Prescription for Public Open Space:

Locating New Public Open Space to Combat Obesity in New Orleans

Wade Hanson
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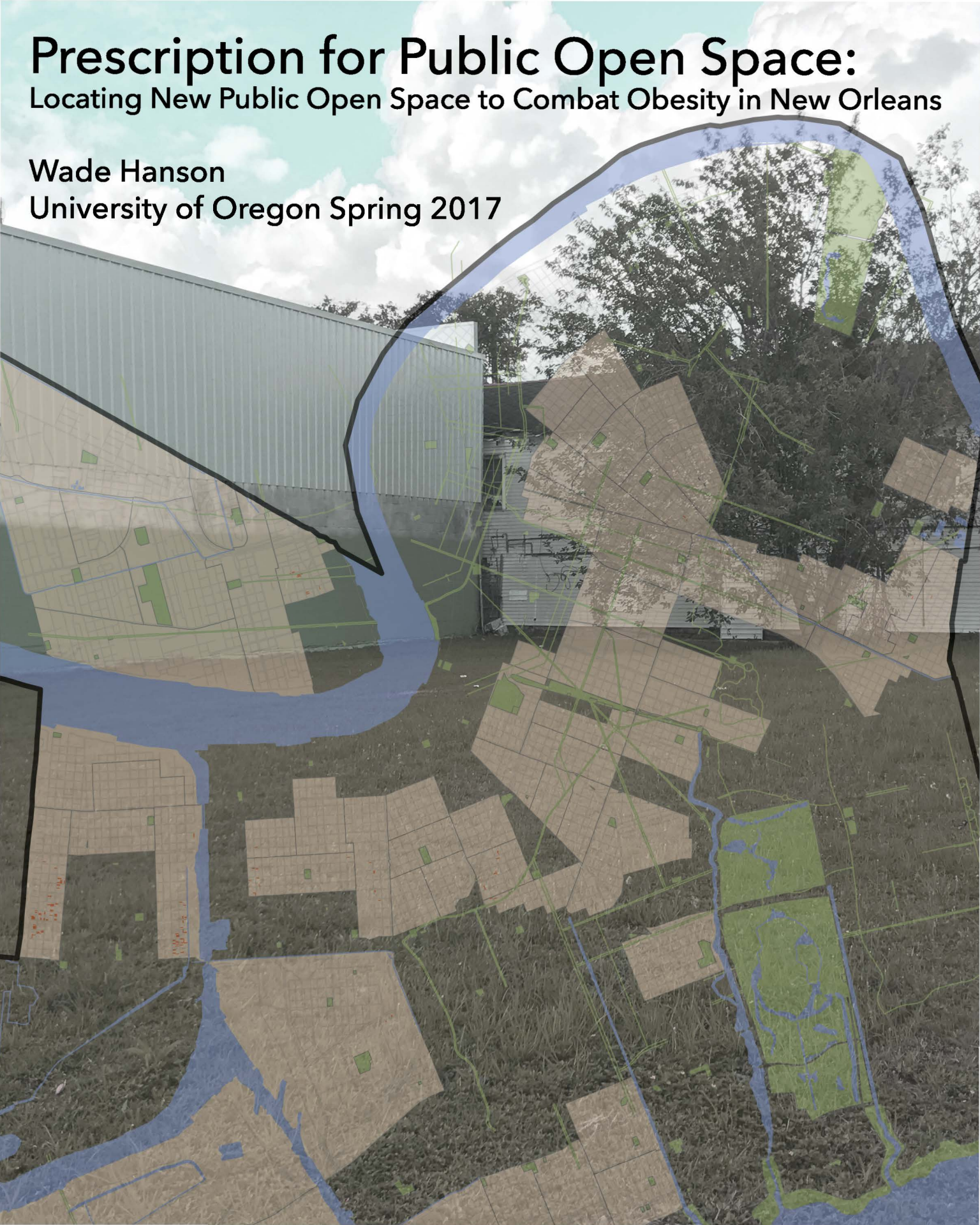

Approval

Submitted in Partial fulfillment for the Master of Landscape Architecture,
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Master's Project Committee

Roxi Thoren, Masters Project Chair
Dave Hulse, Masters Project Committee Member
Dr. Chris Enright, Masters Project Committee Member

Master's Project Chair Approval

Date: _____ Signature: _____

Abstract

Literature suggests that many of the current approaches to developing new public open space focus on individual parcels of land and the ease of their acquisition rather than their location and value within a larger system. One concern of these approaches is that they result in neglecting communities or populations at risk of many health issues. This oversight results in greater societal costs, including increased strain on the health care system. This project focuses on addressing the communities at risk of obesity and their access and proximity to public open space. The estimated cost of obesity on our society was $218 billion in 2007 alone.

Much research exists that correlates proximity to public open space with decreased risks for obesity. Despite this research and the development of rating systems like SITES and LEED ND, a gap still exists where designing open space networks to address obesity has not been integrated into city open space planning processes in the United States.

This project develops both an evaluative tool derived from five case studies of open space networks and a prioritization process that utilizes spatial analysis to prioritize sites for expansion of New Orleans' open space network. After the sites for expansion were designed, the entire network was evaluated using the case study criteria to reveal system changes as a result of the design.

The resulting design shows that communities in New Orleans that are most at-risk for obesity are also the communities that have the most vacant or available land for development as public open space. This project identifies sites where New Orleans' open space network could be increased by 14.83 acres or 0.5% of the total open space to allow 10,600 citizens (31% obesity rate of census tracts with priority sites) access to an open space within 1/4 mile of their home. This approach can be adapted to local priorities and utilized in other cities.

Acknowledgements and Dedication

To my mother, Bev, for your unbelievable patience, encouragement, sacrifice, and instilling in me a drive to learn and pursue my dreams.

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Introduction

Introduction and Problem Statement

As people continue flocking to cities, urban parks and open space are of critical importance to quality of life for all urban inhabitants. However, many current approaches to developing new public open space focus on individual parcels of land and the ease of their acquisition rather than their location and contribution to a larger system. This opportunistic, space left over after planning (SLOPE) approach utilizes residual parcels for open space usage that are left over after all other uses are satisfied (Maurani and Amit-Cohen 2007). Developing new public open spaces that address communities or neighborhoods most in need of access to these areas is one example of focusing on the location and function of individual open space within a larger system.

There is a growing body of research showing that where people live (their environment) impacts their health and well-being. Individuals with chronic diseases like obesity, asthma, and other health issues often live in areas with poor environmental quality and poor access to public open space. Using current approaches like SLOPE, communities or populations at risk for obesity are neglected, as these communities are not a focus of this type of planning. These approaches result in greater societal costs, including increased strain on the health care system. The estimated cost of obesity on our society was $218 billion in 2007. (Price et al. 2013)

Much research has been done that links proximity and access to public open space with decreased risks for obesity and other health issues (asthma, type 2 diabetes, cardiovascular disease, hypertension, etc.). However, this research has not been integrated into an approach for planning new urban parks and open space. This project develops a process that prioritizes access to public open space for communities most at risk for obesity in order to provide city planners a way to analyze, prioritize, and connect parcels for development into new public open space.

Using New Orleans as a prescriptive case study, this project proposes an approach for identifying sites for new public open space on city owned vacant lots within areas of the city where residents are most at-risk of obesity.

Public Health and Open Space

The link between public health and open space goes back to the development of cities theorized by Vitruvius, and gained a new urgency in the Industrial Age. Urban planning has its roots in these industrial cities and the discipline arose primarily out of health concerns in the mid 19th century. Outbreaks of typhoid, typhus & cholera, and issues of overcrowding and public sanitation all were common, especially in large cities like New York (Fig.1.1).

The father of American landscape architecture, Frederick Law Olmsted, viewed parks as places where people could improve their health through activity and access to fresh air. His designs also sought to address sanitation issues through well-designed landscapes. Areas that were well drained, had good water circulation, and well designed sanitary facilities all sought to address the outbreaks of infectious diseases. These ideas draw on his work improving sanitation in Union Army Camps in the Civil War. In these camps, more deaths occurred due to unsanitary conditions than from wounds inflicted to soldiers from the battlefields. "Such observations may seem far removed from his experience in the design of public landscapes, but Olmsted viewed the field broadly, not separating the quality of a person's life from the quality of the physical or natural environment." (Fisher 2010)

Although public health policy and land use planning started out attempting to solve the same issues, the fields diverged from one another. Public health primarily focused on individuals and their medical history, behavior, and other lifestyle factors which influence their health. Land use planning developed into a field that helps to separate different types of land uses in order to influence development patterns of a city by considering economics, transportation, and what constitutes, 'good neighbors,' or compatible adjacent uses. Dahlgren and Whitehead (1991) looked at how each of these two issues, lifestyle factors and environmental factors, can influence an individual's health (Fig 1.2). They found that there are three different levels of factors influencing health: Individual health, genetics, and lifestyle choices; social interaction and norms; and built and natural environmental factors. This project focuses on the third realm as a way to impact public health.

Recently, there has been much research examining how public health is influenced by open space through proximity and access, biophilia, and ecosystem services. (Sister et al. 2009, Brown and Grant 2005, Cohen et al. 2007, McCracken et al. 2016, Koohsari et al. 2015, Blanck et al. 2012) While this research includes all aspects of human health/ wellbeing (physical, social, and mental), this project focuses on physical health and well-being, in particular, obesity rates. It is assumed that there will be tangential benefits to individuals in the areas of social and mental health through the creation of new public open spaces.

There is a general understanding that open spaces are good for people, but much of the earlier literature focuses on biophilia, or the affinity of people to seek out nature. Quantifiable benefits of nature and open space are harder to define. Brown and Grant (2005) discuss environmental services, active experiential services, and passive experiential services that open spaces and nature provide for city residents. Benefits that people can enjoy as a result of the above services include: improved air quality due to plants removing particulates and chemicals from the atmosphere; active exercise or physical activity one partakes in within these spaces; or passive experiences like taking in a view of the park from your third story apartment.

This project examines the active experiential services or benefits that one receives through

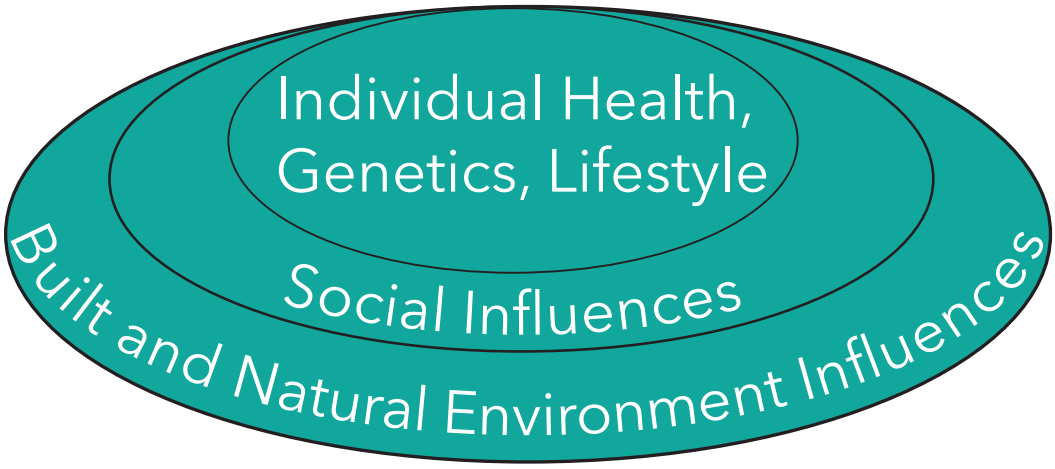

Fig 1.2- Dahlgren and Whitehead: Social Model of Health

a physical engagement with nature. Cohen et al. (2007) undertook a study of eight parks in Los Angeles in which they asked residents to complete park usage surveys and also observed park users and asked them to complete the same surveys. Their study found that proximity to parks strongly impacts who uses these spaces and how frequently people visit. Forty-three percent of park users lived within a quarter mile of the park. Twenty one percent of the users lived between a quarter mile and a half mile from the park. Only 13% of users lived over a mile from the park. They also found that users living within a mile of the park were 4 times more likely to visit at least once per week. These individuals also had a 38% higher rate of exercising in a given week. These results all show strong correlation between distance from individuals' homes to nearest parks and likelihood of physical activity.

The limitations of the above study are that only 20 random addresses at each distance level (quarter mile or less, quarter to one-half mile, half mile to one mile, and one to two miles) were surveyed and all respondents were required to be 18 or older. Additionally, the study did not differentiate or analyze how often respondents used the park for physical activities versus undertaking these activities in different settings. (eg- gyms, trails, yards, etc.) Such information would more clearly show how vital parks are to these populations. That being said, parks are a vital and invaluable resource in urban areas, especially for lower-income populations who do not have means to afford gym memberships, work out equipment, etc. Additionally, parks and open space within close proximity to all city residents can help to mitigate issues associated with individuals and communities who do not have access to a vehicle, time, and willingness to travel to parks that are miles away.

Physical activity and exercise is one key component to active or healthy living. The Center for Disease Control (CDC) states that, "There are strong correlations between

compact, pedestrian friendly environments and decreases in negative health indicators such as obesity, diabetes, hypertension, and asthma." Parks serve as a vital and increasingly important aspect of a city's public health policy. They combine with bicycle infrastructure, walkable communities, mixed use development, and urban agriculture to help promote and preserve healthy lifestyles for all residents. These planning and landscape scale designs can help to prevent chronic diseases and reduce the load on hospitals and medical clinics. The next section will look at how risk factors for obesity do not cut across all socioeconomic classes equally.

Obesity

Obesity is one of many chronic health issues, but is unique in that it is correlated with other chronic conditions including diabetes, asthma, and hypertension. Due to this correlation, obesity can be viewed as an umbrella health topic: by addressing this issue, the other conditions are also being addressed. This project focuses on obesity as a key public health issue that must be addressed through public open space planning among other tactics.

Obesity in the United states is strongly correlated with ethnicity, income, education, and having health insurance. Price et al. (2013) examine the racial and ethnic disparities of chronic diseases in youth in the US. This information is summarized in Fig. 1.3. African American and Hispanic youth are 1.8 times more likely than caucasian children to be obese. Similarly, Flegal et al. (2016) examined obesity trends among adults across the United States (Fig 1.3). They also found that African American adults were 1.31 times as likely to be obese as caucasian adults and Hispanics were 1.15 time as likely to be obese.

Price et al. (2013) also found that obesity is also is affected by income and parental education levels with children from low income homes or low parental education having obesity rates of 3-4 times higher than those with higher incomes or college educated parents.

The average obesity rate for all adults in the Flegal et al. study had increased from 34.5% in 2005-2006 to 38.5% in 2013-2014. This statistic would indicate that as time goes on, the number of obese people in the US will continue to increase. Since 1980 obesity rates continue to increase in the US and it has emerged as a national health crisis. Finklestein et al. (2012) predicted that if current trends continue in a linear fashion, 51% of the US population could be obese by 2030. Alternatively, if obesity rates from 2010 were to hold and not increase, this could represent a savings of $549.5 billion over the next 20 years.

Attempts are being made to address this crisis across diverse disciplines and at various scales. From healthier school lunches and urban agriculture to standing desks and walking meetings, there are many complex solutions to a complex problem; from individual lifestyle factors discussed by Dahlgren and Whitehead (1991) to the broad impact environmental factors can play

Obesity rates (Price et al 2013 & Flegal et al 2016)

Ethnicity	Children	Adults
Caucasian	13%	37.1%
African American	24%	48.5%
Hispanic	23%	42.7%

Overweight rates (Price et al 2013)

Ethnicity	Children	Adults
Caucasian	27%	-
African American	41%	-
Hispanic	41%	-

Fig 1.3- Summary of Obesity/Overweight Rates from literature

on people's health. It is at the environmental level that landscape architects can help to address gaps that still exist in combating obesity and contribute to public health.

Relevance (Why New Orleans)

New Orleans Health Issues, Demographics, and Public Views

New Orleans, Louisiana is tied for 13th most obese city in the United States at 31% of the population (Forbes), 9th worst city to live with asthma (Asthma Allergy Foundation of America), has 23% of people below the

poverty line, and 18.9% of people without health insurance. This compares to the US poverty rate of 13.5% and 10.9% uninsured rate. (US Census Bureau) The state of Louisiana is worst in the nation with a 36.2% obesity rate. The city is also one of 100 cities to participate in the Resilient Cities Challenge sponsored by the Rockefeller Foundation. This participation illustrates that the city and elected officials are aware of unique environmental, social, and economic issues within New Orleans and have taken steps, in the form of the Resilient Cities visioning document, to begin addressing said issues. Forbes also identified New Orleans as the #9 Magnet City for Young Adults with a growth rate of 14.7% between 2007-2012. This growth would seem to imply that wealth and income inequality will grow as more and more young adults and young professionals move into the city.

The above statistics and information indicate that New Orleans is a city that has a large percentage of the population that is unhealthy and without health insurance; has a large percentage of the population in poverty; and is primed and willing to address these issues. All of these conditions make the city of New Orleans a perfect candidate and case study city for developing a method of designing a public health promoting open space network.

Additionally, although much rebuilding work has been done in the city since the levee failures and flooding in 2005, a survey by the Kaiser Family Foundation (2015) found that African American residents were 1.7 times more likely than white residents to feel that all of the rebuilding efforts have done nothing to help people like them (Fig 1.4). This divide is also exacerbated by income

Rebuilding Survey (Kaiser Family Foundation 2015)

Demographic	Hasn't helped people like them
Caucasian	28%
African American	47%
Above 200% of Federal poverty	31%
Below 200% of Federal poverty	46%

Feels New Orleans has recovered (Kaiser Family Foundation 2015)

Demographic	Feels city has recovered
Caucasian	70%
African American	44%

Survey of Neighborhood Amenities (Kaiser Family Foundation 2015)

Demographic	Feels kids have safe places to play outside
Caucasian	63%
African American	36%

Fig 1.4- Key statistics from Kaiser Family Foundation Survey of New Orleans Rebuilding Efforts

levels - people below 200% of the federal poverty level were 1.5 times more likely to feel that the rebuilding efforts haven't aided them versus the people above this level. African Americans in New Orleans typically bring home over 50% less in median income than their white counterparts. Caucasians are 1.6 times more likely than African Americans to say that New Orleans has recovered from the flooding and destruction in 2005 (Fig 1.4). Finally, in a survey of neighborhood amenities, caucasian respondents were 1.75 more likely than African Americans to state that there were areas where their children could safely play outside (Fig 1.4). All of this leads to the conclusion that white residents likely feel that the city has successfully rebuilt since the flooding, has helped people like them recover, are better off financially, and live in safer environments for their children compared to African American residents.

New Orleans Land Use and Park Space Issues

As of 2015, New Orleans has approximately 71.8 acres of parkland per 1,000 residents to serve a population of 378,715 people (Fig 1.5). While these numbers look good at a first pass, a more detailed investigation into the public open space of New Orleans reveals that most of the land included in these statistics is composed of the Bayou Sauvage National wildlife refuge and City Park, which composes another 1300 acres. The Bayou Sauvage refuge is roughly 20 miles from the center of the city and does not have public transit to access it (Fig 1.6). In reality, New Orleans has about 7.7 acres/1000 residents and open space acreage just under 3,000 (Fig 1.5). This compares to an average of 6.8 acres/1000 residents in high density cities

New Orleans Open Space

Published	Actual (-Bayou Sauvage NWR)
71.8 acres / 1000 residents	7.7 acres / 1000 residents
27,208 acres of open space	2,915 acres of open space
107,655 acres of land area	107,655 acres of land area
22.4% of land area= open space	2.7% of land area= open space

Fig 1.5- Overview: New Orleans Open Space Statistics

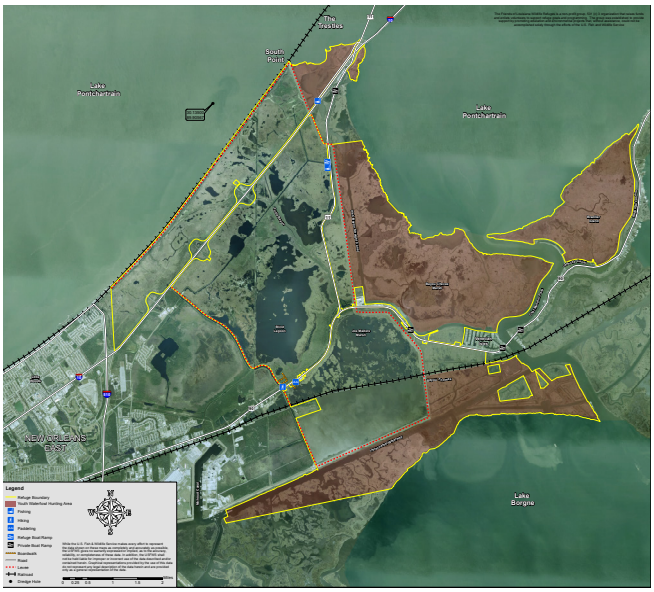

Fig 1.6- Bayou Sauvage National Wildlife Refuge in Red

Fig 1.7- Existing Aerial and Proposed Open Space Plan - Downtown New Orleans

to 23.3 acres/1000 residents in low density cities according to the Trust for Public Land in 2016. While New Orleans' amount of open space falls within this range, the location and distribution may not be equitable. City Park comprises 45% of the 2,915 acres, which means that the remaining regional and local parks within the city compose only 1.9% of the entire land area.

Peter Harnik makes the point in *Urban Green* that providing a prescribed number of acres per 1,000 residents, while a metric for comparison between cities and urban areas, isn't really a prescriptive method for public open space planning. For example, if you are planning the future of the New York park system, you'll never get to the recommended 7-10 acres/1000 persons as the required land area would be greater than the entire island of Manhattan. He further elaborates on distances to parks and the amount of park space that is considered adequate for a given neighborhood likely depends on each individual's personal circumstances and what programmatic elements or facilities are wanted. As this project is focused at a planning scale, these concerns are taken to heart and specific park acreage per a given population is not an objective, the focus is instead on access and location and distribution of open space. In the City of New Orlean's 2030 Masterplan, their stated goal is achieving a park located within 1/3 mile of every resident. (City of New Orleans' 2030 Masterplan) This is a tractable goal that helped inform access distance within the context of this project.

The Urban Land Institute (ULI) Louisiana and the Downtown Development District of New Orleans participated in a Technical Assistance Panel in 2014 entitled, "Enhancing Open Space in Downtown New Orleans." This study focused on downtown living and how to encourage open space development, primarily through incentives to private developers and the creation of mandatory open space. These solutions are not surprising, as ULI is composed of members from both land use planning as well as real estate development and they understandably want to serve their own interests. The graphic plan in Fig 1.7 illustrates a shape-based model of open space development that concentrates on connecting Duncan Plaza, Lafayette Square, and Loyola Avenue in downtown via greenways. The main issue with this study and associated panel is that it doesn't address populations at risk of obesity or the unequal distribution of open space in the city. While the building of greenways and connections between open space patches is good for an open space network generally, the residents of downtown areas typically tend to be wealthier, more affluent, healthier, and more mobile than individuals in other areas of the city. While it makes sense that real estate developers would want to focus their efforts on areas with high potential for return on investment, in the context of this project this community is not a priority population to design for. Work like this will only continue to exacerbate the inequalities in the city related to open space access.

Relevance (Rating Systems that address health & gap)

The profession of landscape architecture is

beginning to focus on evidence-based and data driven design, with the development of different rating systems that evaluate the effectiveness of a design. Despite the implementation of these rating systems to date, none of them explicitly address obesity.

The Sustainable Sites Initiative that has been developed by the Green Building Certification Institute (GBCI) is the first attempt at a rating system geared towards sustainable landscapes. The central message of the program is that every project has the potential to conserve, restore, and create benefits provided by healthy ecosystems and ecosystem services. The scale of projects within this could range from parks to mixed use developments and urban to rural contexts. Health and well-being benefits that are identified in this rating system include: biophilic response, improved air quality, and better performance at work or lowered recovery times in the hospital. Strategies to increase activity levels or to specifically address obesity are absent within this rating system.

Similar to the SITES program, LEED for Neighborhood Development Version 4 (LEED ND V4) also addresses the issue of health within the development of communities. The LEED ND program is broken down into 3 main categories: Smart Location and Linkages, Neighborhood Pattern and Design, and Green Infrastructure and Buildings. The program advocates for many of the same values shared by landscape architects in creating complex, layered, and multifunctional neighborhoods and spaces within them.

Within the requirements and credits, an undercurrent of prioritizing bicycling and walking to promote and enhance human health and wellbeing is implied. Many of the credits are prescriptive and focused on providing amenities including: access to outdoor recreation facilities, indoor recreation facilities, access to civic/public space, neighborhood gardens, and farmers' markets within 1/4 to 1/2 mile of 90% of dwellings within a development. Targeting obesity in neighborhood development is not explicitly stated within the LEED ND rating system, but many of the prerequisites, credits, and elements focus on walkability, the prescription of mixed uses, and proximity of amenities to residential dwellings that can contribute to the overall health and wellbeing of individuals inhabiting a development certified by this program. This isn't a guarantee though, as each project may pursue different points or credits to achieve certification.

Relevance (Landscape Architecture)

The field of landscape architecture is uniquely positioned to influence human health through site scale and landscape scale design work. From Fredrick Law Olmsted's work with sanitation in parks to the attitudes of the late 19th and early 20th century viewing open space and green infrastructure as lungs of the city, parks and open space were considered a necessity for the cities and urban areas. Unfortunately, too often today, parks and open space are viewed as amenities instead of necessities. By undertaking work similar to this project, landscape architects can help to address a national health crisis in obesity and provide

evidence based designs for both landscape scale and site scale projects that address this issue.

Approach - Key Goals and Objectives

The goal of this project is to aid New Orleans city planners and community leaders in understanding how populations at risk for obesity can be addressed through developing public open space. The outcome of this project is both an evaluative tool and prioritization process for development of open space in New Orleans. The method that this project uses to identify these priority sites can be adapted and transferred to other cities looking to develop new public open spaces to reduce obesity rates.

City residents living in areas that currently do not have access to public parks and open space would benefit from parks being developed according to this project in the future. Such a plan would also improve mobility among city residents if connections in the form of pedestrian and bicycling corridors are made between priority sites.

The APA (American Planning Association) has identified a framework of five strategic points of intervention for planners looking to integrate public health into their work. These include: Visioning and Goal Setting, Plans and Planning, Implementation Tools, Site Design and Development, and Public Facility Siting and Capital Spending (Morris 2006). The city of New Orleans has laid out visioning and goals in their 100 Resilient Cities Challenge document as well as in their 2030 masterplan. This project fits into the APA framework by moving one level down in detail and scale by addressing the Plans and Planning point of intervention.

