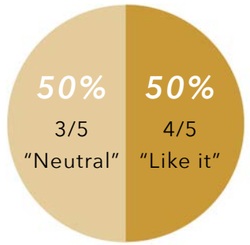
"One City has many great amenities to offer. Of course, every property is more appealing with a pool, but that is something that just would not be able to work here. To attract more residents, I believe the company could spend a little more money on our Google campaign, as well as offer some more competitive rates more in line with the market."

IF ANY, WHAT ARE THE PLANS FOR THE COMMERCIAL SPACE ON THE GROUND LEVEL? HOW DO YOU THINK THIS WILL IMPACT THE OPERATION OF ONE CITY?

"There is currently nothing under contract, but One City would love to see a coffee shop in our 1,000 SF space and a high-end restaurant join our large 8,000 SF space. This will add foot traffic to the corner of Broad and Arch and will help the buildings reputation and google SEO."

PART III: USER SURVEYS

WHAT IS YOUR GENERAL OPINION ON ONE CITY SO FAR?



WHAT FACTORS MADE YOU CHOOSE ONE CITY AS YOUR NEW HOME?

- Location
- Modern Interior Design
- Amenities
- Size of Apartments
- 24 hour Doorman
- Apartment Selection
- Rent Price

WHAT FACTORS MADE YOU THINK TWICE ABOUT CHOOSING ONE CITY?

- Expensive Rent
- Apartment Size
- Location / Views
- Noise Concern
- Gentrified Feeling

IF YOU COULD, HOW WOULD YOU CHANGE YOUR APARTMENT UNIT?

- Better Sound Isolation
- Larger Kitchen
- Larger Living Area
- Modern Windows
- More Storage
- More Sunlight
- Better View

IF YOU COULD, HOW WOULD YOU CHANGE ONE CITY'S AMENITIES?

- Add Pool to Roof
- Add Jacuzzi to Roof
- Add Outdoor Garden
- Larger Game Room
- Add Parking

APPENDIX

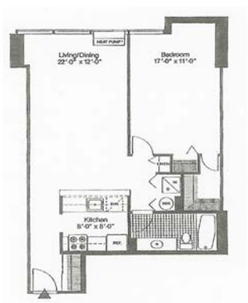


FIGURE 27: PLAN A

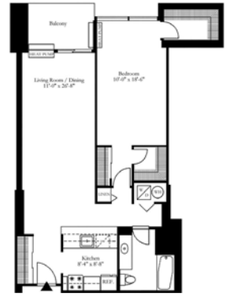


FIGURE 28: PLAN B

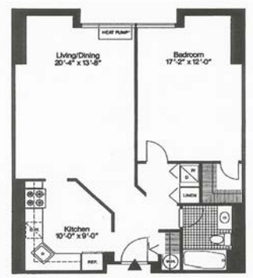


FIGURE 29: PLAN C

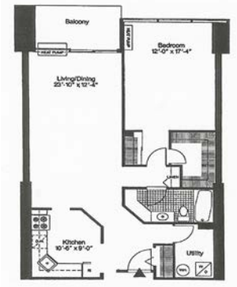


FIGURE 30: PLAN D

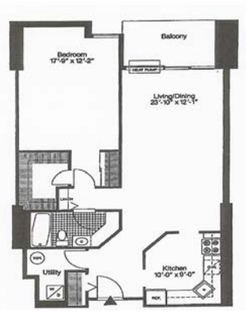


FIGURE 31: PLAN E

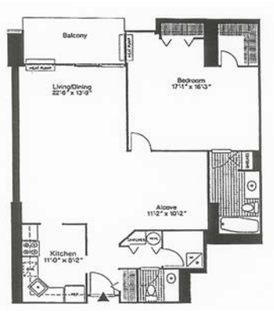


FIGURE 32: PLAN F

FIGURE 33: PLAN G

FIGURE 34: PLAN H

FIGURE 35: PLAN J

FIGURE 36: PLAN K

FIGURE 37: PLAN L

FINAL DRAWINGS

Drawing List

Type 1 Floor Plan

Model Unit Floor Plan

Crosswalk Level Floor Plan

Type 2 & Type 3 Floor Plan

Crosswalk Enlarged Floor Plan

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