This project is approached from a landscape planning or urban land planning scale and as such, only the location of sites for an open space network were identified. Actual site design would be undertaken in a future step with community involvement to determine the facilities, features, etc. of this public open space.

Chapter Summary

This chapter has illustrated the issues posed by not addressing communities at risk of obesity through the provision and location of public open space. Additionally, the links between public health and open space and the impact of obesity on society were examined. The unique health, economic, and social conditions of the city of New Orleans were discussed and the rationale for choosing it as a case study city was established. The gaps in existing rating systems, the relevance to the landscape architecture field, and goals/outcome of this project were also laid out in this chapter. In the next chapter, the approach for this project will be laid out along with its fit within research in the landscape architecture field. The development of the evaluative tool: the case studies will be covered, as will an overview of utilizing GIS analysis for the design of new public open space in New Orleans.

Chapter 2: Method Introduction

This chapter briefly discusses methods used by other researchers to address open space provision and planning; this project's fit within the larger context of research in landscape architecture; and an overview of the project method. This is followed by a more in-depth discussion about designing the evaluative tool and prioritization process that compose the project method (case studies and a design process to prioritize sites using GIS analysis)

Relevant Methods Used by Others

Types of Open Space Planning

Maruani and Amit-Cohen (2007) examine the different approaches to open space planning from a land use perspective. They propose two broad categories of open space planning models: one focused on services for human use and one focused on conserving natural values. These categories, while elementary and easily understood, diminish the trend toward multi-layered and multi-functional spaces. Within these two categories, they also identify nine different development models that can be employed, ranging from Opportunistic (taking what land is leftover after all other uses fulfilled) to Biosphere Reserves (center which is completely protected, buffer beyond containing natural/ agricultural areas, and peripheral zone with varied, low-impact uses).

Maruani and Amit-Cohen (2007) postulate that the Garden City Model is considered a cornerstone of modern urban and open space planning and a precursor of greenbelts, green fingers, and shape-related development models they describe. Due to this, it was viewed as the most suitable and applicable model to use for open space development in this project.

Ebeneezer Howard conceived of the Garden Cities Model in the late 1800s; 200 years later, the goal of social reform though the distribution of public open space is still a concern of landscape architects and a goal of this project as well. Howard's Garden Cities planning approach responded to typical conditions of the Industrial Age: overcrowding, unsanitary living conditions, and increasing pollution. These conditions led to the development of many of the open space networks that are described in the Case Studies Chapter of this project. A development approach that addresses communities that are at risk of obesity requires the integration of public open space in areas of development, one of the key tenants of the Garden Cities Model.

GIS Network Analysis

GIS is the most effective tool to analyze existing open space networks spatially, view socio-economic information as it pertains to specific geographic areas, and to prioritize vacant lots available for development as public open space. Existing research has employed GIS to analyze access to existing open space using two different methods, network analysis and park service areas. Comber et al. (2008) used network analysis

Fig 2.1- Existing Open Space Network - Leicester, England

	(Post)positivism
Kind of new design knowledge	Predictive 'Objective' Deductive/generalizable Quantitative Verified theory/design guidelines Patterns, prototypes
Issues that research questions address	Physical/functional Psychological
RTD methods	Design hypothesis testing Design experiments tested with surveys, simulations or measurements Strict protocol
Research evaluation criteria and methods	'Objective' Validity Reliability Generalizability
	Quantitative/numerical Statistical analysis Empirical science test methods

Fig 2.2- Knowledge gained through (post) Positivist Research Through Design

of existing infrastructure to determine access for ethnic groups in Leicester, England (Fig. 2.1) and Sister et al. (2010) used park service area polygons to determine locations for new parks based on population density. Wolch et al. (2013) completed research on park funding in Los Angeles and examined the spatial relationship between where funding went and the communities her analysis determined to be in the greatest need of park access.

This project draws on this work by utilizing census data to determine communities at high risk for obesity and therefore in most need of access to public open space. Additionally, the existing open space of New Orleans is analyzed using distances and ideas that were presented in Comber et al. (2008), Sister et al. (2010), and Wolch et al. (2013).

Project Methodology

This project uses a combination of analytical and prescriptive case studies to produce both an evaluative tool for cities' open space networks and a prioritization process for expanding open space networks. (Fig 2.3) The key elements of this project are:

1. Adapt Francis' case study method (Francis 1999) for this project
2. Develop a method for identifying sites for development as new public open space utilizing GIS
3. Applied the case study method (evaluate) to five cities' open space networks,
4. Applied the case study method (evaluate) to New Orleans to establish a baseline condition,
5. Applied the prioritization process (GIS method) to New Orleans open space network

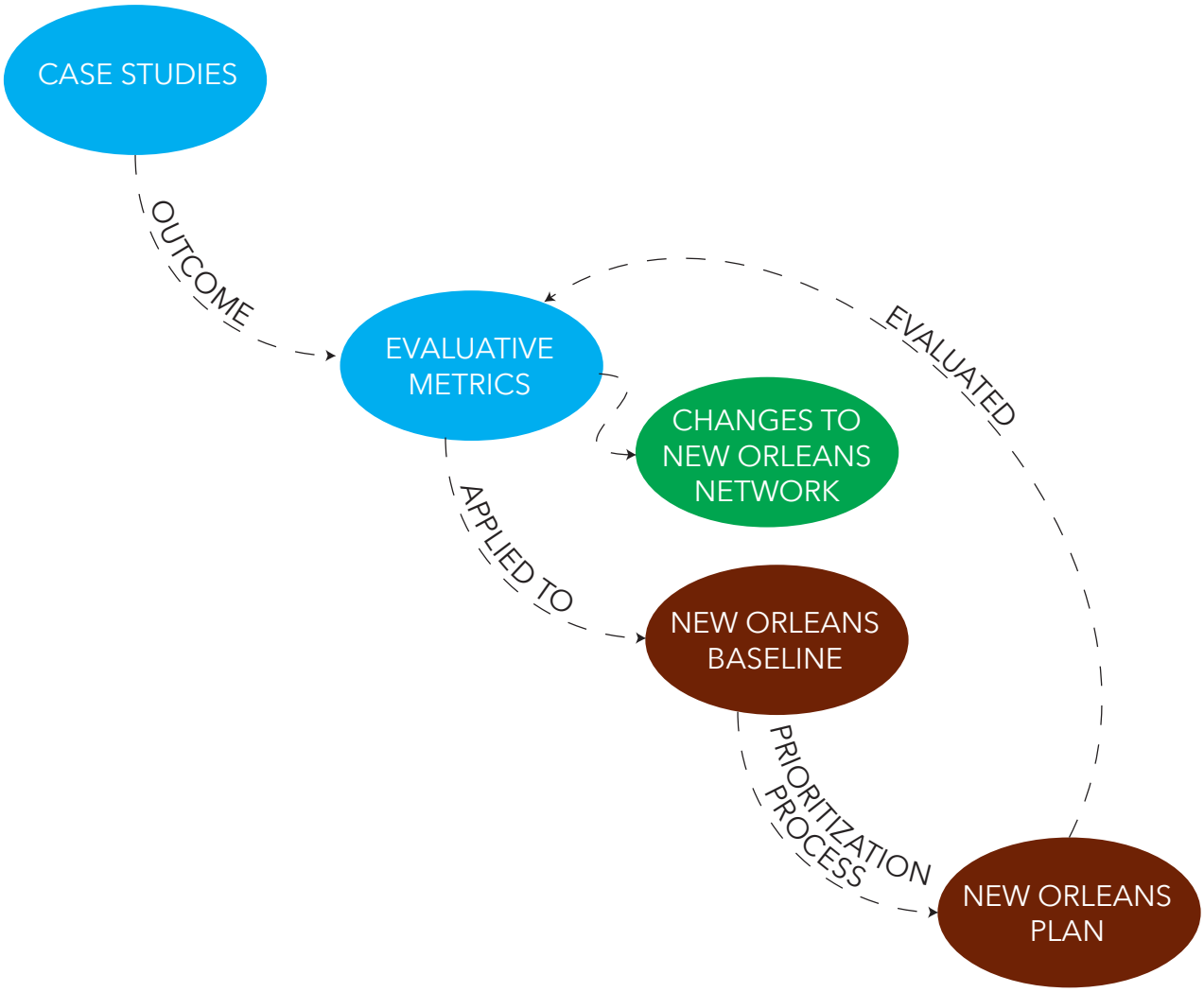

Fig 2.3- Evaluative and Design Tools Process

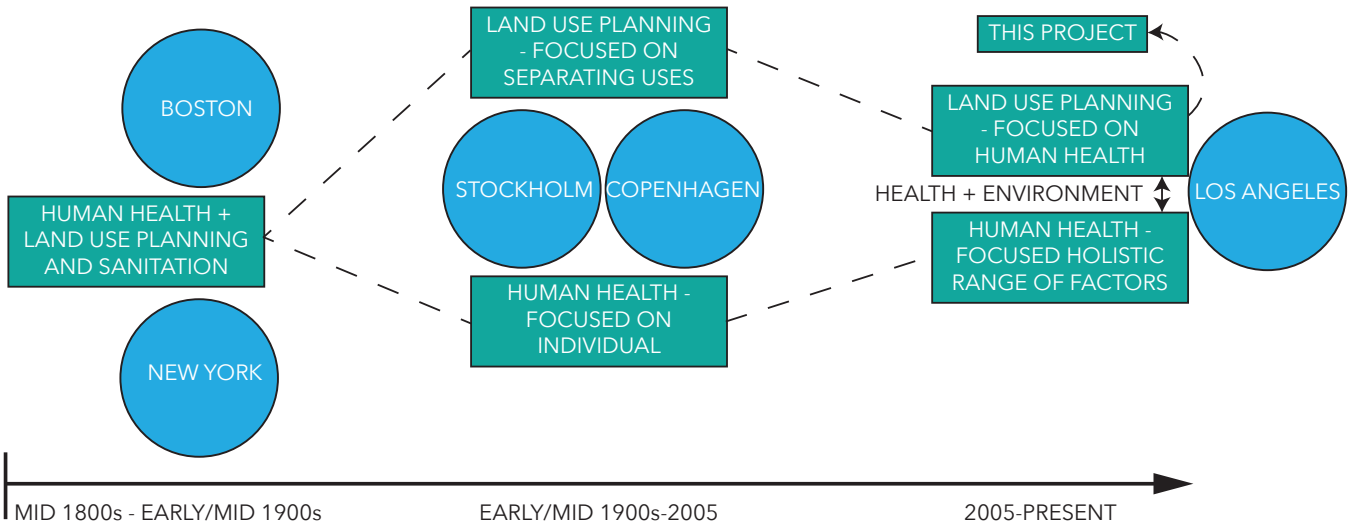

Fig 2.4- Case study cities within Human Health and Land Use Planning Timeline

6. Re-evaluated how New Orleans' open space network would change as a result of the added sites.

From synthesis of the literature review and lessons learned from the case studies, I developed criteria for the spatial analysis portion of the project. It translates a body of specialist knowledge from the health field into a spatial model for obesity rate reduction. The method that was produced is objective, quantifiable, spatially explicit, and is adaptable to other cities who also would like to implement this approach to new open space development.

Introduction to Case Studies and Choosing Case Study Cities

I used brief case studies of five different cities' open space networks in the US and abroad in order to understand how land use planning for public health has changed and grown over time, and to develop an analysis method and an evaluative tool. The cities that were chosen for study are: New York, Boston, Los Angeles, Stockholm, and Copenhagen.

New York and Boston were chosen as the founding of their public open space networks coincided with the Industrial Revolution. Additionally, these cities' open space networks were products of Frederick Law Olmsted's work. He was employed as the secretary of sanitation for the Union Army and his work on these networks was explicitly intended to improve human health. Stockholm and Copenhagen were chosen as two examples of coastal cities with innovative and holistic approaches to developing public open space networks and ranked 2nd and 1st, respectively, on the European Green Cities Index (Siemens 2012). Los Angeles was chosen as it is one of only a few cities to have completed a comprehensive, spatially explicit health analysis of the city and used that information to locate 50-60 new public open spaces in the areas with the biggest health issues. (Health Atlas for the City of LA 2013) These cities' approach to planning public open space networks is situated within the broader approach to land use planning and public health below in Fig 2.4.

According to Francis, "A case study is a well-documented and systematic examination of the process, decision-making, and outcomes of a project that is undertaken for the purpose of informing future practice, policy, theory, and/or education." (Francis 1999). Francis describes case studies as tools to answer big questions at the intersection of policy and design and for trying to test or refine emerging concepts and ideas. (Francis 1999) This project tests the concept of utilizing open space planning to address obesity rates in a city. Comparative case studies of public open space were used to extract information on cities' health issues and cities' open space networks for this project.

Designing the Case Study/ Evaluative Tool

Francis describes the method of undertaking the case studies with the following steps: "Designing the case study, conducting the case study, analyzing the results, and disseminating the results." (Yin 1994, Francis 1999). In designing the case study/

evaluative tool, this project first determined the necessary data to analyze cities' open space networks, described below. Secondly, the information gathered for each city was reviewed and analyzed in order to compare the different cities. Finally, I applied the correlations and lessons that were learned to New Orleans to help inform the open space network expansion.

For this project, I separated the information to be gained into Open Space Network information and Obesity Risk Factors information. This information was split into two sections, listed in Fig. 2.5 and Fig 2.6, as I acknowledge the difference in disciplines that still exists today (Fig 2.4). This allows each portion of the case study to read on its own and form part of a larger whole.

The Open Space Network portion of the case study describes when the open space networks of these different cities began, the background conditions leading to their formation, how they evolved over time, whether population density and open space as a percentage of land area has changed from formation to current day, and what current attitudes and approaches toward developing public open space is in these cities.

The City Obesity Risk Factors portion gathers information that was identified in Price et al. 2013, Flegal et al. 2016 as indicators or risk-factors for obesity. Their research identified ethnicity (African-American or Hispanic), low educational attainment, low-income or poverty status, obese childrens' likelihood of becoming obese adults, and the lack of health insurance as risk factors. The indicators show that educational attainment, low income or poverty status, and lack of health insurance disproportionately affect African American or Hispanic communities when compared to caucasian communities. To summarize, if a child has parents with low educational attainment, they are unlikely to make much money. The low-income of these parents is more likely to be unable to afford living in communities with amenities like open space, unable to afford health insurance, and unable to purchase nutritious food for their families.

Both of these case study portions can be examined for correlation between each other, but it is important to note that correlation of more public open space land to lower rates of obesity does not constitute causation. There are many factors that contribute to obesity outside of access to public open space and these will be covered more in depth in the Limitations chapter.

Prioritization Process: Using GIS to locate new public open space in New Orleans

Overview

The New Orleans case study brings the two parts of the project - evaluative system and prioritization process together and tests their utility. The evaluative tool (the metrics) that was developed in case study section of this project is applied to the city of New Orleans and its open space network to understand the current condition as a baseline. Next, the prioritization process (GIS Analysis) is applied to New Orleans to produce an outcome of new priority sites for open space

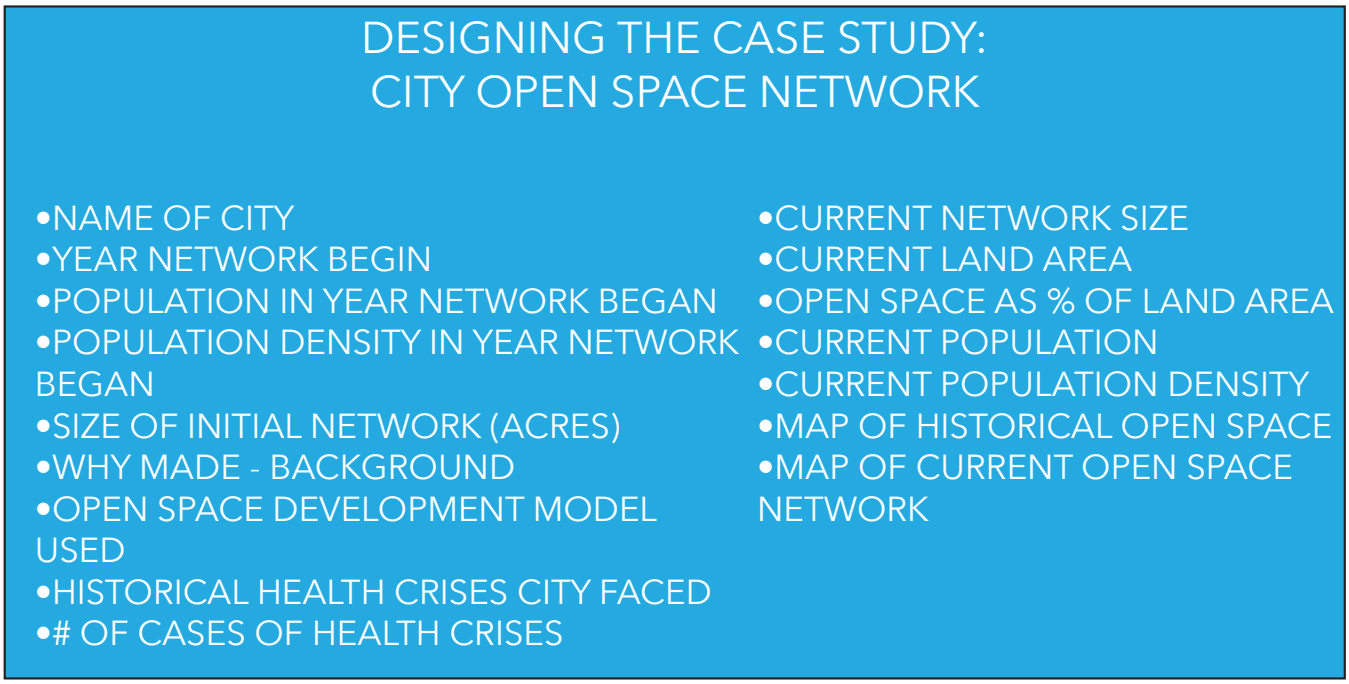

Fig 2.5- Information gathered for each case study's open space network

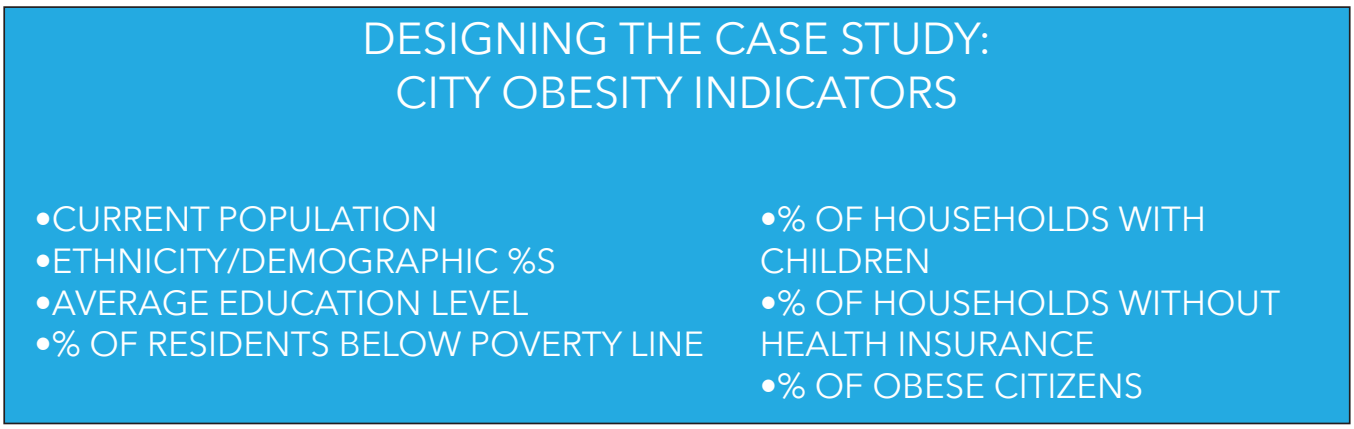

Fig 2.6- Information gathered for each case study's obesity risk factors

development. Finally, the resulting open space network is re-evaluated using the case study metrics to analyze how the open space network changed as a result of the design. This process can be seen in Fig. 2.3.

GIS Process

Four parts comprise the prioritization process, as seen in Fig. 2.7 below. The workflow consists of mapping existing open space networks and their relationship to residential areas; communities most at-risk for obesity; and land that is available for development as new public open space. Using a McHargian overlay process, the final step prioritizes the available parcels that best address the need for new public open space.

Within this overall process, I have identified the ideal information or spatial data that would most effectively inform the creation of maps for each step. As is often the case, the data and information that was actually available for use in this project is not necessarily the ideal spatial data. The columns on the right side of Fig. 2.7 describe the analogue spatial information that was used in the analysis and creation of the maps for this project.

Chapter Summary

This chapter discussed methods used by other researchers to address open space provision and planning and how ideas presented in that research informed this project. This project's method and the knowledge it seeks to create was examined for its fit into the category of Research Through Design in the field of landscape architecture. This method uses a combination of case studies and GIS analysis to evaluate existing open space networks and inform the design of an expansion to New Orleans' open space network. The process for developing each of these components was also discussed in this chapter.

Case studies for the five selected cities: Boston, New York, Los Angeles, Stockholm, and Copenhagen are contained in the next chapter, along with an evaluative table to compare across case studies and the lessons learned from them.

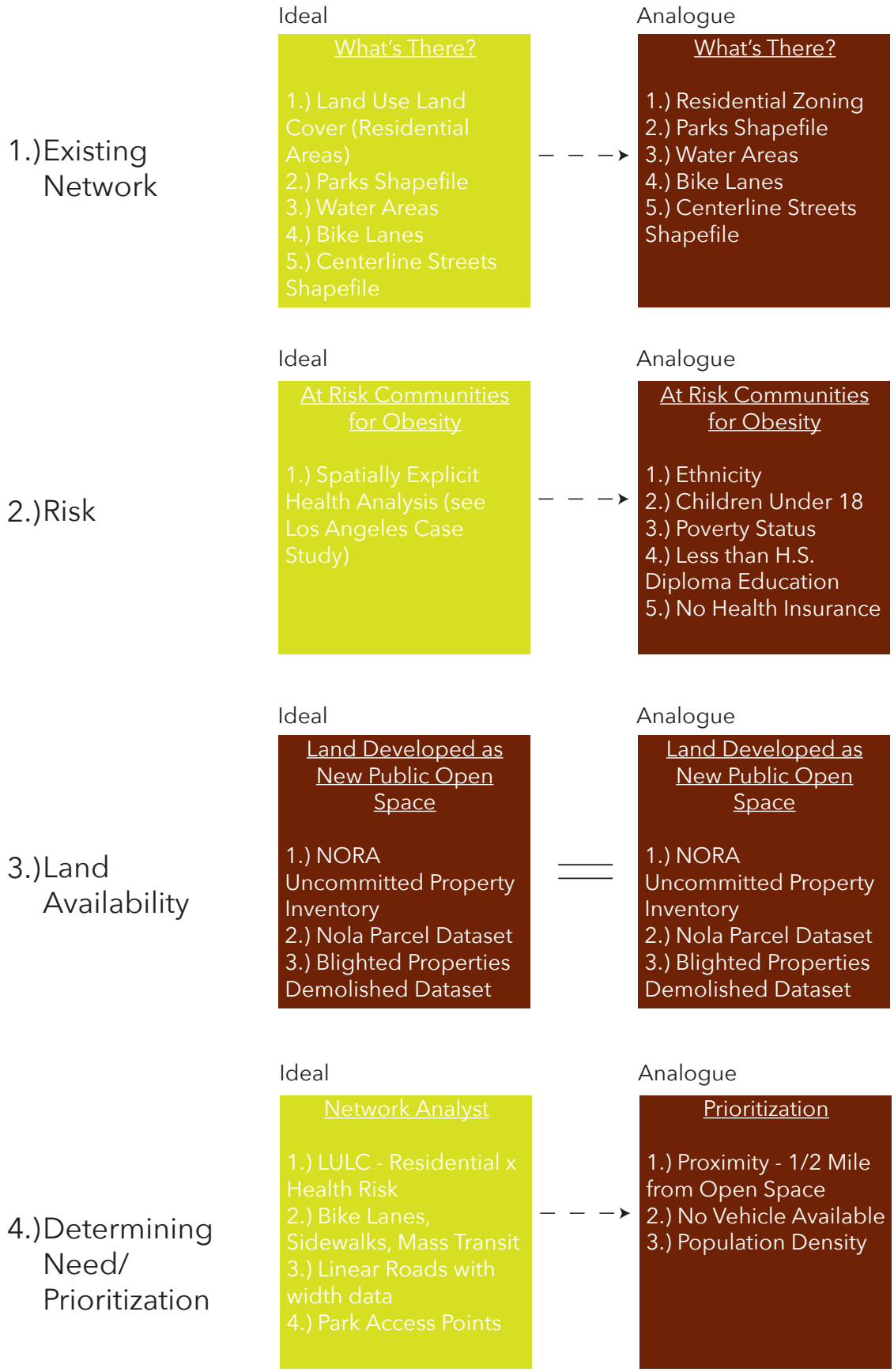

Fig 2.7- Overall Open Space Design Process with Ideal vs. Analogue GIS data for each step

Analytical Case Studies: Historical and Innovative Open Space Networks

Case Study Introduction

This chapter contains the work and evaluative tool of the case studies and the results of applying the case study method described in the Chapter 2 for the following cities: Boston, New York City, Los Angeles, Copenhagen, and Stockholm. These five cities' open space networks and risk factors for obesity are examined with normalized data for total population, population density, open space acreage, open space as a percentage of land area, and total land area; as well as demographics, educational attainment, poverty rate, percentage of children in population, uninsured rate, and obesity rates to identify a correlation between a better park system (defined by larger percentage of city's land area) and better health (defined by lower obesity rate). These cities' approach to planning public open space networks, situated within the broader approach to land use planning and public health is shown in Fig 3.1. This illustrates that the case studies chosen fall along the evolution of viewing human health and land use planning as the same field to the separation of these fields, to the now overlapping views of the two fields once again.

Tables containing information on open space networks and Risk Factors for Obesity are located alongside the evolution of each city's open space network, the current approach to developing open space, health crises and issues faced by the city, and brief information about important takeaways for each city. The end of this chapter contains comparative tables with information on each city's open space network and obesity risk factors as well as a brief discussion of lessons learned from completing this part of the method. These lessons will help to inform the design of New Orleans' open space network expansion in Chapter 4.

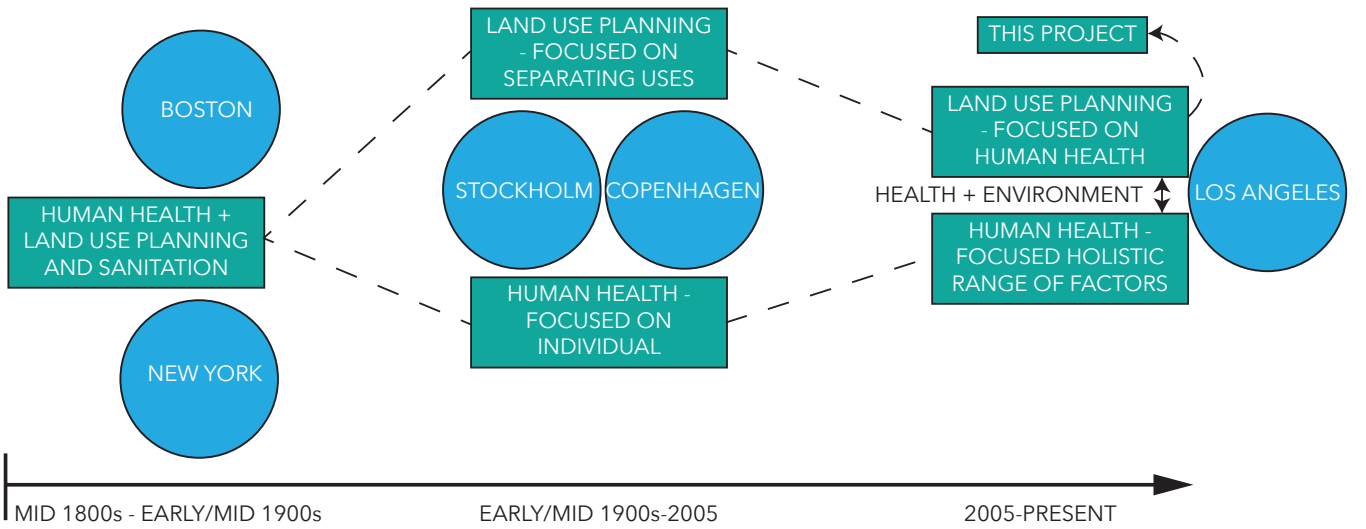

Fig 3.1- Case study cities within Human Health and Land Use Planning Timeline

Boston

Project Background and Evolution

Boston in the early 1800s grew from a city of 25,000 to a city of more than 93,000. In the late 1800s, the method of city development and planning shifted from the private sector to the city government. During this time the city annexed neighboring towns in an attempt to keep up with the growing population. Park boosters around this same time were advocating for the creation of public parks to bring the country into the city and provide both recreational open space and rural scenery for the citizens (Hardy 1980). Both were considered to improve citizens' physical and mental health. A massive fire in 1872, combined with the city's population boom, drove the infilling of the Back Bay of the Charles River with rubble from buildings burnt in the fire. This had the effect of limiting tidal flows in the area, creating public sanitation problems: the city used streams and waterways for sanitation, disposing of waste, and the twice daily tidal flows flushed that waste out into the ocean.

Olmsted submitted a plan to the city that sought to tie together improved sanitation, improved air quality, recreation space, and a space to reform/assimilate the working classes of Boston (Izzo 2007). This plan was developed and became the Emerald Necklace, 1,100 acres of connected public open space containing nine different parks linked by parkways and waterways throughout the peninsula of Boston. This represents a Park System approach to open space development.

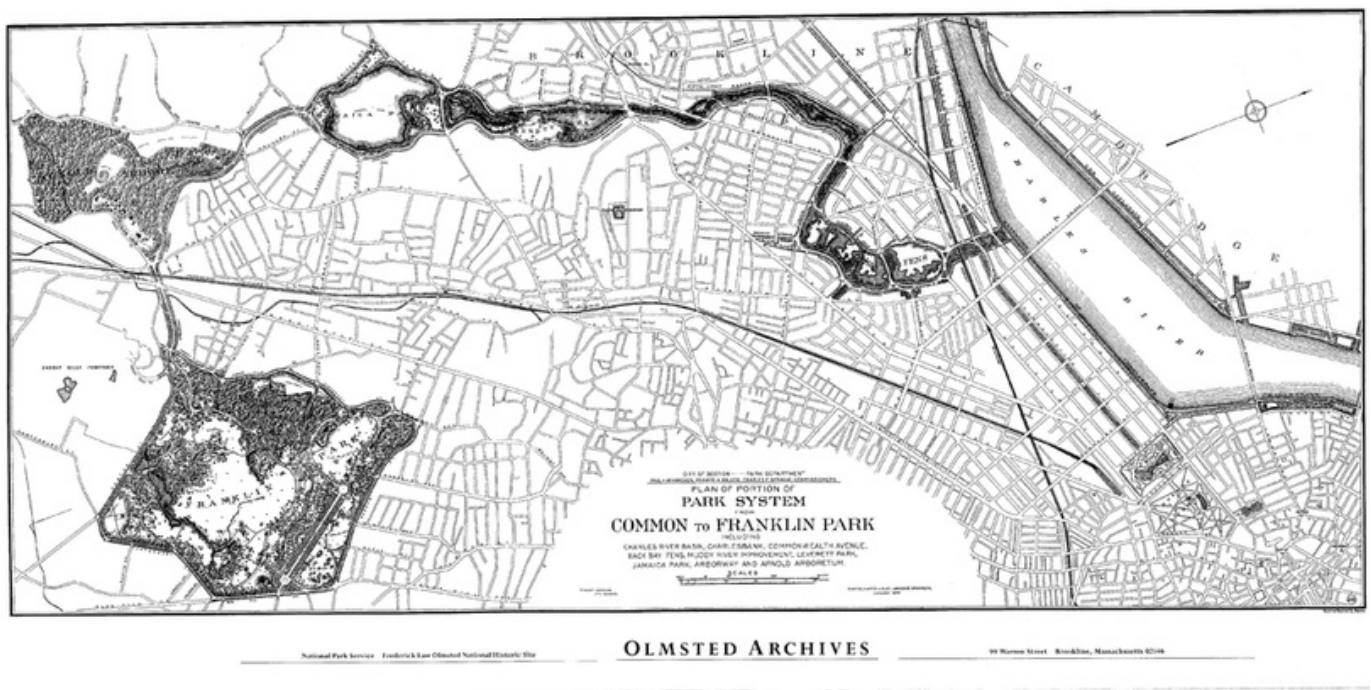

Fig 3.2- Emerald Necklace Plan of Boston's Park System

Boston Open Space Network

Year Open Space Network Began	**1875**
Population in Founding Year	**250,526**
Population Density in Founding Year	**10.4 people/acre**
Land Area in Founding Year	**24,000 acres**
Open Space as a % of Land Area Founding Year	**4.58%**
Size of Original Open Space Network	**1,100 acres**
Current Size of Open Space Network	**4,956 acres**
City Land Area (2016)	**30,897 acres**
Current Open Space as a % of Land Area	**16.04%**
Current Population (2016)	**667,137**
Current Population Density	**21.6 people/acre**
Persons / acre of open space (1875)	**228**
Persons / acre of open space (2016)	**135**

Fig 3.3- Boston Open Space Network Statistics

Boston Obesity Risk Factors

Current Population	**667,137**
Demographics:	**47% White** **22.4% Black** **17.5% Latino** **8.9% Asian** **4.2% other**
Average Education Level	**20.2% less than H.S.** **30.3% College Degree** **25.6% Grad Degree**
% of Residents in Poverty	**21.6%**
Children Under 18 as % of Population	**23%**
% of People Without Health Insurance	**3.8%**
% of Population that's Obese	**21.7% Adults** **13.8% High School**

Fig 3.4- Boston Obesity Risk Factor Statistics

Current Open Space Approach/ Development Model

Boston has developed an Open Space and Recreation Plan for 2015-2021. The plan is organized by neighborhood and has a needs analysis completed for each. One of the most intriguing and valuable parts that has come out of this plan is how the city has analyzed and defined neighborhoods in need of community open space and recreation. (Section 7.2 Boston Open Space Plan) Boston has defined a need for open space through the analysis of: Context, Demographics, Population Density and Need Score, Facilities Distribution, Park Access and Equity, and Community Planning & Development.

Boston assigns each neighborhood a need score based on social demographics and access/equity analysis. To classify as a high need area, a neighborhood would contain: high population density, Age: high % of population under 18, high % of the population over 69, Income: high number of low income households, Race: high minority population,

Park Type	Park size (acres)	Typical Uses	Service Area
Pocket Parks	Less than 0.25 acres	Plazas and squares	0.1 mile
Neighborhood Parks	0.25 acres to 5 acres	Multi-use	.25 miles – 5 min walk
Community Parks	Over 5 acres	Multi-use, large facilities	0.5 miles – 10 min. walk

Fig 3.5- Boston Open Space Service Areas

Language: being English language isolated. (BOSP 2015) The access + equity analysis of Open Space Need categorizes service areas by distance:.1 mile, 1/4 mile (5 minute walk), and 1/2 mile (10 minute walk) and open space sizing as described below in Fig 3.5.

Key Takeaways

In the Emerald Necklace Plan for Boston, Olmsted designed a complex park system containing multiple functions: sanitation, recreation, transit/circulation ways, air quality, and social reforms. Boston uses a 2 stage analysis to define need of parks: social demographic analysis and access analysis. This informs the prioritization process portion of this project. Finally, the obesity risk factor table (Fig 3.4) illustrates that Boston has a population that is not at great risk for obesity. The citizens are highly educated, a low uninsured population, and 1 in 5 people with poverty status. This correlates to a 21.7% obesity rate, which compares to the state of Colorado at 20.1%. (lowest in US)

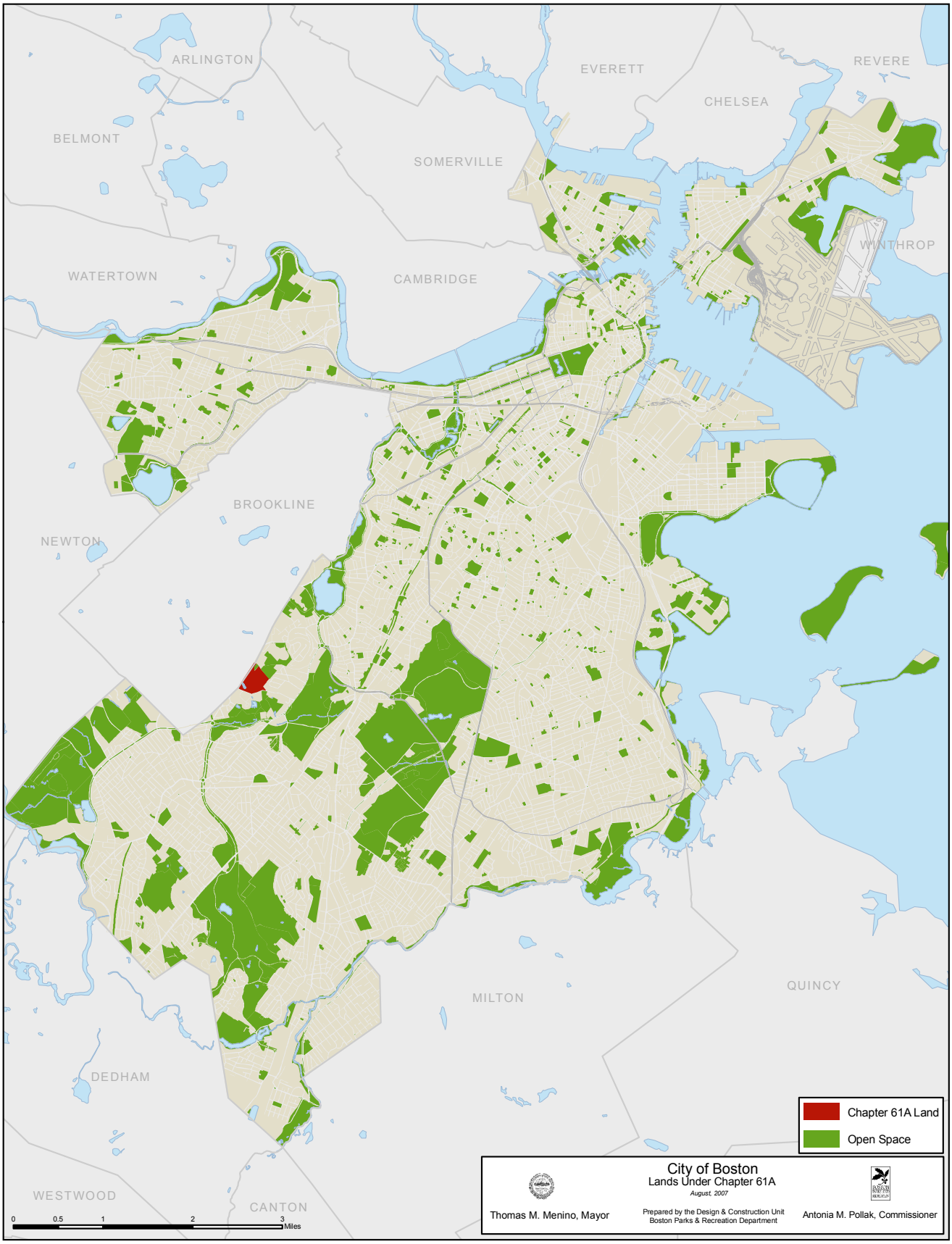

Fig 3.6- Boston Open Space Network - 2016

New York

Project Background and Evolution

Parks and public open spaces in New York City originated as sites for small squares, parade grounds, markets, and reservoirs between 1686-1811. In 1811, the Comissioner's Plan for New York City that formalized the city grid was published and only 470 acres of open area was originally dedicated for all of Manhattan. From 1811-1850, parks continued to be developed in the different boroughs both according to city plans and sporadically. These included: Washington and Tompkins in Brooklyn, Veterans Park in Staten Island, Daniel Carter Beard Memorial Square and Wyanda Park in Queens, and Madison Square and Bryant Park in Manhattan.

By 1850, the population of New York had exploded to over 500,000 from 97,000 in 1811. Affluent citizens pushed politicians to develop a large public park to compete with international cities like Paris and London. The city used eminent domain to seize approximately 800 acres of land from large, poor immigrant communities for what became Central Park. This swampy, rocky land represented one of the earliest methods of the opportunistic models of open space development as the land was left over and not suitable for commercial development. (Maurani and Amit-Cohen 2007) Fredrick Law Olmsted and Calvert Vaux won a design competition for the park and set about creating a pastoral-style landscape like those in Europe. The design for Central Park was based on Birkenhead Park in Merseyside, England, completed in 1847. Birkenhead was the first public park in Britain and designed to

Fig 3.7- New York Open Space Plan - 1811

improve the health and morals of the citizens it served and acted as an economic engine. Central Park was specifically designed for the affluent and upper class to use, although its users evolved in later years.

After the serving as the Secretary of the US Sanitary Commission for the Union Army in the Civil War, Olmsted reunited with Vaux in 1865 and determined the location and design for Prospect Park. To facilitate movement of people in the surrounding neighborhoods into and out of the park, they also designed parkways connecting the park to the city. In 1887, the state enabled the city to acquire new small parks in crowded neighborhoods.

When Robert Moses took over as head of the Parks Department in the late 1920s, the automobile was just coming into vogue. Much of his city planning and park planning revolved around automobiles and as a result, he helped create hundreds of miles of parkways within New York. He saw these parkways as an evolution of Olmsted and other early landscape architect's 'green lungs of the city' concept. Additionally, he created hundreds of new playgrounds and continued to add more parks to New York City's growing park system.

The mid 1960s-mid 1970s saw New York city as one of the first cities to implement ideas surrounding vestpocket parks, or what are now known as pocket parks, less than a quarter acre in size. It was also one of the first cities in the US to implement Greenstreets in the early 1990s and began looking at public-private partnerships to develop new parks to ease the financial burden on the city.

Current Open Space Approach/ Development Model

The current approach to open space development within New York City can be still be described as an Opportunistic model, but out of necessity. (Maurani and Amit-Cohen 2007) Projects like Governor's Island, The High Line, Freshkills, and Brooklyn Bridge park all reclaim post-industrial, landfill, or post-military sites for public open space. With one of the densest populations in the country, additional land for new public open space will likely continue to come from infill, disused industrial sites, or other land that the city is able to repurpose.

To address communities and neighborhoods that are in the greatest need of parks, the city has developed the Community Parks Initiative. The city holds community input meetings and is working with the communities they've identified as having the greatest need (high population density, high population growth, and high poverty rates) to redesign or refurbish parks in these communities to meet these needs. The city has identified a goal of having every citizen live within a 10 minute walk to a park. (PlaNYC 2014)

Key Takeaways

New York developed their open space network beginning with Central Park using an Opportunistic open space development approach - taking land unsuitable for any other use and using it as open space. This trend has continued through to the present day with infill parks due to high population density and low available land area. The parkways connecting parks and

New York City Open Space Network

Year Open Space Network Began	**1811**
Population in Founding Year	**96,373**
Population Density in Founding Year	**6.6 people/acre (53.5/acre S. Man)**
Land Area in Founding Year	**14,600 acres (most in 1,800 ac)**
Open Space as a % of Land Area Founding Year	**3.22%**
Size of Original Open Space Network	**470 acres**
Current Size of Open Space Network	**39,615 acres**
City Land Area (2016)	**193,692 acres**
Current Open Space as a % of Land Area	**20.45%**
Current Population (2016)	**8,550,405**
Current Population Density	**42.2 people/acre**
Persons / acre of open space (1811)	**205**
Persons / acre of open space (2016)	**216**

Fig 3.8- New York Open Space Network Statistics

New York City Obesity Risk Factors

Current Population	**8,550,405**
Demographics:	**44.6% White 27.5% Latino 25.1% Black 11.8% Asian**
Average Education Level	**19.7% less than H.S. 35.7% College Degree**
% of Residents in Poverty	**20.6%**
Children Under 18 as % of Population	**30.7%**
% of People Without Health Insurance	**13.9%**
% of Population that's Obese	**25% Adults 11.8% Youth**

Fig 3.9- New York Obesity Risk Factor Statistics

neighborhoods to parks in the city are a result of Olmsted and Vaux's work, with Robert Moses later focusing on auto-parkways. The city's park access goal is to have a public park within a 10 minute walk (1/2 mile) for every resident. Evaluating the Obesity Risk factors table in Fig 3.9 shows that the city is very diverse, has a high education rate, 1 in 5 people in poverty, a large population under 18, and an uninsured rate above the US average of 11.7%. These statistics illustrate a city that is at low-medium risk for obesity. This correlates to a 25% obesity rate, which ranks 8th lowest when comparing the city to US state obesity rates.

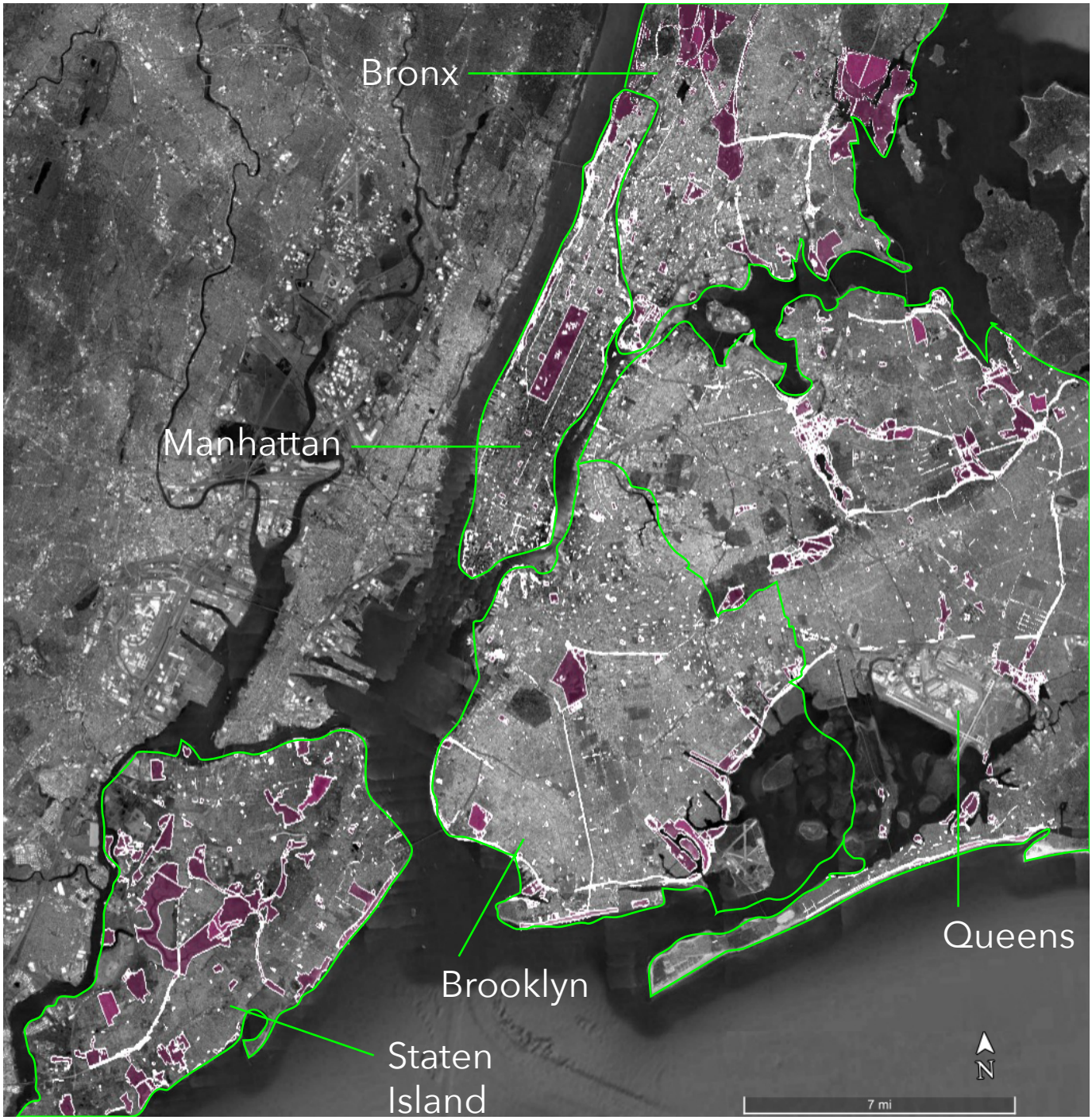

Fig 3.10- New York Open Space Network - 5 boroughs 2016

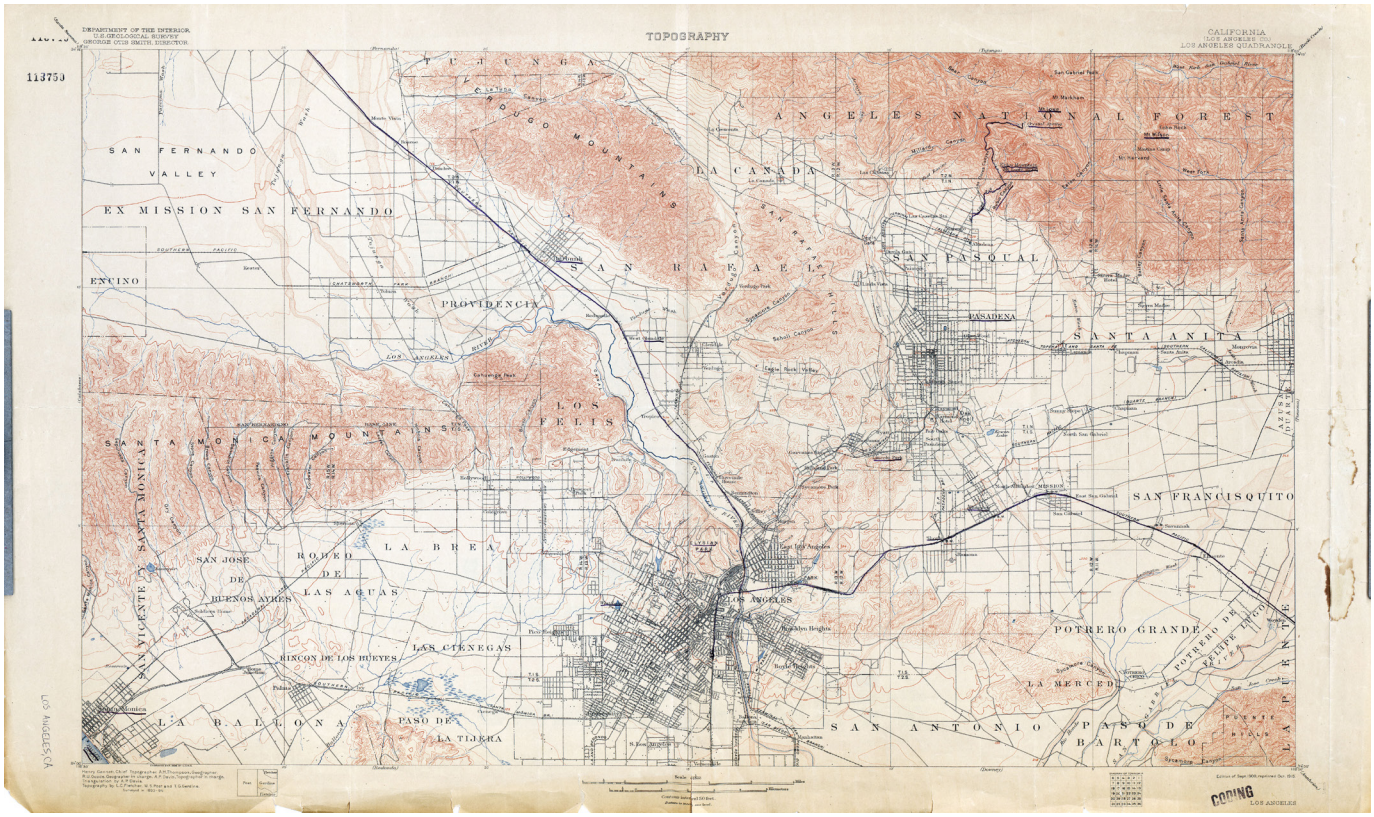

Fig 3.11- Plan of Los Angeles in 1889

Los Angeles

Project Background and Evolution

The first open space in Los Angeles was the development of the Plaza around the original pueblo structures, today known as Los Angeles Plaza Park. This plaza was the original center of the city and development was intended to radiate outward from this central point. As the city grew through the late 1800s due to new railway lines, it developed a Parks Department in 1889 to manage Los Angeles Plaza, Elysian Park, and Pershing Square, the first parks in Los Angeles' park system. Many of these lands were considered refuse or undevelopable lands. This is typical of other cities who also took an Opportunistic approach to open space development. Pershing Square arose out of swamp; Elysian Park out of steep hills unsuitable for farming or housing; and Griffith Park also contains much steep and undevelopable land (Masters 2013).

Like many other cities, attention in the early 1900s shifted towards the development of playgrounds and social/recreational programs. Unique to LA, they developed both children's camps and family camps on campgrounds owned and managed by the parks department. The development

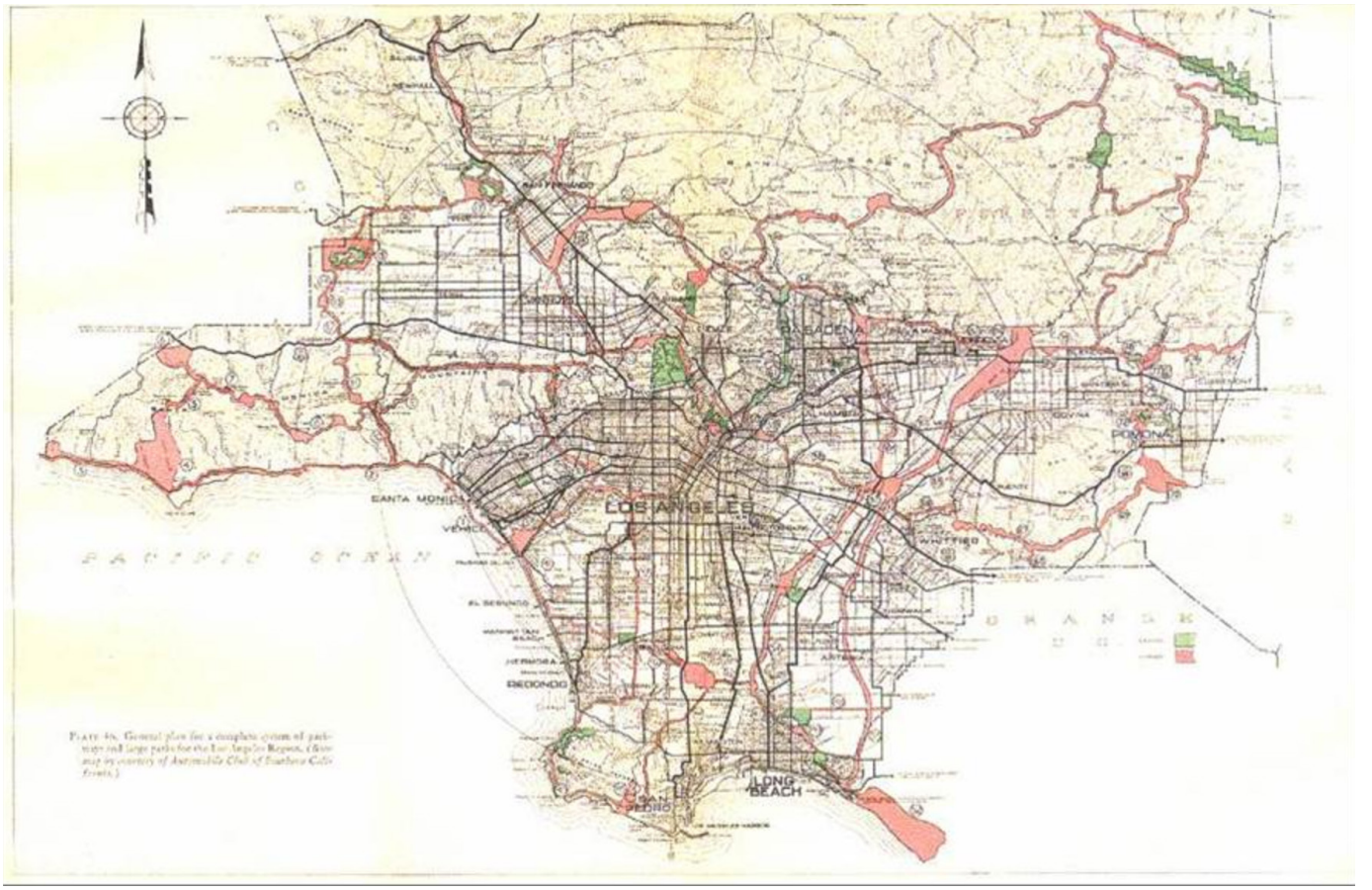

Fig 3.12- Olmsted Brother's Emerald Necklace Plan for LA -1929

of the city of Los Angeles from the 1800s through the early 1900s is characterized by subdivisions and neighborhoods and the lack of a comprehensive plan for parks or open space. This has led to the inequitable distribution of open space throughout the city that persists today.

In the 1930s, Fredrick Law Olmsted's sons, along with Bartholomew and Associates of St. Louis, completed an "Emerald Necklace" plan for Los Angeles County which expanded the project scope outside of the city (Fig 3.12). This work was commissioned by the Citizens' Committee on Parks and was intended to inventory the existing parkland, asses the need for new parkland, and make recommendations on how and where to implement them. The Emerald Necklace plan identified four different types of park development: increased access to beaches, expanded numbers of athletic fields, additional large reserves or parks (mountain ranges, canyons, and islands; and an interconnected network of parkways, that linked the above assets together in a comprehensive network (Hlady 2014). Unfortunately, this plan was shelved due to the Great Depression and desires of communities at the time to keep things as they were.

Current Open Space Approach/ Development Model

In 2009, Los Angeles developed the 50 Parks Initiative. This used factors such as population density, median household income, and poverty rates to define need. The city cross-referenced this spatial data with existing parks within a half mile radius of these neighborhoods to determine locations

Los Angeles Open Space Network

Year Open Space Network Began	**1889**
Population in Founding Year	**50,000**
Population Density in Founding Year	**2.8 people/acre**
Land Area in Founding Year	**17,920 acres**
Open Space as a % of Land Area Founding Year	**3.62%**
Size of Original Open Space Network	**649 acres**
Current Size of Open Space Network	**38,822 acres**
City Land Area (2016)	**299,949 acres**
Current Open Space as a % of Land Area	**12.94%**
Current Population (2016)	**3,928,864**
Current Population Density	**13.1 people/acre**
Persons / acre of open space (1889)	**78**
Persons / acre of open space (2016)	**102**

Fig 3.13- Lost Angeles Open Space Network Statistics

Los Angeles Obesity Risk Factors

Current Population	**3,928,864**
Demographics:	**48.5% Latino** **28.7% White** **11.3% Asian** **9.6% Black** **1.9% Other**
Average Education Level	**24.53% less than H.S.** **27.1% College Degree**
% of Residents in Poverty	**26.9%**
Children Under 18 as % of Population	**22%**
% of People Without Health Insurance	**21.2%**
% of Population that's Obese	**24.7% Adults** **23% Children**

Fig 3.14- Los Angeles Obesity Risk Factor Statistics

that were suitable for new public open space. Many of these park locations were in southern Los Angeles, which lacked existing parklands. (Stephens 2015)

In 2013, LA completed a comprehensive health analysis and complied a Health Atlas for the city. This health atlas was meant to provide a baseline for the city in order to understand which areas of the city have the worst health issues and to understand how demographics, social factors, economics, and the physical environment impact health. (Health Atlas for the City of LA 2013) After this Health Atlas was complied, the city set about addressing the areas with the potential to affect the largest number of residents. They have subsequently continued developing parks in the 50 Parks Initiative with this information in mind. Furthermore, the city has increased park fees that are charged to the developers of new projects in order to help fund this work.

Finally, the Amigos de las Rios, a parks development nonprofit, has taken up the Olmsted Plan and adapted it into a plan for the county. They are undertaking key projects, communicating with citizen groups for park design, and building support for their model of open space development.

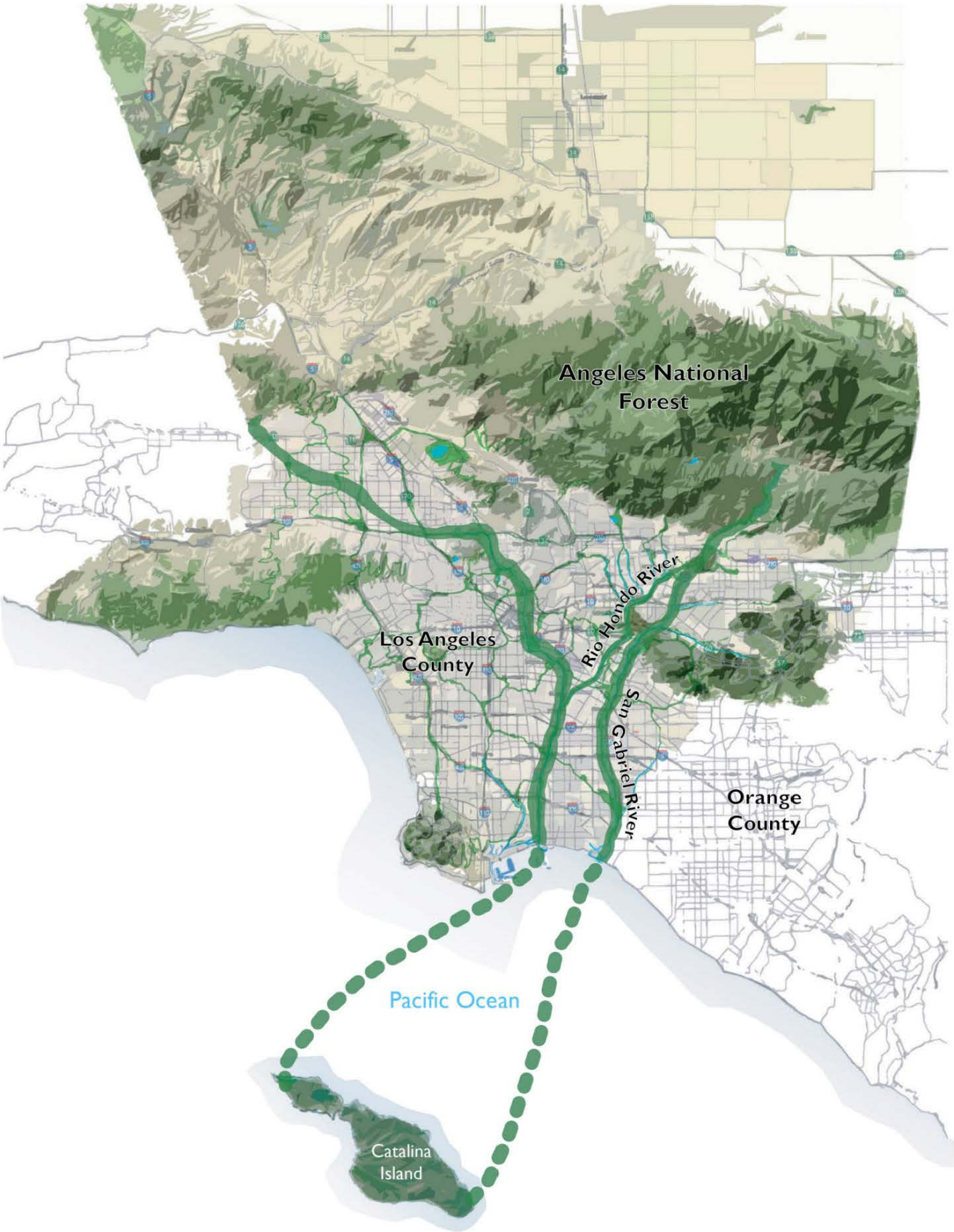

Fig 3.15- Amigos de las Rios Revised Emerald Necklace Plan 2016

Key Takeaways

Los Angeles' growth is characterized by subdivisions and housing development, which was often done without a comprehensive plan and has resulted in the inequitable distribution of open space in the city.

The Olmsted Brothers designed a comprehensive Emerald Necklace Plan (network of parks and connecting parkways) for LA County in the 1930s that was shelved, but recently was revived by the Amigos de las Rios nonprofit. In 2013 the city completed a spatially explicit health analysis, and are able to spatially locate communities with the worst health problems. The city has developed the 50 Parks Initiative to address communities most in need of parks through building many pocket parks. This initiative used demographics and spatial proximity to define need. Recently, the LA Health Atlas has helped to redefine need as communities with specific health issues and their spatial proximity to parks.

The Obesity Risk Factor Table, Fig 3.14 shows that Los Angeles has a high risk for obesity. This is illustrated through high diversity, a large population that did not graduate from high school, high poverty rates, and a high uninsured population. This correlates to adult (24.7%) and childhood (23%) obesity rates comparable to New York City, ranking it 8th lowest when comparing the city to US state obesity rates.

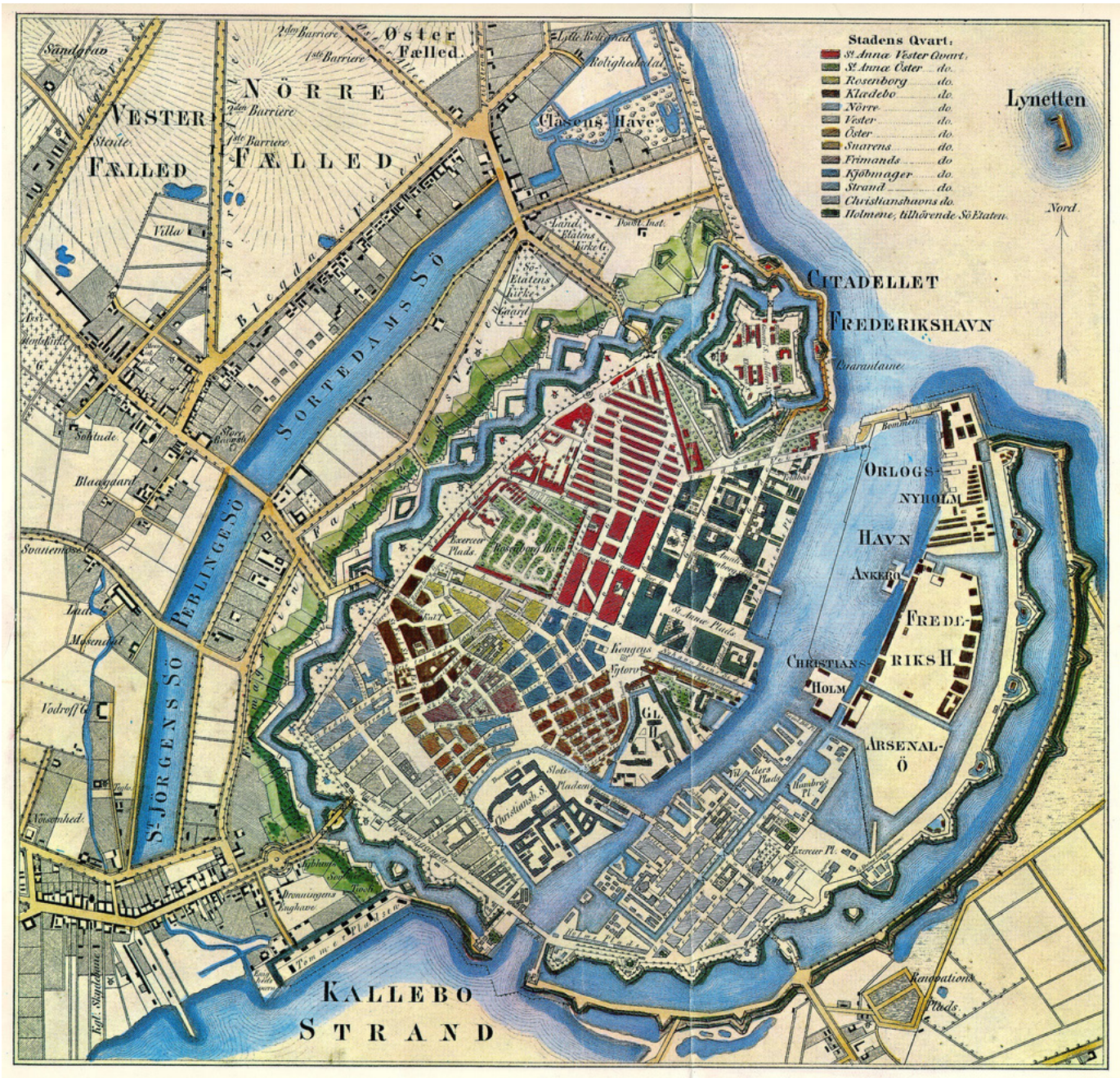

Fig 3.16- 1850 Plan of Copenhagen, Denmark

Copenhagen

Project Background and Evolution

The city of Copenhagen began as a medieval town in the 11th century. Like many medieval European cities, it grew within a defensive wall, built in the 13th century, and the growth of the city was constrained to the area within the walls. The only open space during these early years was the Rosenborg Castle Gardens, seen in the center of Fig 3.16. The population continued to grow past 140,000 in the 1850s on a land area of only 741 acres, constrained by the original angled fortifications (Fig 3.16). This population density, roughly 189 people/acre, and sanitary conditions were so bad that the city was forced to open the ramparts and allow the city to expand into the surrounding land area.

In 1947, Steen Eiler Rasmussen and Christian Erhardt 'Peter' Bredsdorff, working for the Danish Town Planning Institute, developed what today is known as the Five Finger Plan for Copenhagen (Fig. 3.19 and 3.20). The center of the city is the palm of the hand in this plan and the urban areas are the fingers. They focused on concentrating development along the existing metro train lines and leaving the green wedges in between the transit corridors for public use. The concentrated development allowed for a much larger area to be dedicated to public open space and parkland than in many US cities (Fig 3.17). This plan attempted to address 10 key challenges the city had identified: industrialization, migration, mobility, health, energy, nature preservation, food, waste, drinking water, and global war. (Copenhagen MOE 2015) Copenhagen joined the World Health Organization's Healthy City Network in 1989 and focused on integrating public health into its planning processes. This is done through developing the city's cycling infrastructure (50% of trips made by bike) and focusing on providing access to open space in the city (96% of citizens able to walk to parks/beaches in less than 15 min). The focus of this work was primarily on physical health: healthy eating and regular exercise making healthy citizens.

Current Open Space Approach/ Development Model

While revisions and expansions of the Five Finger Plan have been effective for almost 60 years, in 2010 Bjarke Ingels Group developed the Ring City plan in order to re-imagine development in Copenhagen. The development along the Fingers had started to sprawl outwards, which resulted in a reduction of the amount of open space and parkland in the green wedges, lying in between the fingers. The Ring City Plan uses the fortification lines from 1890 in order to help focus redevelopment, density, and infrastructure along this path and stop the sprawl that is occurring. This has the effect of connecting all the fingers and providing an alternative means of circulation and movement throughout the city. (BIG 2010) The connected fingers still allow for large amounts of open space in the areas between the fingers and rings and additional emphasis will be placed on the connections between these wedges as this plan is implemented.

The city's current Health Policy (Enjoy Life, Copenhagen) is a 10 year plan (2015-2025) aimed at enhancing the city's physical, mental, and social health outcomes. Within the plan, the city describes investing in urban spaces that encourage exercise, provide free healthy school meals for the poorest children, and urban renewal and social programs in disadvantaged areas of the city. There is a clear focus on equity and equitable access within the policy.

Key Takeaways

Copenhagen evolved from a walled medieval city into a sustainable metropolis thanks in part to its Five Finger Plan for development. This plan concentrated development in the city center and in urban areas that made up the fingers, allowing for open space wedges in between. This plan addressed complex needs ranging from industrialization to mobility, health, energy, and nature preservation. The focus on cycling infrastructure and open space access for all citizens contributes to the healthy culture

Copenhagen Open Space Network

Year Open Space Network Began	**1850**
Population in Founding Year	**140,000**
Population Density in Founding Year	**188.93 people/ acre**
Land Area in Founding Year	**741 acres**
Open Space as a % of Land Area Founding Year	**4.04%**
Size of Original Open Space Network	**30 acres**
Current Size of Open Space Network	**6,143 acres**
City Land Area (2016)	**21,712 acres**
Current Open Space as a % of Land Area	**28.29%**
Current Population (2016)	**763,908**
Current Population Density	**28 people/acre**
Persons / acre of open space (1850)	**4,667**
Persons / acre of open space (2016)	**125**

Fig 3.17- Copenhagen Open Space Network Statistics

that exists today. The newest plan for the city involves building on the Five Finger Plan to concentrate further development in radial rings connecting the fingers. This allows for 28% of the city to be constituted of open space, one of the highest percentages of all case studies (Fig. 3.17). The Obesity Risk Factor Table, Fig 3.18, shows that Copenhagen has very low risk for obesity. The city has a highly educated population, low poverty rate, high percentage of children under 18 in the population, and zero uninsured rate. These statistics correlate with an obesity rate of 18.2%, that is lower than all US states and lowest of the case studies.

Copenhagen Obesity Risk Factors

Current Population	**763,908**
Demographics:	**76% Danish 24% Immigrant (Pakistan, Morocco, Poland, Germany, etc.)**
Average Education Level	**20% Basic School 33% College Degree**
% of Residents in Poverty	**5.4%**
Children Under 18 as % of Population	**29.5%**
% of People Without Health Insurance	**0%**
% of Population that's Obese	**18.2% Adults 15% 11-15 yr olds**

Fig 3.18- Copenhagen Obesity Risk Factor Statistics

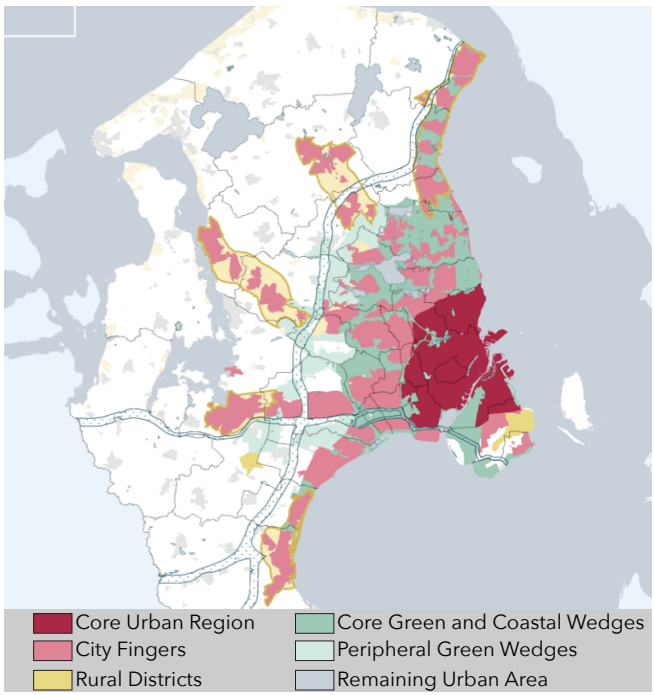

Fig 3.19- Large Scale Five Fingers Plan

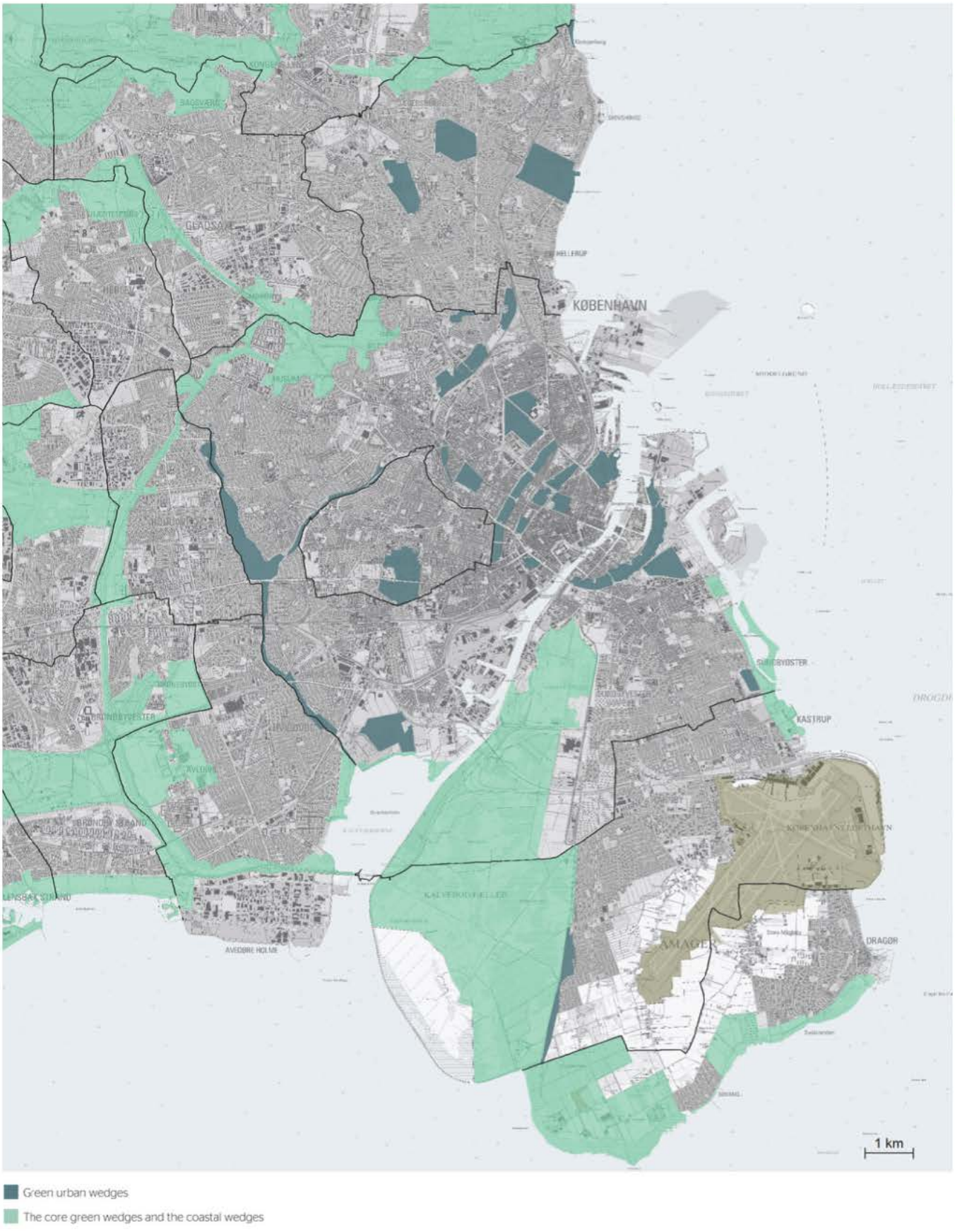

Fig 3.20- Copenhagen City Center Five Finger & Green Wedges Plan

Stockholm

Project Background and Evolution

Stockholm's open space network originated with the opening of royal gardens and hunting grounds to the bourgeoisie class in the 1700s: this type of park system was a function of dispersed royal holdings and occurred by happenstance, not as part of an city plan. The gardens that were opened included the Humlegarden and Kungsträdgården. This continued through the early 1800s as the bourgeoisie became stronger and strove to define their own patterns of interaction and sought to develop areas in the cities to act out what their version of life should be. In 1832, Parterre was developed, the first landscaped park in Stockholm that used public money. This park's purpose was to beautify the Royal Castle's immediate surroundings. In the 1850s, the Industrial Revolution made parks much more valued as hygiene in the city was terrible and the infant mortality rates were very high. (Clark 2006)

In 1866, Albert Lindhagen led a committee and developed what became known as the Lindhagen plan. Key strategies of this plan were to accommodate population increases through densification and mountainous areas of the city became designated as parks because they were too difficult to build on. This, like other case studies in this project, is an example of opportunistic development of open space. Additionally, a minimal amount of work could be put into turning these natural areas into lush parks. (City of Stockholm 2017) The outcome of this type of planning resulted in concentrated development in valleys while mountainous wedges of open space at least 500 feet wide surrounded the development. The benefits to be gained from using these mountainous areas as parks is that there was cleaner air at higher altitudes and better views for the residents. This is a very early view of parks as natural areas versus many of the contrived or designed gardens of the bourgeoisie.

This plan was in place through roughly 1941, when Holger Blom developed the Park Network/System proposal. This proposal was a multifunctional approach to public green space that acknowledged recreational, health, ecological, architectural, and cultural aspects of green space. (Littke 2015) The Park Network included an overarching vision for health: "The park makes room for outdoor recreation." Blom understood that parks must be a place for exercise and movement for young and old people alike. This holistic approach to urban open space planning kept evolving in the 1960s, as the city began employing a network approach to urban green space which focused on commons, parks, gardens, squares, streets, and graveyards. (Littke 2015)

Current Open Space Approach/ Development Model

Sweden today has a government that continues the tradition of valuing urban public open space and recommends that municipalities develop green plans as part of their comprehensive plans. In 2012, the policy directive of "creating and maintaining a good built environment," was changed to specify that green areas in high density urban spaces must be of high quality and availability to its citizens. Today, 90% of Stockholm's population lives within 300m, (.2 miles) of some form of green space. (Littke 2015)

Fig 3.21- Stockholm Royal Gardens

Fig 3.22- 1817 Plan of Stockholm

Stockholm Open Space Network

Year Open Space Network Began	**1870**
Population in Founding Year	**90,000**
Population Density in Founding Year	**86.1 people/acre**
Land Area in Founding Year	**1,045 acres**
Open Space as a % of Land Area Founding Year	**4.21%**
Size of Original Open Space Network	**44 acres**
Current Size of Open Space Network	**21,000 acres**
City Land Area (2016)	**46,720 acres**
Current Open Space as a % of Land Area	**44.94%**
Current Population (2016)	**910,000**
Current Population Density	**20.3 people/acre**
Persons / acre of open space (1870)	**2,046**
Persons / acre of open space (2016)	**44**

Fig 3.23- Stockholm Open Space Network Statistics

Stockholm Obesity Risk Factors

Current Population	**910,000**
Demographics:	**73% Swedish 27% Immigrant (Finland, Iraq, Iran, Poland, Turkey, Somalia, etc.)**
Average Education Level	**13% less than H.S. 34% College Degree**
% of Residents in Poverty	**7%**
Children Under 18 as % of Population	**21.5%**
% of People Without Health Insurance	**0%**
% of Population that's Obese	**18.6% Adults 5.9% Youth <9**

Fig 3.24- Stockholm Obesity Risk Factor Statistics

The current planning program for public open space in Stockholm is titled the Green Walkable City. (GWC 2010) This planning document has four key goals, "protect and develop the green character of the city; to support accessibility and recreation through the perspective of green urban space as a "living room" or an everyday public space; to support the ecological infrastructure, pertaining to biodiversity and ecosystem services; and to develop tools and processes for the government to work with green space." (Littke 2015) In order to accomplish this, the city has two key goals: develop regional nodes and preserve regional green structure which results in a focus on infill development rather than additional sprawl. The government is focused on preserving the long shoreline and the city's identity as a city on/defined by water. The shoreline serves both as an amenity for city residents and the preservation of these areas as open space results in habitat along the ecotone. This represents a holistic approach to developing public open space and also a valuing multiplicity/complexity in public open space. This is evident in the functions of urban green spaces listed by the GWC plan that include: public space, social cohesion and inclusion, safety, health, restoration, accessibility, management, seasonal changes, biodiversity, local climate mitigation and microclimate, and stormwater management. Specific public open space development strategies within this document that support public health include providing good access to parks and nature for all (quality) and to promote acceptable park standards with enough space for all local inhabitants (quantity).

Key Takeaways

Beginning with the Lindhagen Plan, Stockholm has taken a very practical approach to development of public open

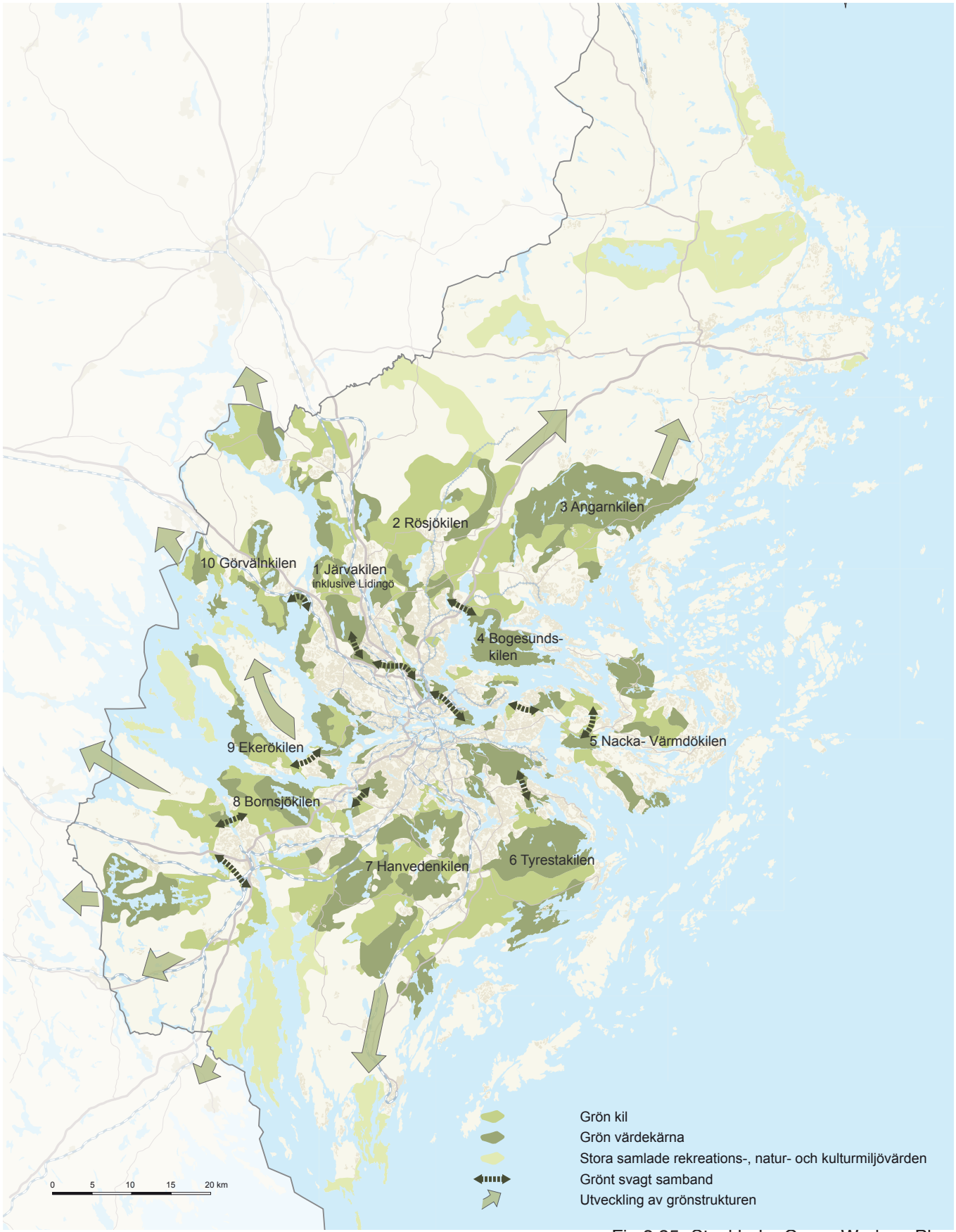

Fig 3.25- Stockholm Green Wedges Plan

space. The open space originated in the hills and mountains as development was too difficult in these areas. Blom expanded on this idea with his Park Network Plan, in which open spaces achieved multiple functions and goals. This holistic view of complex open space networks is still present today and the city is composed of 45% open space from Fig 3.23. This marks the highest percentage of open space from any of the case studies that are part of this project. The Obesity Risk Factor Table, Fig 3.24 shows that Stockholm has low risk for obesity alongside Copenhagen. This illustrated by a highly educated population, extremely low poverty, and zero uninsured. This correlates to an low adult obesity rate of 18.6%, which is second only to Copenhagen.

Lessons Learned from Case Studies

After examining each of the case study cities individually, the tables for Open Space Networks and Obesity Risk Factors are compiled together in Figs 3.25 and 3.26 to allow for comparison.

The Open Space Networks Composite table shows that all of the case study cities started with relatively low open space acreage as a percentage of their overall land area ranging from 3.2%-4.6%. The origination of all of these open space networks occurred between the early and late 1800s, and often was a result of industrialization, overcrowding, sanitation, and new technologies in these cities. As cities have grown, their open space networks have also grown at different rates according to the population demands, open space network development approaches, and individual cultural values of each city. The European cities have the highest percentage of land area composed of open space, followed by New York, Boston, and Los Angeles.

Similarly, the European cities also have the lowest obesity rates as seen in Fig 3.26. They also have two of the highest educational attainment rates, lowest poverty rates, and zero uninsured due to their socialized healthcare. Within the US cities in the table, correlations are harder to discern. Boston has the lowest obesity rate of these three US cities, the lowest uninsured rate of the three, and the second highest amount of open space. Los Angeles has the lowest percentage of land area as open space, the highest population without a High School education, the highest poverty rate, and highest uninsured rate, but is comparable to New York for obesity rate. It is beyond the scope of this project, but further investigation could be undertaken to analyze the connectedness of the open space networks of New York and Los Angeles to determine if the level of connectedness has a correlation to the obesity rate.

Key Lessons to be Applied to New Orleans Design Process

Historically, most of the case study cities took an opportunistic approach to open space development. Recently, there has been a shift to identify need for new open space based on population instead of, “left over land not suited for economic development.” This represents growing value and prioritization of public open space as essential to human health and well being in these cities.

One key lesson that informs the design process of new public open space for New Orleans is the distance that parks are located from where residents live. In Stockholm, this is typically .2 miles. For Boston, their open space plan lists 1/4 to 1/2 mile as a goal. For both New York City and Los Angeles, this distance is set at 1/2 mile. It follows then, that open space in New Orleans should be located somewhere between a 1/4 and not more than 1/2 mile away from residential areas or census tracts.

In the Boston case study, the city defines a park need score by community in 2 stages: socio-economic analysis and access. Los Angeles 50 Park Initiative and NYC Community Parks Initiative also use socio-economic information to identify need. The criteria that are used for Boston which can be transferred to the design process in New Orleans includes: percentage of population under 18, percentage low income, and percentage minority population. For each of these factors, a higher percentage equals greater need.

The New York case study described pocket parks that are less than a quarter acre and infill development as strategies to provide new public open space in a highly densified city where expanding or sprawl is not an option. For New Orleans, this sizing helps to inform how small potential new open spaces can be.

The process that the Olmsted Brothers used in designing the Emerald Necklace plan for LA can be translated to the design process in New Orleans. They inventoried existing parkland and open space, assessed need for new open space, and then made recommendations for where the new open space would be located. Then they connected the existing and newly created open spaces using a network of parkways. Also contained in the LA case study was the components that helped to constitute the LA Health Atlas. These metrics are similar to the Boston park need score criteria and include: demographics, social factors, economics, and the impact of the environment on health. These are broad categories, but are still applicable to New Orleans.

In the Copenhagen and Stockholm case studies, both aimed to concentrate development either along fingers or in nodes to allow for more open space in the city. These approaches focus primarily on spatial configurations and economic development rather than using demographics to drive location. These cities focused on complex layered uses within a given open space to provide multiple functions to the residents and ecosystems in those areas. Additionally, Stockholm's open space developed from mountainous areas that were difficult to develop. Translated to New Orleans, this means that low-lying areas that are likely to flood again could be priority areas for new public open space. Finally, Stockholm's location as a city surrounded by water has influenced it to develop open space along the water as well as view water as another kind of open space. After potential sites for open space are identified in New Orleans, these concepts would help to make connections between sites using waterways as another linear element.

City	Boston	New York City	Los Angeles
Year Open Space Network Began	1875	1811	1889
Population in Founding Year	250,526	96,373	50,000
Population Density in Founding Year	10.4 people/acre	6.6 people/acre (53.5/acre S. Man)	2.8 people/acre
Land Area in Founding Year	24,000 acres	14,600 acres (most in 1,800 ac)	17,920 acres
Open Space as a % of Land Area Founding Year	4.58%	3.22%	3.62%
Size of Original Open Space Network	1,100 acres	470 acres	649 acres
Current Size of Open Space Network	4,956 acres	39,615 acres	38,822 acres
City Land Area (2016)	30,897 acres	193,692 acres	299,949 acres
Current Open Space as a % of Land Area	16.04%	20.45%	12.94%
Current Population (2016)	667,137	8,550,405	3,928,864
Current Population Density	21.6 people/acre	42.2 people/acre	13.1 people/acre

Fig 3.26- Complied Open Space Networks Table

City	Boston	New York City	Los Angeles
Current Population	667,137	8,550,405	3,928,864
Demographics:	47% White 22.4% Black 17.5% Latino 8.9% Asian 4.2% other	44.6% White 27.5% Latino 25.1% Black 11.8% Asian	48.5% Latino 28.7% White 11.3% Asian 9.6% Black 1.9% Other
Average Education Level	20.2% less than H.S. 30.3% College Degree 25.6% Grad Degree	19.7% less than H.S. 35.7% College Degree	24.53% less than H.S. 27.1% College Degree
% of Residents in Poverty	21.6%	20.6%	26.9%
Children Under 18 as % of Population	23%	30.7%	22%
% of People Without Health Insurance	3.8%	13.9%	21.2%
% of Population that's Obese	21.7% Adults 13.8% High School	24.7% Adults 11.8% Youth	24.7% Adults 23% Children

Fig 3.27- Complied Risk Factors Obesity Table

Copenhagen	Stockholm
1850	1870
140,000	90,000
188.93 people/ acre	86.1 people/acre
741 acres	1,045 acres
4.04%	4.21%
30 acres	44 acres
6,143 acres	21,000 acres
21,712 acres	46,720 acres
28.29%	44.94%
763,908	910,000
28 people/acre	20.3 people/acre

Copenhagen	Stockholm
763,908	910,000
76% Danish 24% Immigrant (Pakistan, Morocco, Poland, Germany, etc.)	73% Swedish 27% Immigrant (Finland, Iraq, Iran, Poland, Turkey, Somalia, etc.)
20% Basic School 33% College Degree	13% less than H.S. 34% College Degree
5.4%	7%
29.5%	21.5%
0%	0%
18.2% Adults 15% 11-15 yr olds	18.6% Adults 5.9% Youth <9

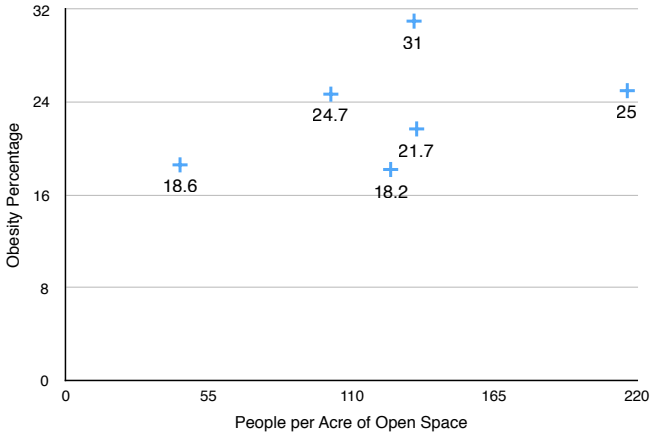

Fig 3.28- Comparison of Obesity Rates to Number of People per Acre of Open Space

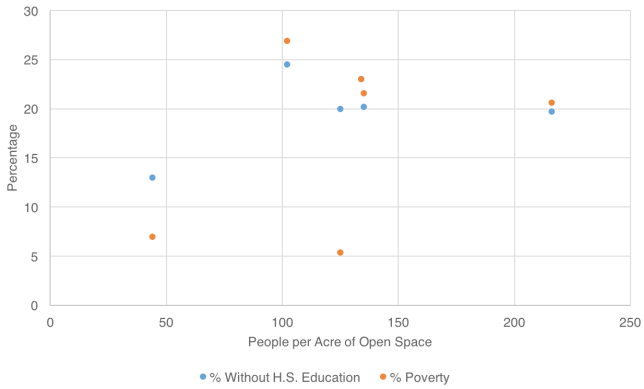

Fig 3.29- Comparison of Educational Attainment and Poverty to Number of People per Acre of Open Space

Chapter Summary

Important takeaways from these five case studies that can be applied to the design of the open space network of New Orleans or future projects include:

Los Angeles' 2013 Health Atlas - spatial locations of communities with different health problems allows for easy targeting.

Almost all of the case studies designed open space networks to be multifunctional and address multiple issues ranging from air quality to sanitation to recreation to circulation, and preserving nature.

The concentration of development either along fingers and rings, or valleys within Stockholm and Copenhagen, allowed for a much greater amount of land area to be dedicated to the open space network.

Infill development of open space and the development of small or pocket parks is a strategy used in multiple cities to address communities that are defined as having the most need of parks.

Boston, New York, and Stockholm have laid out park access goals in walking distances ranging from 5-10 minutes (1/4 to 1/2 mile) for all citizens.

Boston's definition of needs analysis has key metrics (low income, minority, population under 18) that can be utilized for the identification of communities at-risk for obesity in New Orleans.

In the next chapter, New Orleans will be evaluated using the same metrics developed for these case studies to establish what exists as a baseline condition for the city. Next, the design process for the expansion of New Orlean's Open Space Network will be completed, which includes using GIS spatial analysis to help determine priority sites to address communities most at-risk of obesity. Finally, this process will be evaluated using the same metrics to determine how the open space network changed and the population that is potentially impacted by the new open space.

Prescriptive Case Study: Applying Prioritization Process to New Orleans Open Space Network

New Orleans as Prescriptive Case Study

Key lessons from the case study projects informed the prioritization of new open space sites in New Orleans, including design process, definitions of risk, and proximity or access distances. I applied the same evaluative tool to New Orleans before beginning the prioritization process in order to establish a baseline condition. After the analysis was completed, key metrics were re-evaluated in order to see how the network has changed as a result of the design.

New Orleans Baseline

Project Background and Evolution

New Orleans spent roughly 100 years evolving from a French colonial outpost into the metropolis it became in the 19th century. In 1850, Baroness Pontalba led a citizen's effort to convert an old drill field into a garden that was raised above the adjacent flooded streets. This garden became what is today known as Jackson Square. A few years later, around 100 acres of land was donated to the city and it became the southern portion of City Park. Most of the early development and expansion of the city and its open space began from the old city and French Quarter, as these were the higher elevation areas within the city (Fig 4.1). Much of the land on the south shore of Lake Ponchartrain was swamp and as such, was not developed until the 20th century. Like many of the case studies, early park development in New Orleans was opportunistic. There were many citizen-led initiatives within the city that led to the development of public open space, streets, and avenues in an ad hoc fashion. In the middle 1880s, the Cotton Centennial Expo led to the development of Audubon Park, later designed by the Olmsted Brothers. The Parkway commission began around 1900 and was responsible for both the parks and neutral grounds (open canals and medians). In the 1930s, the Works Progress Administration (WPA) completed many projects in the city's parks, including roads, bridges, shelters, Audubon Zoo, and renovations to the French Market. During the 1970s, Louis Armstrong Park was added to the network and open space along the riverfront was developed, which included the Moon Walk (across from Jackson Square) and later, Woldenberg Park.

Current Open Space Approach/ Development Model

In 2008, the design and opening of Crescent Park continued the trend of riverfront open space development that began with the Moon Walk. In 2014, ULI completed Enhancing Open Space in Downtown New Orleans, a plan examining how different parks and open spaces could be connected via greenways (ULI 2014). The Lafitte Greenway project was completed in 2015 and extends 2.6 miles from Louis Armstrong Park to Bayou St. John, enabling pedestrians and cyclists to move along this linear park.

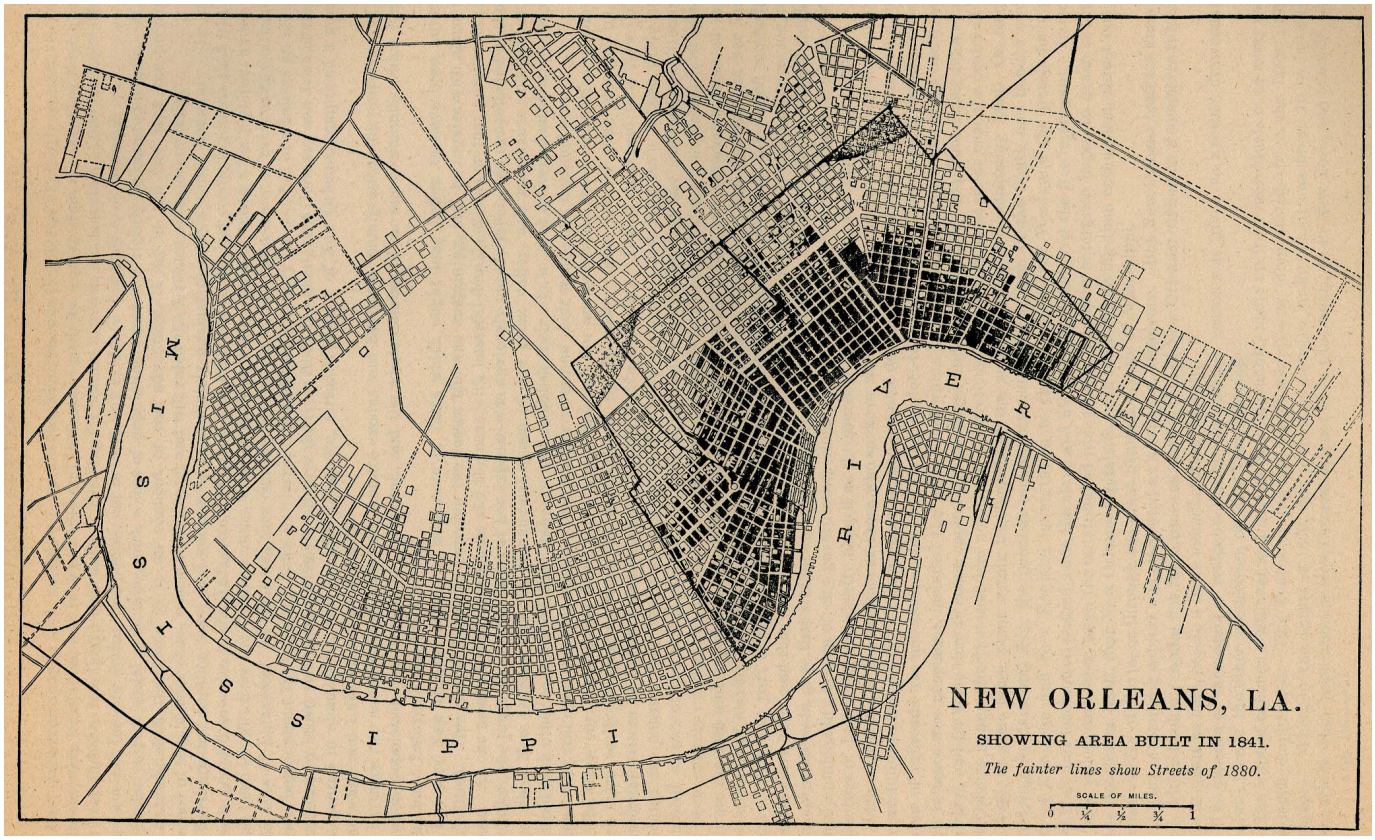

Fig 4.1 - 1849 New Orleans City Plan

Due to its location in the Mississippi River Delta, the city is particularly prone to flooding, hurricanes, and vulnerable to the effects of sea level rise from climate change. The city is using these issues as an opportunity to build green infrastructure and landscape designs that embrace water's role in their city. (Resilient New Orleans Strategy 2015) The city has worked with leaders and innovators from Rotterdam in order to learn how to plan and implement flexible water infrastructure into its open space planning. Additionally, in the New Orleans 2030 Masterplan, the city lays out its goals of: protecting remaining wetlands, no net loss of public parkland, a park within approximately 1/3 mile of every resident, more public access to waterfronts, and more green connections throughout the city (New Orleans 2030). The city also is promoting urban agriculture and community gardening both on public and private properties.

Despite all these advancements and progressive views on developing public open space, the city lacks a parks and recreation department to oversee, plan, and manage these spaces. Planning and management is currently split amongst the Parks and Parkways Department, the New Orleans Recreation Development Commission, and other nonprofit and state entities. As a result, there are scattered visioning and planning documents but not an overarching parks masterplan or integrated vision for New Orleans.

City	Boston	New York City	Los Angeles
Current Population	667,137	8,550,405	3,928,864
Demographics:	47% White 22.4% Black 17.5% Latino 8.9% Asian 4.2% other	44.6% White 27.5% Latino 25.1% Black 11.8% Asian	48.5% Latino 28.7% White 11.3% Asian 9.6% Black 1.9% Other
Average Education Level	20.2% less than H.S. 30.3% College Degree 25.6% Grad Degree	19.7% less than H.S. 35.7% College Degree	24.53% less than H.S. 27.1% College Degree
% of Residents in Poverty	21.6%	20.6%	26.9%
Children Under 18 as % of Population	23%	30.7%	22%
% of People Without Health Insurance	3.8%	13.9%	21.2%
% of Population that's Obese	21.7% Adults 13.8% High School	25% Adults 11.8% Youth	24.7% Adults 23% Children

Fig 4.2 - New Orleans in Comparative Table for Obesity Risk Factors

City	Boston	New York City	Los Angeles
Year Open Space Network Began	1875	1811	1889
Population in Founding Year	250,526	96,373	50,000
Population Density in Founding Year	10.4 people/acre	6.6 people/acre (53.5/acre S. Man)	2.8 people/acre
Land Area in Founding Year	24,000 acres	14,600 acres (most in 1,800 ac)	17,920 acres
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City Land Area (2016)	30,897 acres	193,692 acres	299,949 acres
Current Open Space as a % of Land Area	16.04%	20.45%	12.94%
Current Population (2016)	667,137	8,550,405	3,928,864
Current Population Density	21.6 people/acre	42.2 people/acre	13.1 people/acre
Persons / acre of open space (founding year)	228	205	78
Persons / acre of open space (2016)	135	216	102

Fig 4.3 - New Orleans in Comparative Table for Open Space Networks

Copenhagen	Stockholm	New Orleans
763,908	910,000	389,617
76% Danish 24% Immigrant (Pakistan, Morocco, Poland, Germany, etc.)	73% Swedish 27% Immigrant (Finland, Iraq, Iran, Poland, Turkey, Somalia, etc.)	58.5% Black 31.3% White 5.6% Hispanic 3.1% Asian
20% Basic School 33% College Degree	13% less than H.S. 34% College Degree	14% less than H.S. 35% College Degree
5.4%	7%	23%
29.5%	21.5%	20.3%
0%	0%	18.9%
18.2% Adults 15% 11-15 yr olds	18.6% Adults 5.9% Youth <9	31% Adults 16.7% H.S. Youth

Copenhagen	Stockholm	New Orleans
1850	1870	1850
140,000	90,000	116,375
188.93 people/ acre	86.1 people/acre	25.8 people/acre
741 acres	1,045 acres	4500 acres
4.04%	4.21%	2.3 %
30 acres	44 acres	103.5 acres
6,143 acres	21,000 acres	2,915 acres
21,712 acres	46,720 acres	108,431 acres
28.29%	44.94%	2.69%
763,908	910,000	389,617
28 people/acre	20.3 people/acre	3.59 people/acre
4,667	2,046	1,125
125	44	134

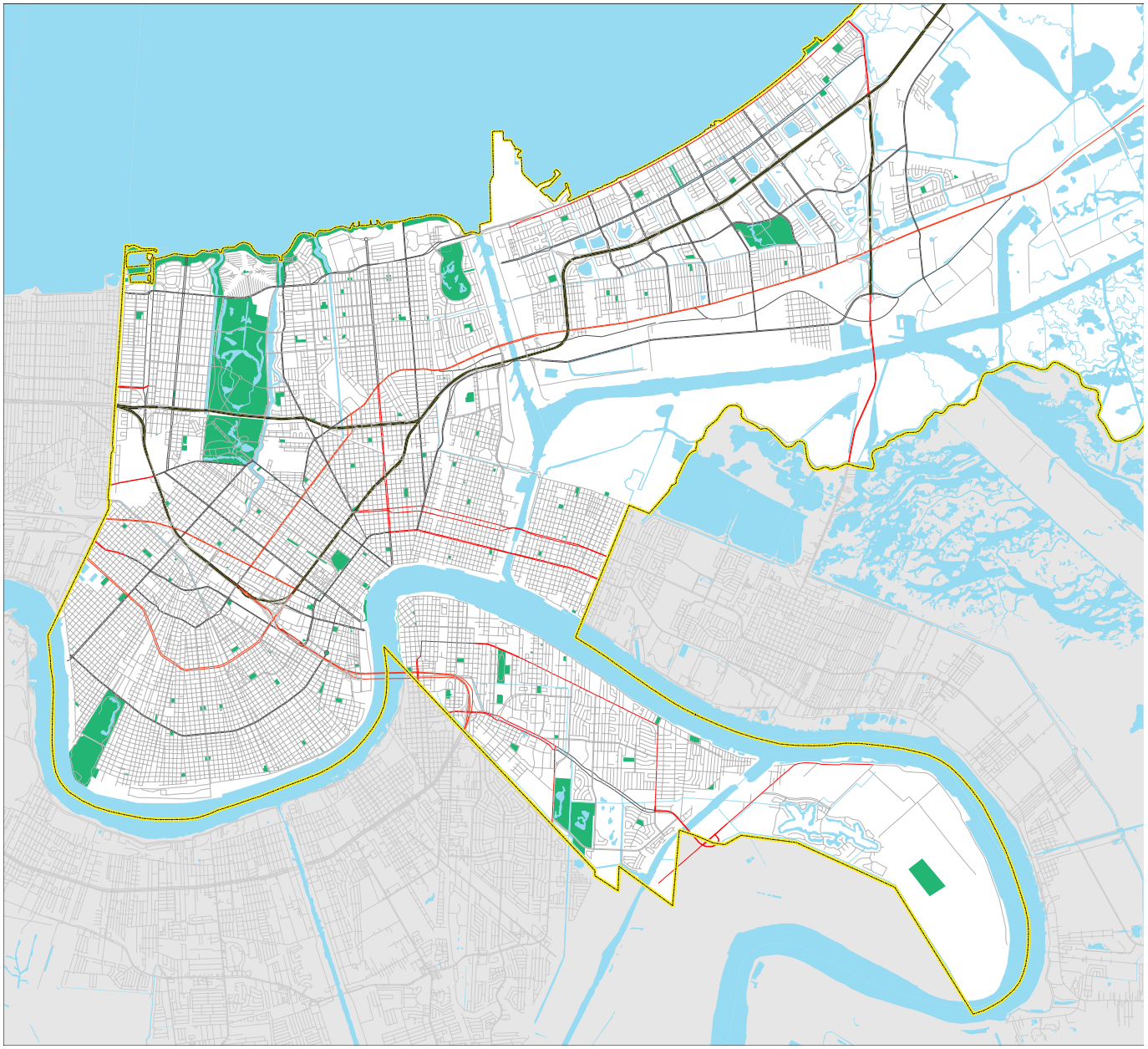

Fig 4.4 - 2016 New Orleans Open Space Plan

Key Takeaways

When comparing New Orleans to the other Case Study cities in Fig. 4.3, it has one of the lowest open space percentages, along with one of the lowest population densities. This would suggest that density could increase in the city moving forward and that the percentage of open space could be increased through reclaiming lands for public open space (Fig 4.4). The city is attempting many innovative approaches to dealing with public open space, and addressing obesity with open space would add another option to the city's toolbox. Of the case study cities, New Orleans has the highest percentage of African Americans, the second highest percentage of poverty and people without health insurance after Los Angeles, and the highest poverty rate (Fig 4.2). These statistics equate to a very high obesity risk for New Orleans residents. The correlating obesity rate for a low amount of open space is 16.7%

New Orleans Statistical Average		GIS Analysis Threshold Metric
Ethnicity 58.5% African American, 5.6% Hispanic, 3% Asian, 1% other, 31.3% Caucasian	→	Over 50% African American + Hispanic population in census tract
Children Under 18 79,432 of 389,617 = 20.3% of total population	=	20.3% of census tract population is children under 18
Poverty/Income 23% of adults and 37% of children in poverty	=	23% of census tract population with poverty status in past 12 months
Educational Attainment 14% of adults do not have High school diploma	=	14% of census tract population over 18 w/no High school diploma
Health Insurance 18.9% of population without health insurance	=	18.9% of census tract population without health insurance

Fig 4.5 - New Orleans Socio-economic Thresholds

of high school youth and 31% of adults (New Orleans Community Health Improvement Plan 2015) which lies between 13th and 17th worst for obesity rates when compared to US states. The state of Louisiana as a whole has a 36.2% obesity rate, the worst in the US.

Introduction to Prioritization Process

This project uses New Orleans, Louisiana to develop and test a prioritization process to provide an expansion to the park network in areas where citizens are most at risk of obesity. The process described on page 19 contains four steps: inventory the existing network; identify the communities most at risk of obesity; identify land available for open space development; and determine need/prioritization. This process is informed by the Los Angeles case study and the work of the Olmsted Brothers on the Los Angeles Emerald Necklace Plan. Maps are produced and results given for each of the intermediate steps within the prioritization to enable cities to evaluate how fine of grain or how broad of an approach they would like to take in addressing new public open space development.

Risk Factors for Obesity

The best data to assess the need for open space to combat obesity in a city would be spatially explicit obesity rates, at the unit of a block or neighborhood scale. Lacking that data for New Orleans, this project uses available socioeconomic data to evaluate census tracts for risk factors commonly associated with obesity. This socioeconomic

data is readily available from the City of New Orleans and the US Census Bureau.

Research completed by Flegal et al (2016) and Price et al (2013) in evaluating socioeconomic characteristics of obese populations provides the criteria/risk factors that this project uses in analyzing the city of New Orleans for populations that are most at-risk of being obese. These risk factors include: ethnicity, income levels, percentage of population consisting of children under 18, educational attainment of adults, and not having health insurance. The risk factors show that educational attainment, low income or poverty status, and lack of health insurance disproportionately affect African American or Hispanic communities when compared to caucasian communities. Parents with low educational attainment are unlikely to make much money. Low incomes mean these parents are likely unable to afford living in communities with open space amenities, unable to afford health insurance, and unable to purchase nutritious food for their families. Children that are obese are also much more likely to become obese adults. Metrics for the park need score from the Boston Case study (population under 18, percentage low income, percentage minority population) and similar metrics from the Los Angeles case study contained in LA Heath Atlas confirmed that these were appropriate risk factors for this project.

Each risk factor for obesity was assessed individually, using thresholds identified in Fig 4.5. If the population of census tracts was above the threshold listed, it was determined to be at risk for that metric. Conversely, if the population of the census tracts were below the threshold, it was determined to not be at risk. For this project, these thresholds correspond to averages for the City of New Orleans. Unique numerical values were given to each risk factor, so that when the individual maps were combined, a census tract could be analyzed to determine exactly which of the risk factor thresholds it met compared to simply knowing it met two or four of the risk factors.

Most of the statistical averages in Fig. 4.5 were obtained from The Data Center (datacenterreserach.org) and the NOLA Community Health Report (2015). Ethnicity is the one metric that was not derived from New Orleans statistical averages (64.1%). For this threshold, tracts over 50% of the population that were African American or Hispanic would be able to function as a threshold both now and moving forward in similar projects. In 2014, 38% of the US population was of a minority ethnicity and that number is expected to reach 56% by 2060. (Wazwaz 2014) Using 38% for New Orleans would be too low of a threshold and the majority of tracts would meet the risk factor. The 50% threshold is just above the median of these two values and is used for the risk factor.

The thresholds used for this project are a starting point, and as the park network grows or city using this design process changes, the thresholds can be shifted by designers to edit what defines risk and address local priorities.

City of New Orleans Open Data	Census Bureau TIGER/Line Shapefiles	New Orleans Regional Planning Council	American Community Survey Tables 2015 (5 yr Estimates)	Atlas GOHSEP
-Bike Lanes -Parks -Lafitte Greenway Project -Addresses -Parcels -Edge of Pavement -Centerline of Roads -Zoning -NORA Uncommitted Property Inventory -BlightStatus Demolitions -Neighborhood Statistical Areas	-NOLA Boundary -Water Areas -Linear Water Areas -	-NOLA 2010 Census Tracts -NOLA 2010 Census Block Groups -NOLA 2010 Census Blocks	-Educational Attainment -Poverty Status in the past 12 months -Selected Characteristics of Health Insurance Coverage -Population Under 18 years by Age -Household size by Vehicles Available	-High Resolution Aerial Ortho-Photography of New Orleans -DEM Models of New Orleans

Fig 4.6 - Data Collection Sources and Information from each

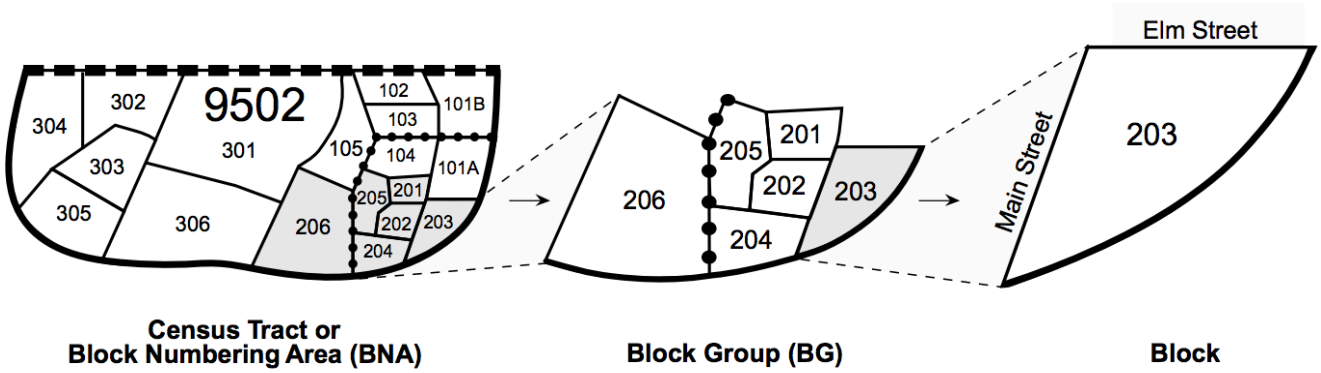

Fig 4.7 - Grain of different census data

Data Collection

The Geographic Information Systems (GIS) datasets for this project were primarily retrieved from the city of New Orleans database, data.nola.gov, and Federal 2010 census data that includes: Tiger shapefiles, census tract, census block groups, and census block datasets. Additionally, American Community Survey (2015, 5 year estimates) tables were used for specific socio-economic data that pertains to the At-Risk Communities portion of the analysis. These tables serve as a replacement for the long form census last completed in 2000. The specific datasets, tables and information gathered from each source is outlined in Fig 4.6.

All of the information that was collected for use in this project is contained within Orleans Parish (Louisiana equivalent of county), which shares an identical geographical boundary with the City of New Orleans.

Since the American Community Survey tables are only available at the grain of Census Tracts, I worked at that level of detail rather than the finer grain block group or block scale. Census blocks are the smallest level of detail, followed by block groups and tracts as seen in Fig 4.7 above. The US Census Bureau defines a census tract as

Fig 4.8 - Sorting Residential Zoning Districts

a geographically contiguous area with, “an approximate population between 1,200 and 8,000 people, with an optimal size of 4,000 people.” (US Census Bureau 2012) Within the city of New Orleans, there are different 177 census tracts with populations ranging from 81 to 6,808. If American Community Survey tables become available at the block or block group scale in the future, this would allow for greater precision within the process.

For the results of this project to be useful for both the City of New Orleans and broadly understandable to residents there, the census tract information is overlaid with Neighborhood Statistical Areas to describe findings. Neighborhood Statistical Areas developed from neighborhood designations from New Orleans City Planning in 2001 and have been adapted over time by The Data Center in their attempts to communicate information about New Orleans neighborhoods. The Data Center is a New Orleans and southeastern Louisiana non-profit that has been providing collecting and disseminating data about the region for the past 20 years with the goals of, “building prosperous, inclusive, and sustainable communities by making informed decisions possible.” (Data Center 2017)

After describing the overall GIS process, how thresholds for Obesity risk factors were arrived at, and examining how data were collected and the granular level at which this project is being completed at, one can move into the process of GIS Analysis and examining the different maps that result from this portion of the project.

Prioritization Process: 4 Steps

1.) Mapping Existing Open Space Network of New Orleans

New Orleans contains 2,962 acres of public open space ranging from City park at 1,134 acres to Franklin Triangle Park at 420 square feet. For this portion of the analysis, I examined the relationship of open space to population density, different concentrations of residential zoning, and neighborhoods to gain an understanding of where open space exists in relation to concentrations of the city’s population. This helps to determine whether what exists is evenly distributed and whether areas of higher population density have access to larger open spaces.

To analyze zoning density, (low, medium, high density, and mixed used zoning areas) I grouped zoning classifications from the New Orleans Comprehensive Zoning Ordinance. (CZO) The grouping and description of what composes the low, medium, high density, and

mixed use zoning areas are illustrated in Fig. 4.8. This exercise was undertaken quickly and only the descriptive names of the districts were used to help sort the different areas into residential groupings. It is understood that there are conditional uses and different permitted uses within each zoning type, but it is beyond the scope of this project and analysis to dive deeper into the intricacies of the zoning ordinance. In lieu of this approach in the future, if a Land Use/Land Cover dataset were available, that could be substituted for the Residential Zoning. These residential zoning areas were then overlaid with the New Orleans parks layer, Lafitte Greenway, Bike Lanes, and Edge of pavement information.

The resulting map (Fig. 4.9) illustrates that most of the high density housing is located in the core of the city and along freeways moving outwards and away from the city center. Additionally, most of the mixed use areas are also located in the urban core, along with medium density residential. Low density residential is located along City Park, Lake Ponchartrain, and the outskirts of the city. It also appears from this map that an existing network of bike lanes is fairly prevalent within the city, and could be a starting point for expanding and connecting an open space network.

The maps for population density (Fig. 4.10) and Neighborhoods & Existing Open Space (Fig. 4.11) helped me to characterize and build an understanding of different parts of the city. The areas of highest population density for New Orleans are approximately 19.8 people/acre and the average of these census tracts was 7.7 people/acre. These maps also allowed me to review the distribution of open space within neighborhoods and within different population densities. There are some areas where density is lower than other areas of the same zoning. These may indicate areas of future need, as there is capacity to increase density. Conversely, areas of higher density in the same zoning category may indicate current need. After developing these maps to aid in understanding the existing network of open space and its relationship to residential areas, the next step in the process is to identify communities that are most at-risk of obesity.

Map Of Existing Open Space and Residential Zoning

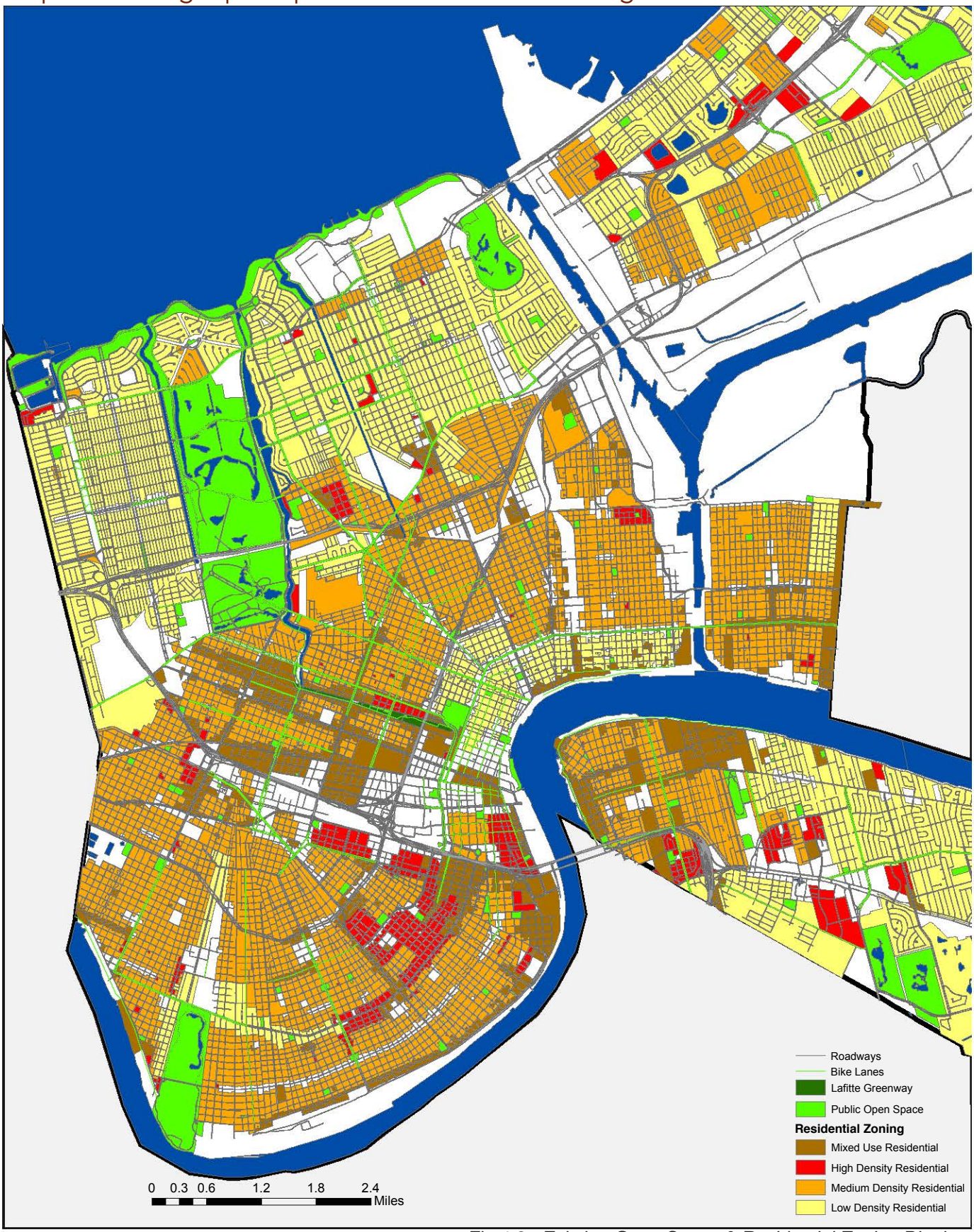

Fig 4.9 - Existing Open Space & Residential Zoning Districts

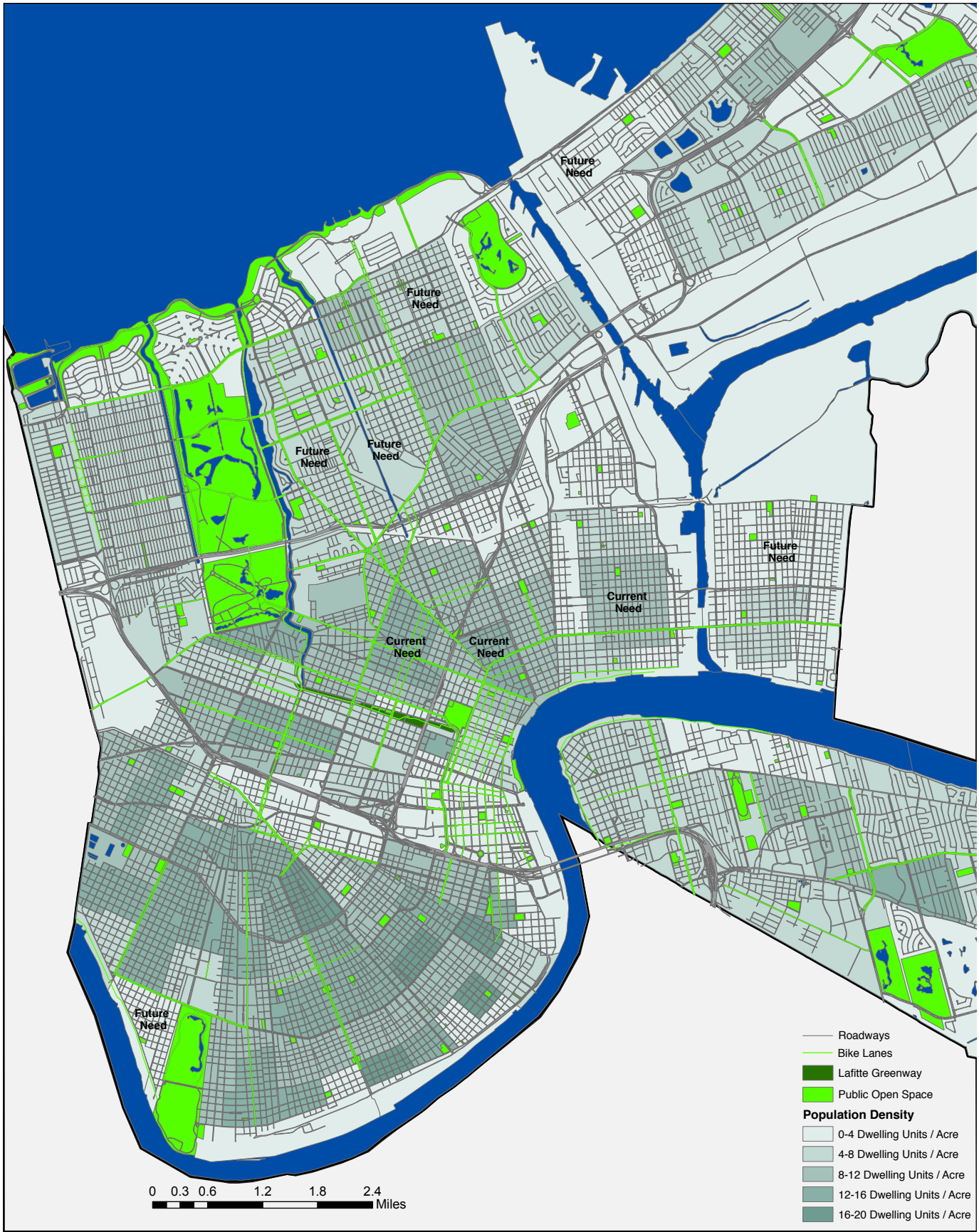

Fig 4.10 - Open Space & Population Density

Map Of Existing Open Space and Neighborhoods

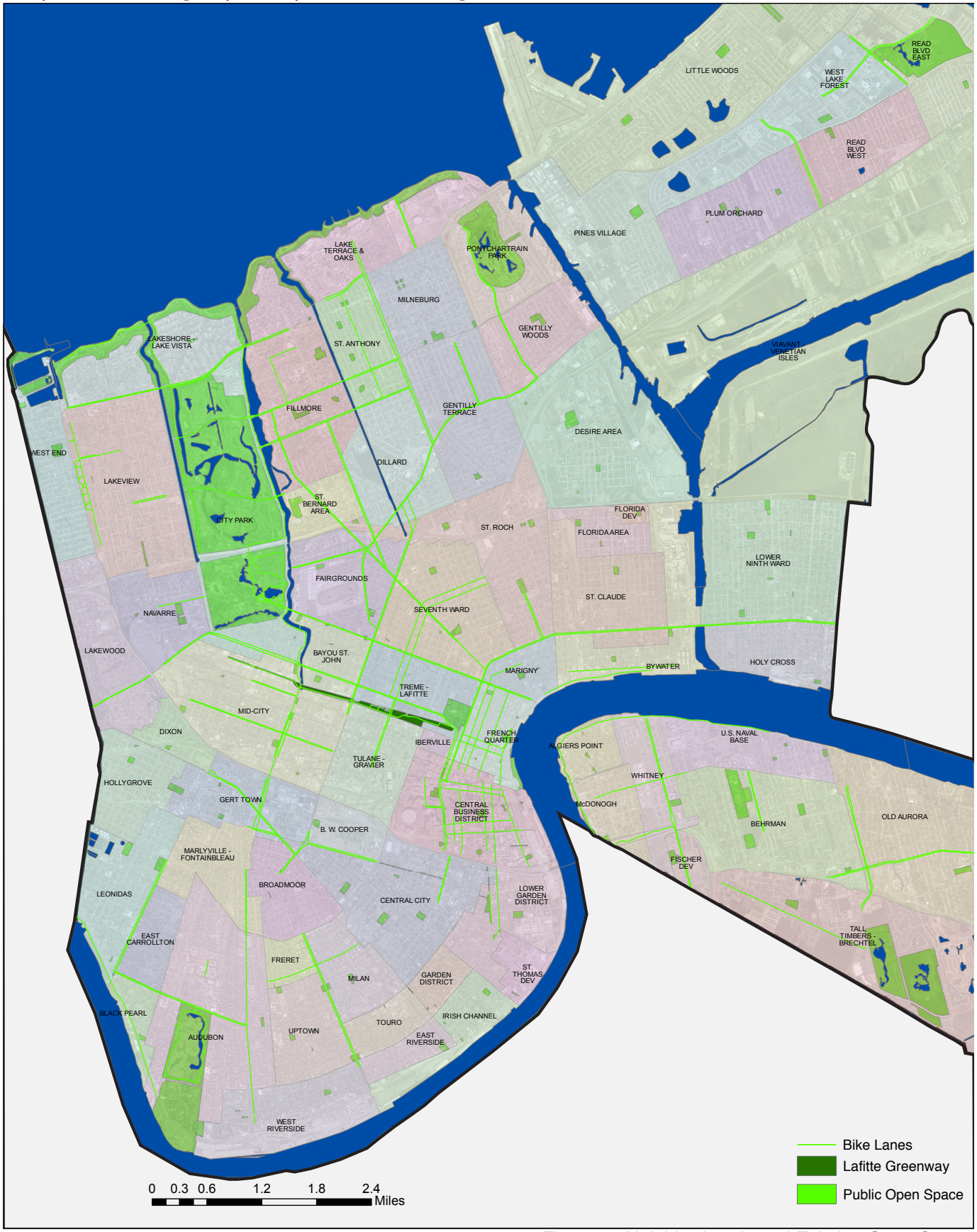

Fig 4.11 - Neighborhoods and Existing Open Space

GIS Analysis Threshold Metric

Ethnicity
Over 50% African American + Hispanic population in census tract

Children Under 18
20.3% of census tract population is children under 18

Poverty/Income
23% of census tract population with poverty status in past 12 months

Educational Attainment
14% of census tract population over 18 w/no High school diploma

Health Insurance
18.9% of census tract population without health insurance

Fig 4.12- Obesity Risk Factor Thresholds

2.) Identifying Communities At-Risk for Obesity in New Orleans

To identify communities that are most at-risk for obesity, I used 2010 Census tract information and 2015 American Community Survey Tables (5 yr estimates.) American Community Survey Tables were simplified and only high-level information was used in the creation of the risk factor maps in this section. Within each table, there is much more detailed information pertaining to populations in poverty, education levels, health insurance, etc. that could be used in future designs. The process for setting thresholds for these maps is discussed in the Risk Factors for Obesity section of this chapter. The thresholds that were used in this section are listed in Fig 4.12. The following sections explain how each risk factor map was created, illustrated with the maps themselves, and a provides a composite map of New Orleans that overlays all of the risk factor maps. This composite map illustrates where Census Tracts which meet the most risk factors are located.

2.1.) Ethnicity

This binary map identifies any census tract where the combined African American and Hispanic population is greater than 50% of the total tract population (Fig 4.12). To create this map, 2010 Census tracts were selected where the Hispanic plus African American population divided by the total population estimate was greater than or equal to 50%. These areas are shown in pink on the resulting map in Fig 4.18.

The statistics for the resultant map are seen in Fig 4.13. This map illustrates that these selected census tracts are distributed

Ethnicity Evaluation Summary- >50%

Number of Census Tracts	**121/177**
Average percentage of Black + Hispanic as % of total population	**84.9%**
Highest percentage of selected census tracts	**100%**
Population of selected Census Tracts	**252,287**
Percentage of Total Population	**64.75%**
Acreage of Census Tracts	**93,822**

Fig 4.13 -Ethnicity Summary

throughout the city and that many of the public open space areas and bike lanes fall within these census tracts. One concentration of the tracts is between the Bayou St. John and the Inner Navigation Canal. Another is northwest of the French Quarter, Central Business District, Garden Districts, Uptown, and Audubon Park. The areas to the northeast of the Inner Navigation Canal all also met this risk-factor threshold. The census tracts meeting the ethnicity risk factor tend to be in elevations that are below sea level within the city, putting these areas at additional risk of flooding. Site-scale park designs in these tracts could include flood mitigation as a goal, as part of a green infrastructure network.

2.2.) Children under 18

This map locates any census tract where children under 18 make up greater than 20.3% of the total population (Fig 4.12). To create this map, the 2010 Census Tract information for New Orleans was joined with the American Community Survey table for Population under 18. The total population under 18 was divided by the total population for each census tract to arrive at the percentage of the total population that was under 18. Census Tracts were then selected where this percentage was greater than or equal to 20.3%. These areas are shown in pink on the resulting map in Fig 4.19 and the statistics for this map are contained in Fig 4.14.

The census tracts meeting this metric are more dispersed than racial demographics across the city, but again the entirety of the Northeast portion of the city that lies east

Children Under 18 Evaluation Summary- >20.3% of population

Number of Census Tracts	**86/177**
Average percentage of census tracts meeting criteria	**26.5%**
Highest percentage of selected census tracts	**53%**
Population of Census Tracts	**212,134**
Percentage of Total Population	**54.4%**
Acreage of selected census tracts	**82,998 acres**

Fig 4.14 -Children Under 18 Summary

of the Inner Navigation Canal and a large part of Algiers, the southeastern part of the city across the Mississippi from the French Quarter meet the metric. Tracts that border City Park, Ponchartrain Park, and Audobon Park all meet the criteria, which suggests that children under 18 in these areas are in close proximity to a large park.

2.3.) Population in poverty last 12 months

This map locates any census tract where greater than 23% of the population was determined to have Poverty status over the past 12 months (Fig 4.12). This metric uses the Census Bureau's definition of poverty: income thresholds vary based on family size, household composition, and age. If the total income for the household is less than the threshold, the entire population of the household is considered to be in poverty. (US Census Bureau) Additionally, determining what income levels constitute constitute a 'living wage' for New Orleans by evaluating household income in ACS 2015 tables to derive the population living in poverty was not

Poverty Evaluation Summary- >23% of population

Number of Census Tracts	**121/177**
Average percentage of census tracts meeting criteria	**33.9%**
Highest percentage of selected census tracts	**86.7%**
Population of Census Tracts	**257,802**
Percentage of Total Population	**66.2%**
Acreage of selected census tracts	**90,149 acres**

Fig 4.15 -Poverty Summary

allowed by time constraints and was not the primary focus of this project.

To create this map, the 2010 Census block group dataset for New Orleans was joined with the American Community survey table for Poverty Status the past 12 months. The field: Percent below poverty level; Estimate was used to evaluate each census tract. Census Tracts were then selected where this percentage was greater than or equal to 23%. These areas are shown in pink on the resulting map in Fig 4.20 and the statistics for this map are contained in Fig 4.15.

The areas meeting this threshold are distributed throughout all areas of the city, but the resulting pattern again shows large areas northeast of the Inner Navigation Canal wrapping southwest through some of the same low elevation areas in the Minority map and along the west side of the city north to Lake Ponchartrain. Much of Algiers also met the risk factor threshold for Poverty. It is also interesting to note that tracts bordering Audubon Park to the east and north met this risk factor, suggesting that the populations in poverty here have access to one of the city's larger parks.

2.4.) Education level - below HS diploma

This map evaluates census tracts where greater than 14% of the population has an education level of less than a high school diploma (Fig 4.12). The original ACS 2015 tables for Education Attainment contain education levels from simple to complex socio-economic characteristics. In order to make this information useful, I selected and used high-level information for adults ages 18-24 and adults over 25. This included the following: total population 18-24; total population estimate 18-24 less than high school graduate; total population 25 and over; total population estimate 25 and over with less than 9th grade education; and total population 25 and over with 9th-12th grade education but no diploma. This revised ACS 2015 table was joined with 2010 census tract information.

The population over 25 with less than a 9th grade education was combined with the population over 25 with a 9th-12th grade education (no diploma) and divided by the total population to obtain the percentage of population over 25 without a high school diploma. The 18-24 population with less than a high school diploma was divided by the total population to obtain the percentage of population 18-24 without a high school diploma. In order to produce one total estimate for percentage of population with less than a high school diploma, the percentage of the 25 and over population meeting this criteria was averaged together with the percentage of 18-24 population meeting the criteria.

Education Level Evaluation Summary- >14% of population without H.S. diploma

Number of Census Tracts	**94/177**
Average percentage of census tracts meeting criteria	**26.2%**
Highest percentage of selected census tracts	**55.9%**
Population of Census Tracts	**185,724**
Percentage of Total Population	**47.7%**
Acreage of selected census tracts	**73,094 acres**

Fig 4.16 -Educational Attainment Summary

Census tracts were selected where this percentage was over 14% (Fig 4.12). These areas are shown in pink on the resulting map in Fig 4.21 and the statistics for this map are contained in Fig 4.16.

Again, portions of the city northeast of the Inner Navigation Canal and much of the Algiers neighborhood in the southeast had many census tracts which met the criteria. Along the southwest side of the navigation canal, the Ponchartrain Park, Desire Area, Bywater/St. Claude, and Lower Ninth neighborhoods all met this risk factor threshold. Census tracts in the Central City/ Tulane-Gravier/Mid City and many census tracts that are west of South Carrollton Avenue and south of I-10 all met the criteria.

2.5.) No Health Insurance

This map illustrates census tracts where 18.9% or greater of the population lacks health insurance (Fig. 4.12). The ACS 2015 table for Selected Characteristics of Health Insurance Coverage in the US was joined to the 2010 census tract information. The

Insurance Evaluation Summary- >18.9% of population uninsured

Number of Census Tracts	**101/177**
Average percentage of census tracts meeting criteria	**27%**
Highest percentage of selected census tracts	**53.8%**
Population of Census Tracts	**113,206**
Percentage of Total Population	**29%**
Acreage of selected census tracts	**33,214 acres**

Fig 4.17 -Uninsured Summary

estimate of total uninsured population was divided by the total population to gain the percentage of each census tract that lacks health insurance. Census Tracts were selected where this percentage was greater than or equal to 18.9%. These areas are shown in pink on the resulting map in Fig 4.22 and the statistics for this map are contained in Fig 4.17.

This map shows that the pattern of census tracts meeting the uninsured threshold hold some similarity to the other risk factor maps in that the northeastern city, tracts along the Inner Navigation Canal, and Algiers all contain tracts meeting this criteria. Unlike the other maps, census tracts throughout the center of the city including parts of the French Quarter, Garden District, Audubon, and neighborhoods surrounding City Park all meet the criteria. One explanation for this is that young adults (18-35) tend to be healthier and often are not making enough to afford health insurance. Many, but not all tracts meeting the poverty threshold also met the uninsured threshold as a person in poverty is unlikely to be able to afford health insurance.

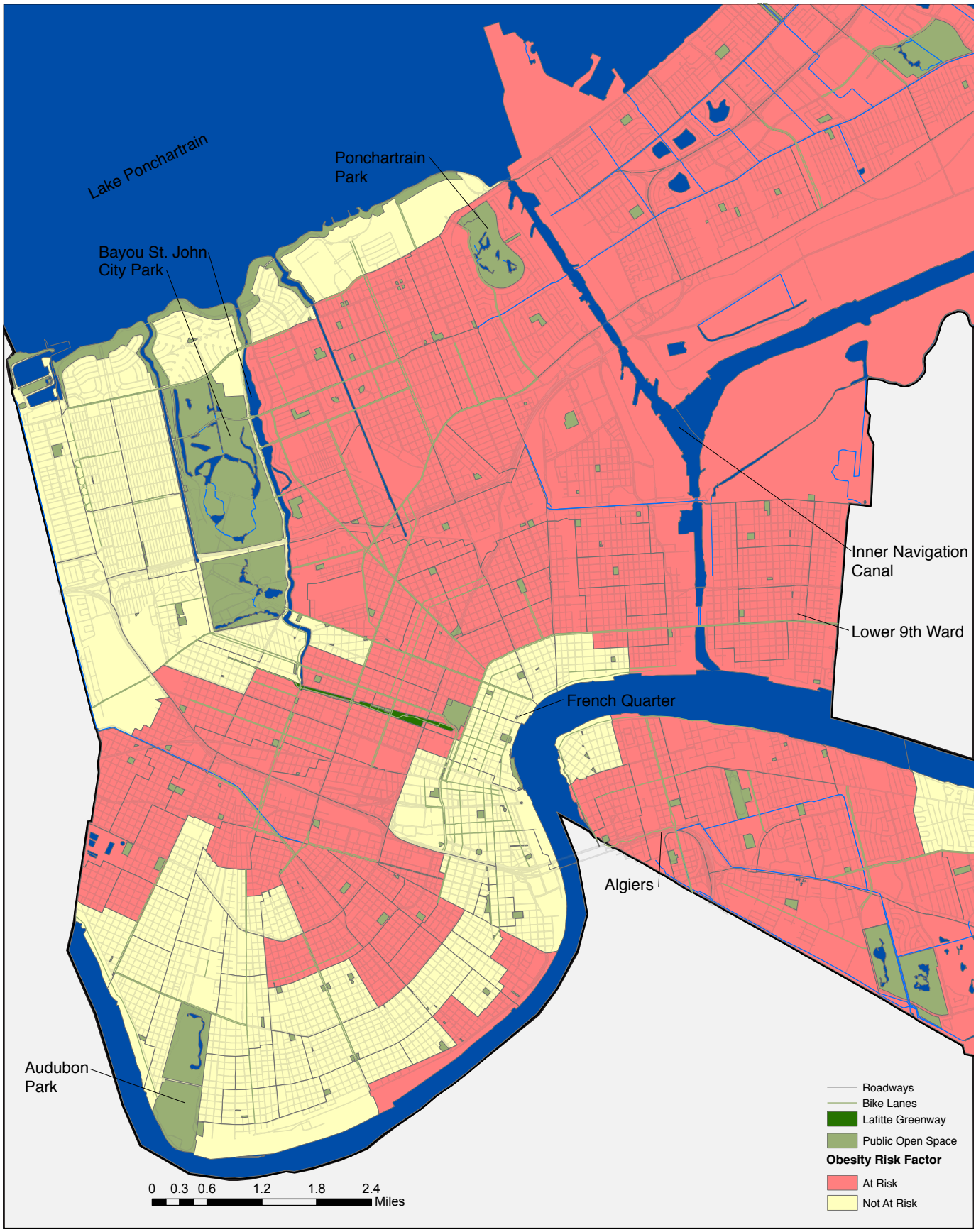

Fig 4.18 - Ethnicity Risk Factor Map

Risk Factor Map: Population Under 18 >20.3% of Total Population

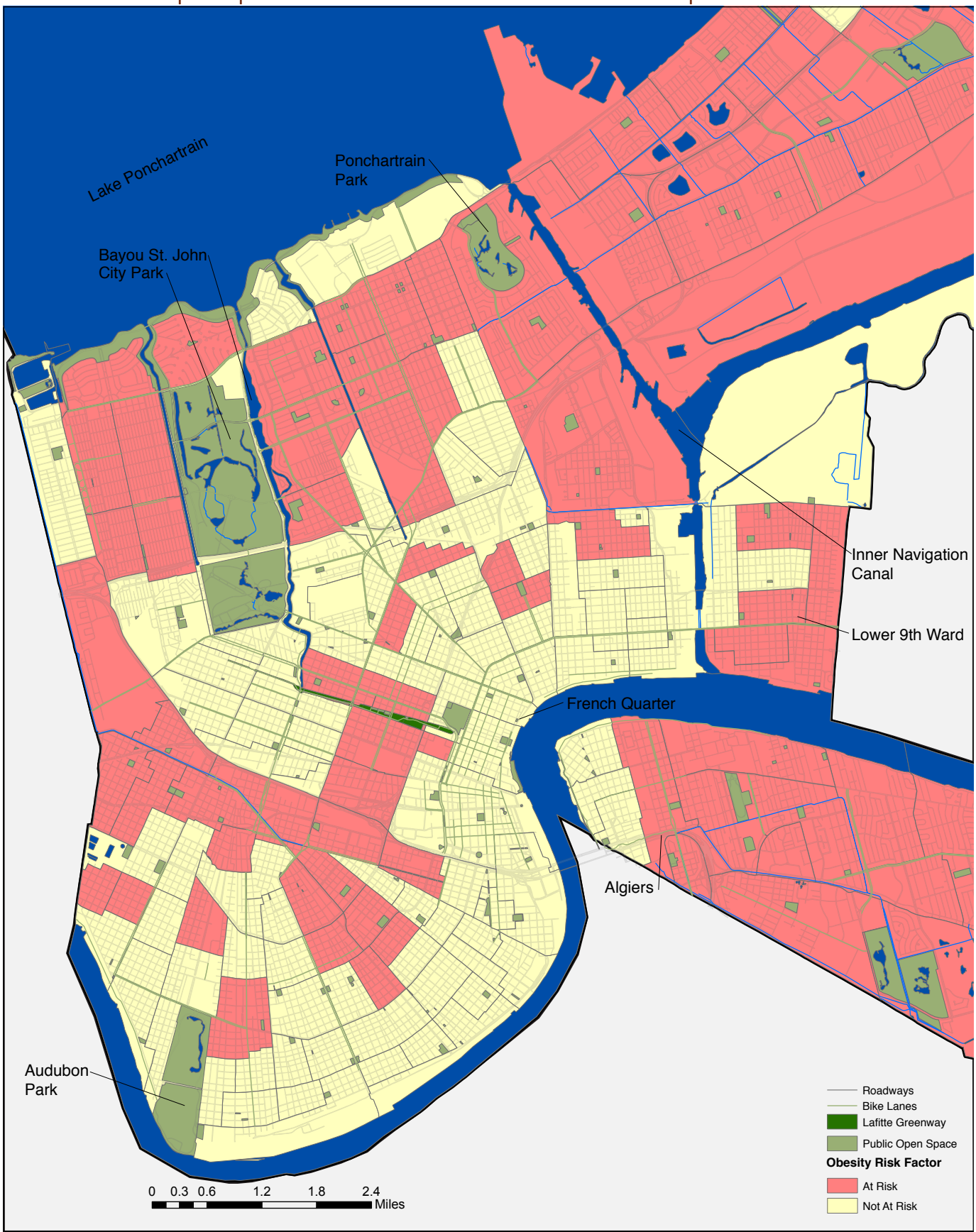

Fig 4.19 - Children under 18 Risk Factor Map

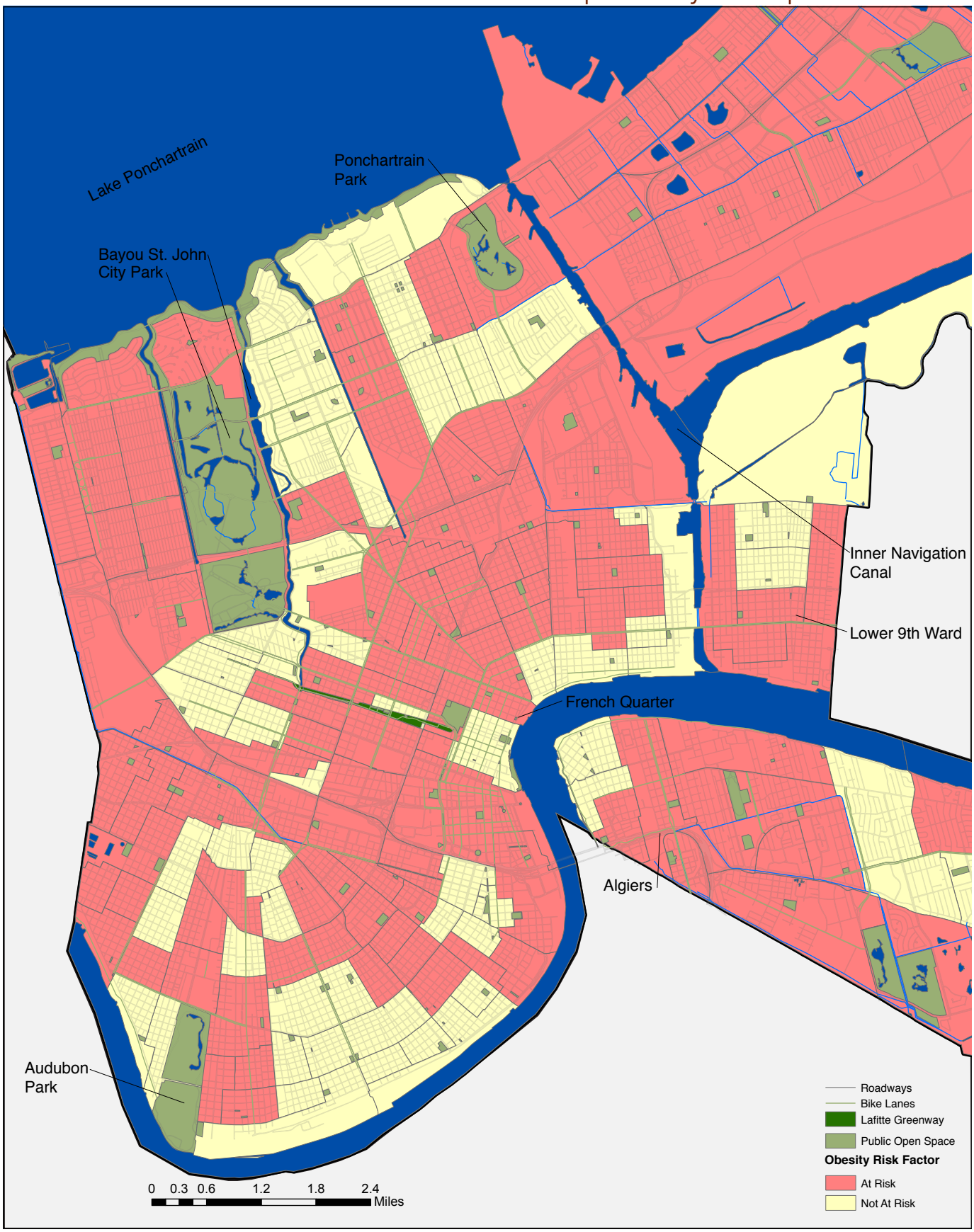

Fig 4.20 - Poverty Risk Factor Map

Risk Factor Map: >14% of Population with Less than High School Diploma

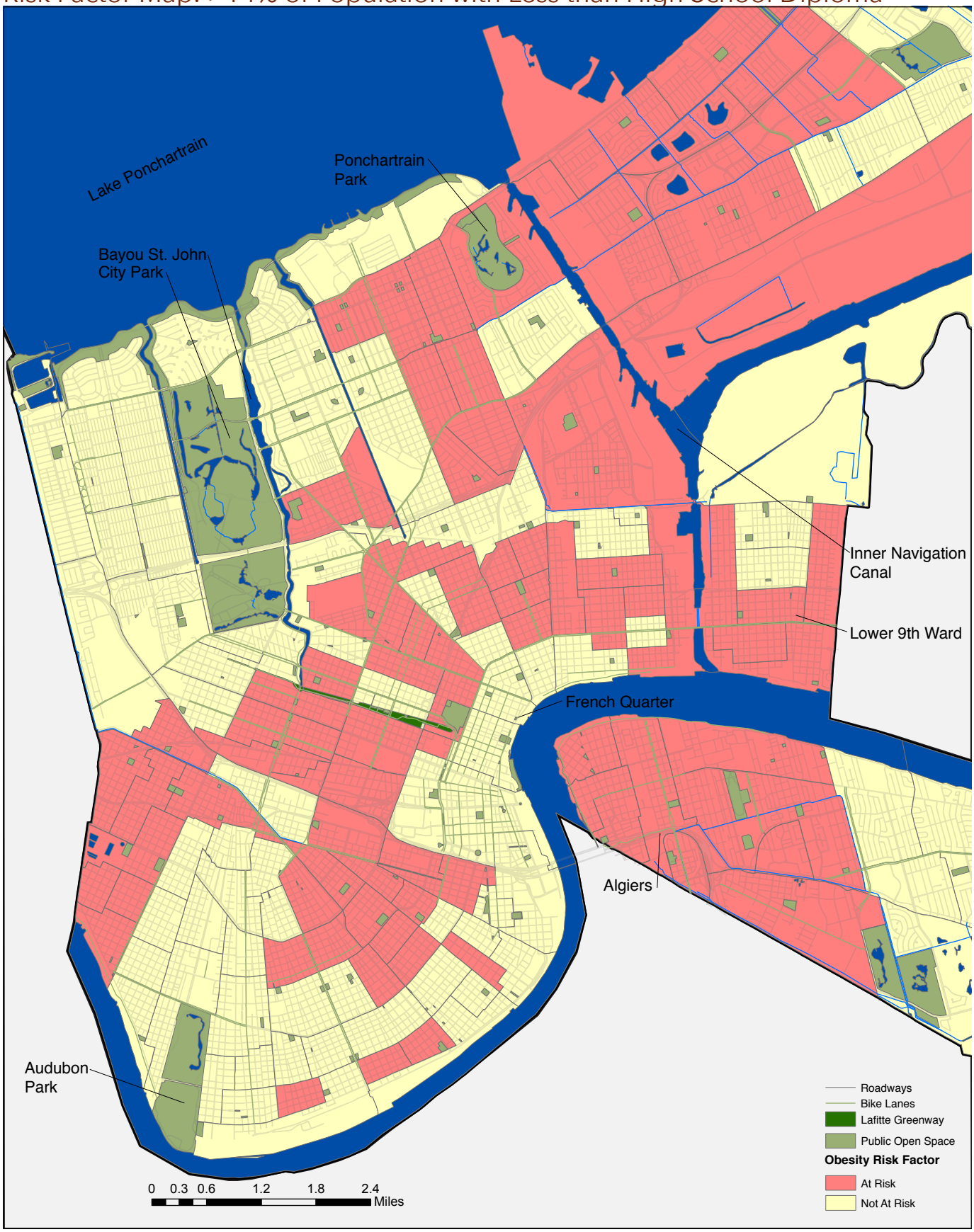

Fig 4.21 - Educational Attainment Risk Factor Map

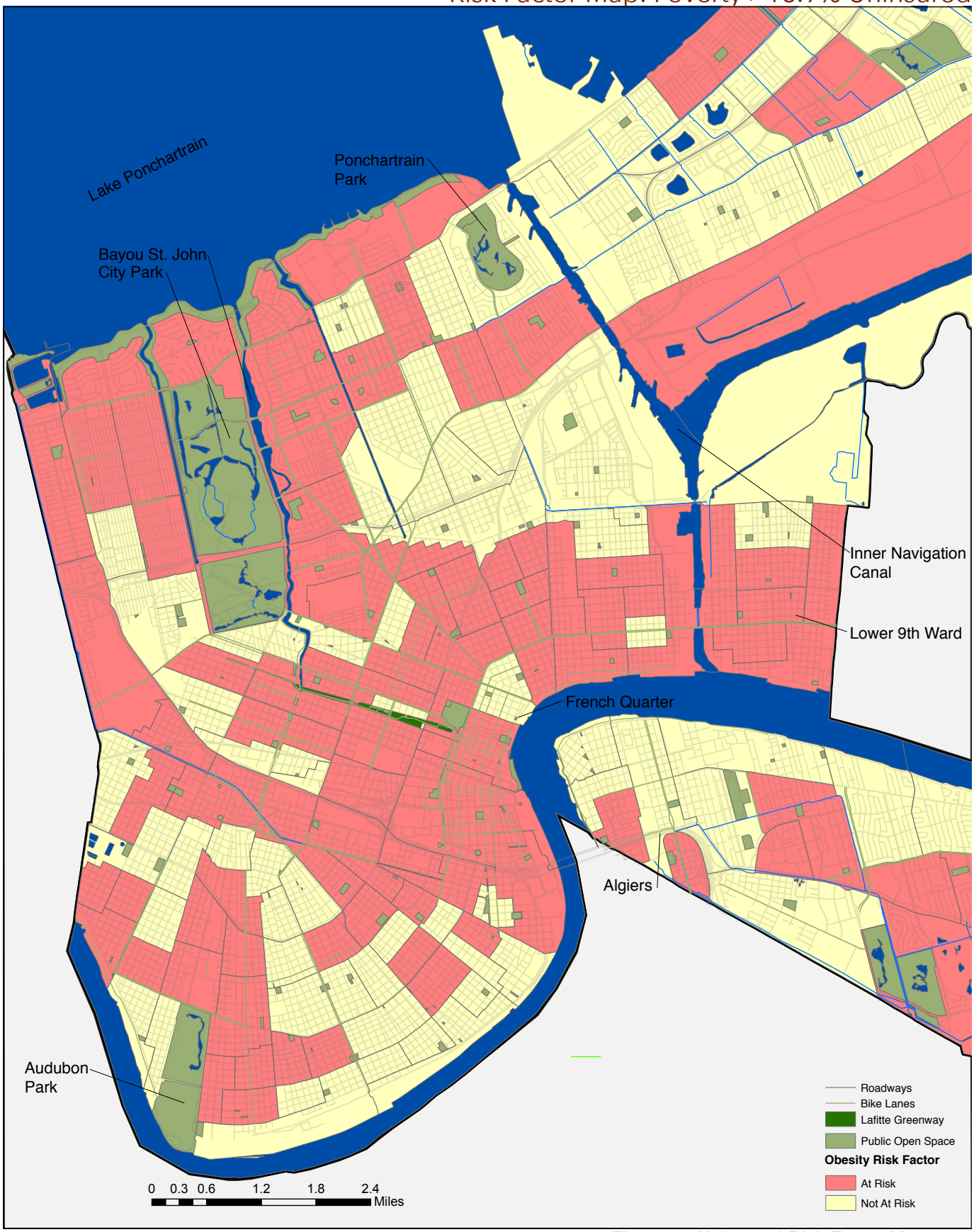

Fig 4.22 - Uninsured Risk Factor Map

2.6.) Composite Map

This map serves as a composite of all of the individual risk maps in the preceding subsections and identifies census tracts with 0-5 of the risk factors for obesity. The isometric diagram in Fig 4.23 helps visualize how this information is overlaid together. Composite scoring was used to identify which risk factors each census tract met. This score is the product of adding the unique values for each of the metrics: ethnicity, children under 18, poverty status, educational attainment, and lacking health insurance. By giving each metric a unique numerical value, the resulting composite scores can then be evaluated to determine how many and which of the criteria that were met. This score to criteria metric can be found in Appendix A.

The resulting map can be seen in Fig 4.24. The orange and dark red colors correspond to the census tracts that are most at risk, with either four or all five of the risk factors. These census tracts are distributed throughout the city, with the tracts with four risk factors often lying directly adjacent to or surrounding the areas of five risk factors. What this means is that the population that is most at risk for obesity lives across a wide geographic range within New Orleans, which increases the likelihood that available land to develop as new public open space will be present in multiple census tracts. Conversely, if the population that was most at risk were concentrated in a very few census tracts, the emphasis and importance of developing what available land exists in those tracts as public open space would greatly increase.

MAPPING RISK FACTORS FOR OBESITY

Ethnicity
Census Tracts over 50% African American or Hispanic

Population Under 18
Census Tracts over 20.3% population under 18

Population in Poverty
Census Tracts over 23% population classified as in poverty last 12 months

Education Level
Census Tracts over 14% population with less than high school diploma

Health Insurance
Census Tracts over 18.9% population without health insurance

Composite Heat Map for Obesity Risk Factors
Darker red = higher amount of risk factors

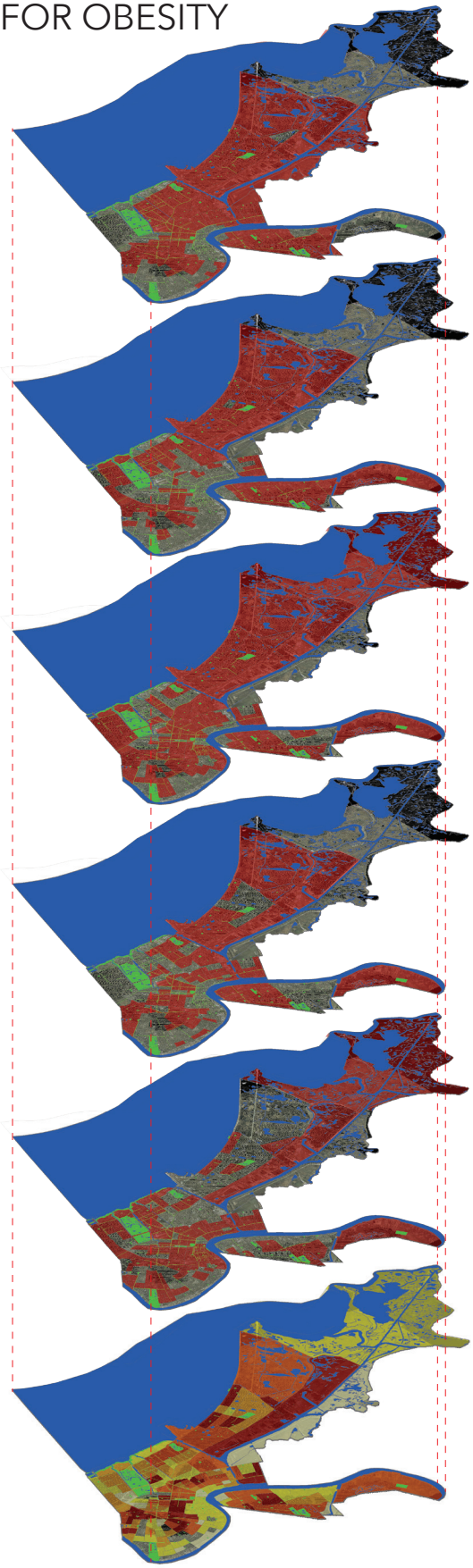

Fig 4.23 - Risk Factor Isometric

Composite Map of Risk Factors for Obesity

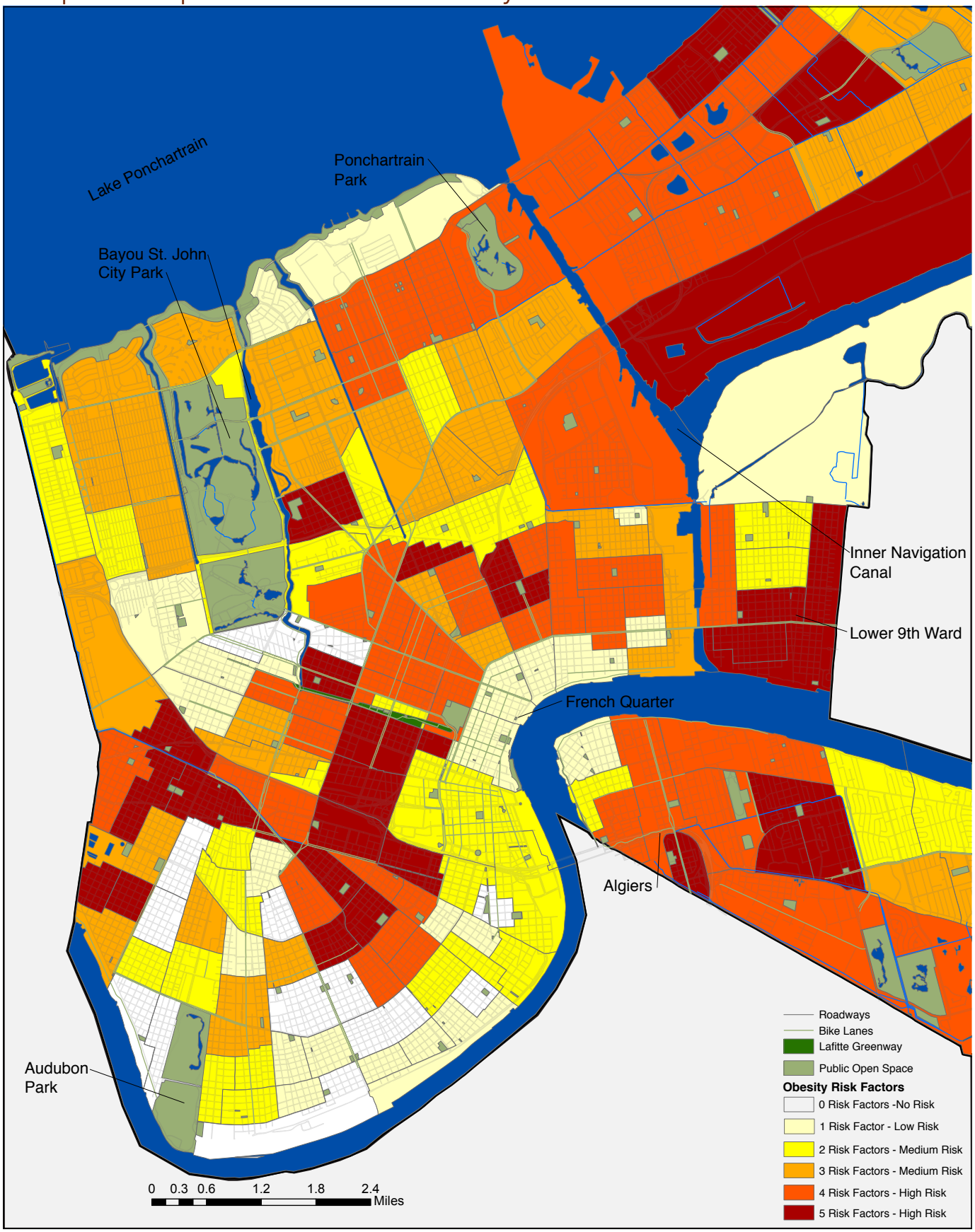

Fig 4.24 - Composite Risk Factor Map

3.) Identifying Land Available for Development as New Public Open Space

The next step after identifying at-risk communities is to determine the land available for development as new public open space. 'Vacant' or available land is defined for this project as demolished properties that were uninhabitable prior to demolition (Blightstatus Demos) or lots that the city owns, maintains, and is looking to redevelop (NORA Inventory). Datasets for the NORA Uncommitted Property Inventory and BlightStatus Demolitions were joined with the parcels dataset in order to view these lots and properties spatially. The resulting map, Fig 4.25, was overlaid with edge of pavement, parks, and bike lanes datasets in order to view relationships between available land and existing open space.

The NORA inventory consists of 1,040 properties across 120 acres. This represents 0.11% of the city's land area and a potential increase of public open space by 4.1% if every lot was to be developed for this purpose. Similarly, the Blightstatus Demolitions inventory consists of 3,533 properties across 364 acres. This represents 0.33% of the city's land area and a potential increase of public open space by 12.5% if every lot was to be developed for this purpose. Due to the size of this land area, I investigated both programs to decide whether to use one source or both.

The New Orleans Redevelopment Authority is, "a public agency charged with revitalization of underinvested areas in the City of New Orleans." (NORA) The three key focus areas of the Authority include affordable housing, commercial corridor revitalization, and land stewardship. After the levee failures and flooding in 2005, the state gave NORA the authority to redevelop approximately 5,000 properties it had acquired, and the organization developed a more holistic approach to redevelopment and neighborhood revitalization. "NORA also functions as the City's landbank, managing a large portfolio of vacant properties across the city." (NORA)

BlightStat is a monthly meeting where updates are given on eliminating the number of blighted (uninhabitable) properties in New Orleans by 10,000 over a period of three years. Contractors fill out forms for project location, demolition start and end dates and these are all input into the Blightstatus Demolitions dataset. When reviewing this information, the earliest demolition completion date was in September of 2010. There's no way to tell whether the current status of these properties is still vacant lots or if redevelopment has taken place since the demolition has ended. Furthermore, many properties within the database contain addresses, but not a Geopin, which provides a spatial location for the property. Finally, unlike the NORA properties, these properties would likely tend to be private/ individually held by hundreds or thousands of different owners. This would greatly increase the complications of property acquisition and decrease the properties likelihood of redevelopment as public open space

After reviewing this background information and history about both the NORA and Blightstat, I decided to use only the NORA Uncommitted Property Inventory for available land for this project and prioritized sites in the next section from that group of properties.

Fig 4.25 - Available Land Map

4.) Prioritizing sites

The final step of the design process is to combine the tracts representing populations most at-risk of obesity with need for open space, defined as over 1/4 mile from existing parks plus no access to vehicle, and with available land (vacant, city owned lots) identified in the previous section to prioritize sites for development as public open space. Sites are prioritized in a 4 step process: high risk tracts, outside 1/4 mile buffer from existing parks, combined high risk tracts and outside 1/4 mile buffer, and tracts with high percentage of no vehicular access. This enables cities to evaluate how fine of grain or how broad of an approach they would like to take in addressing new public open space development.

I filtered the available, vacant, city-owned lots within the context of existing New Orleans parks by including a minimum size constraint for sites. From the "What's There?" section of this chapter, the smallest park in New Orleans is Franklin Triangle Park at 420 square feet. Exclusive of this, the next smallest is Lepage Place at 977.7 square feet. The average park size is 14.45 acres. Using this information, I defined the smallest size of available vacant lots for public open space development at 900 square feet. (.02 acres)

Within High Risk Tracts

Within the composite map for Census Tracts at risk for obesity, census tracts which met four out of the five risk factors or all five of the risk factors were selected. Once this set of census tracts was identified, vacant lots that fell within each of the high risk tracts were also selected to help address these areas. There are 570 vacant lots totaling 68.13 acres available for redevelopment as public open space within these at-risk tracts. The largest of these lots is 2.66 acres and the smallest of these lots is 939.28 square feet. The map illustrating these areas is seen in Fig. 4.28.

1/4 Mile Buffer From Parks

From the case studies, 1/4 to 1/2 mile was identified as the distance residential areas should be located in proximity to parks. New Orleans 2030 Masterplan has a goal of 1/3 mile as the distance parks should be located from residents. The research by Cohen et al. (2007) showed that 43% of park users live within a quarter mile a park. This project uses 1/4 mile as the distance to design around as it equates to a five minute walk and the research shows that this is in line with other cities. To address areas of the city that do not lie within a quarter mile (five minute walk) of a park, the parks were given a quarter mile buffer. Then, vacant lots that fell outside of these buffers were selected. This map is seen in Fig. 4.29. Within the map, these lots total 40.74 acres that are available for development as new public open space. The smallest of these lots is 986.6 square feet and the average lot size available is 5,313 square feet.

At Risk Tracts + 1/4 Mile Buffer From Parks

The next step is to overlay and combine the vacant lots that fall within the four or five Risk Factor Metrics with vacant lots that were outside of the quarter mile park buffer. This results in vacant lots that are both outside of a five minute walk to an existing park AND areas that land within census tracts

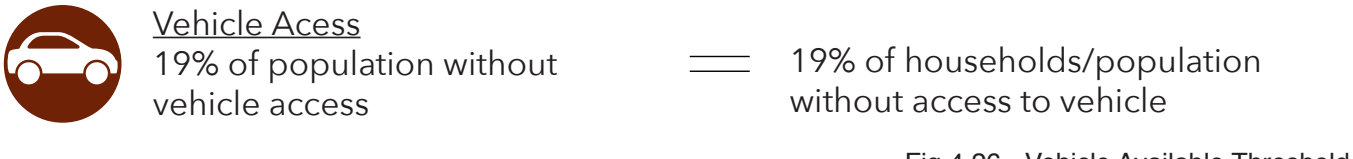

Fig 4.26 - Vehicle Available Threshold

containing 4/5 or 5/5 risk factors for obesity. The resulting map is seen in Fig. 4.30. There are 223 lots meeting these criteria, totaling 26.09 acres. The smallest available lot in this map is 986.6 square feet and the maximum is 11,862 square feet (.27 acres).

Lacking Vehicular Access

The final criteria to help prioritize available lots for development as public open space is the lack of vehicle availability to households. I deemed this as an important criteria to include in the prioritization process, as an individual at risk of obesity that lives more than a 5 minute walk to a park with no vehicle would theoretically be much less likely to have access to a distant park than an individual who could use a vehicle to drive to a park. Additionally, the public transit advocacy group Ride New Orleans has analyzed public transit in New Orleans and found that only 36% of bus and transit service have been restored since 2005 (Cohen 2014). They found that areas with the greatest amount of lost services are disproportionately concentrated in low income areas that are also composed of high minority populations. This means that many of the same areas at risk for obesity are also heavily reliant on autos as a form of transit.

The process for determining this criteria's threshold was the same process used for developing thresholds for the Risk Factor criteria in section: using the statistical average for New Orleans provided by the Data Research Center. This threshold is 19% of a census tract's total households as seen in Fig. 4.26. Using the 2015 ACS table for Household Size - Vehicles available, the number of households with no vehicle available was divided by the total estimated number of households to derive the percentage of households without vehicular access. Census tracts were then selected where this percentage was greater than 19% to create the map. The resulting map can be seen in Fig 4.31.

This map shows that as expected, areas within the central city and surrounding neighborhoods have a higher percentage of people without access to cars. The Algiers and Vavant Venetian Isles neighborhoods that lie in the southeast and northeast portions of the map also contain high rates of households without access to cars. Comparing this map to the map for obesity risk factors (Fig 4.23), there is significant overlap in the census districts meeting both of the criteria.

Composite Map

The final step in prioritizing vacant land available for development as new public open space was to take the map created for vehicle access and overlay that with the map of vacant land within high risk census tracts and outside of 1/4 mile buffer of existing parks. The resulting map in Fig. 4.32 shows vacant lots that are outside of a 5 minute

walk to an existing park AND areas that land within census tracts containing 4/5 or 5/5 risk factors for obesity AND located in census tracts that have over 19% of households with no access to a vehicle.

The result of this prioritization process can be seen in Fig. 4.27. There are 140 lots totaling 14.83 acres which meet all of the prioritization criteria. The minimum lot size is 986.59 square feet and the maximum is 11,862 square feet (.27 acres). In total, these lots address 19 census tracts and are estimated to serve approximately 33,777 residents in the following neighborhoods: Little Woods, West Lake Forest, Plum Orchard, Vavant Venetian Isles, Lower 9th Ward, St. Claude, 7th Ward, Mcdonogh, Desire Area, Holly Grove, Gert Town, and the Central City. Using New Orleans' obesity rate of 31.4% (NOLA Health Department), these 14.83 acres of open space could serve the access needs of approximately 10,600 obese citizens.

The above assumes that all of the 140 lots would be developed as public open space. It's important to note that while the prioritization process this project uses analyzes existing parks and distances to parks, these priority lots all don't necessarily become new parks. Open space for this project can include parks, community gardens, schoolyards, playgrounds, plazas, exercise equipment, etc. When examining the resultant map in Fig. 4.32, one can see that lots in some neighborhoods, like Lower 9th, have large clusters of lots that are close together. In these areas, the city can then ground-truth and find other vacant lots that may be privately owned which are adjacent to the city-owned lots. All of these areas could be aggregated together and developed as one larger public open space (park, sports field, etc.) in that neighborhood. Alternatively, if there are only a few small lots in a neighborhood, like those in Gert Town or Central City, the city could select the largest lot to develop as public open space focused on physical activity to help to meet need in that area and achieve greater

Lower Priority ◀ – – – – – – – – – – – – – – – ▶ Highest Priority

	High Risk	High Risk + >1/4 mile	High Risk, >1/4 Mile, No vehicle
Number of Lots	570	223	140
Acres	68.13	26.09	14.83
Largest Lot	2.66 acres	.27 acres	.27 acres
Smallest Lot	939.3 sq ft	986.6 sq ft	986.6 sq ft
% of Open Space Network Expansion	2.34 %	0.9 %	0.5 %

Fig 4.27 - Results of Prioritization

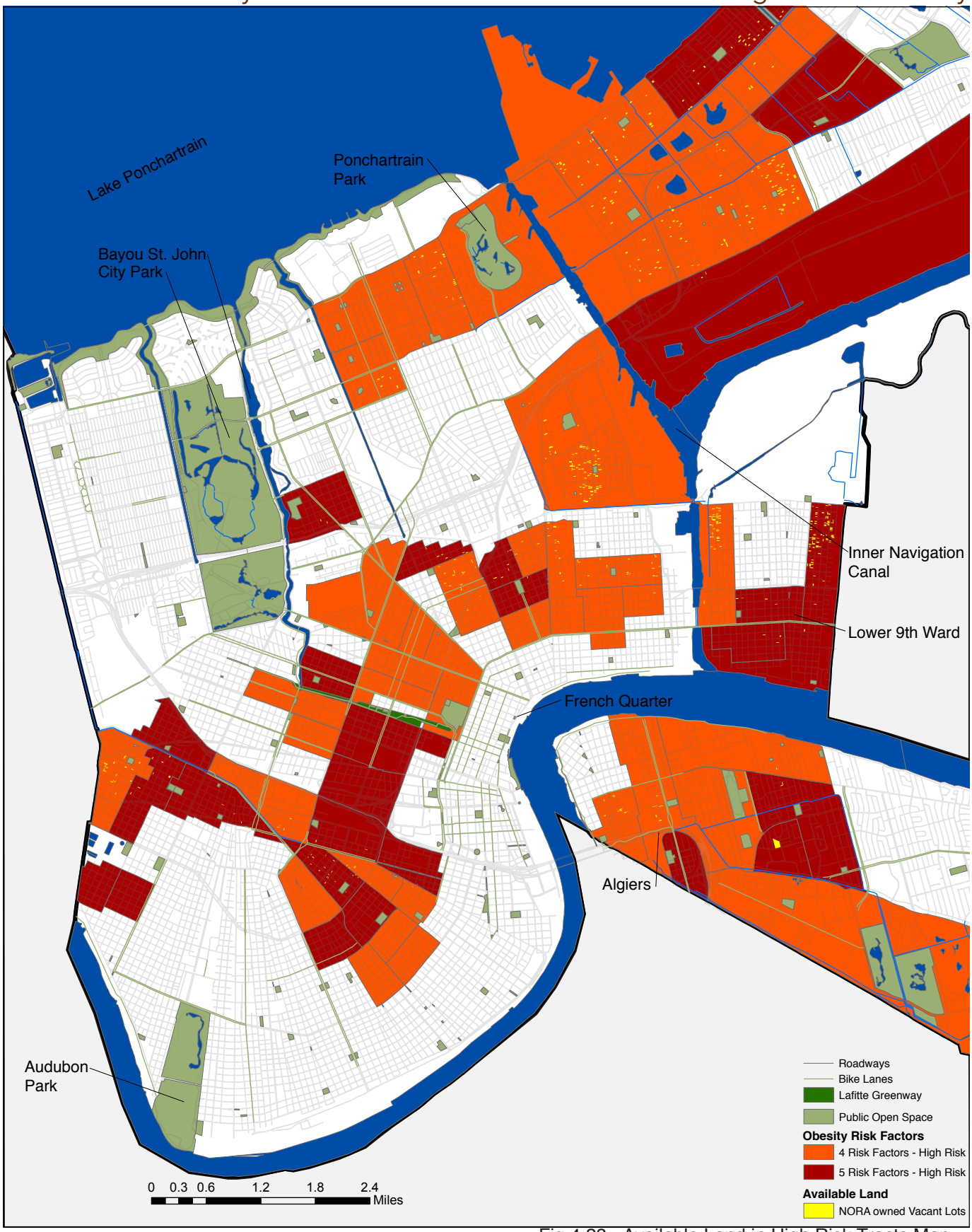

Fig 4.28 - Available Land in High Risk Tracts Map

Prioritization: City Owned Vacant Lots Outside Park Buffer

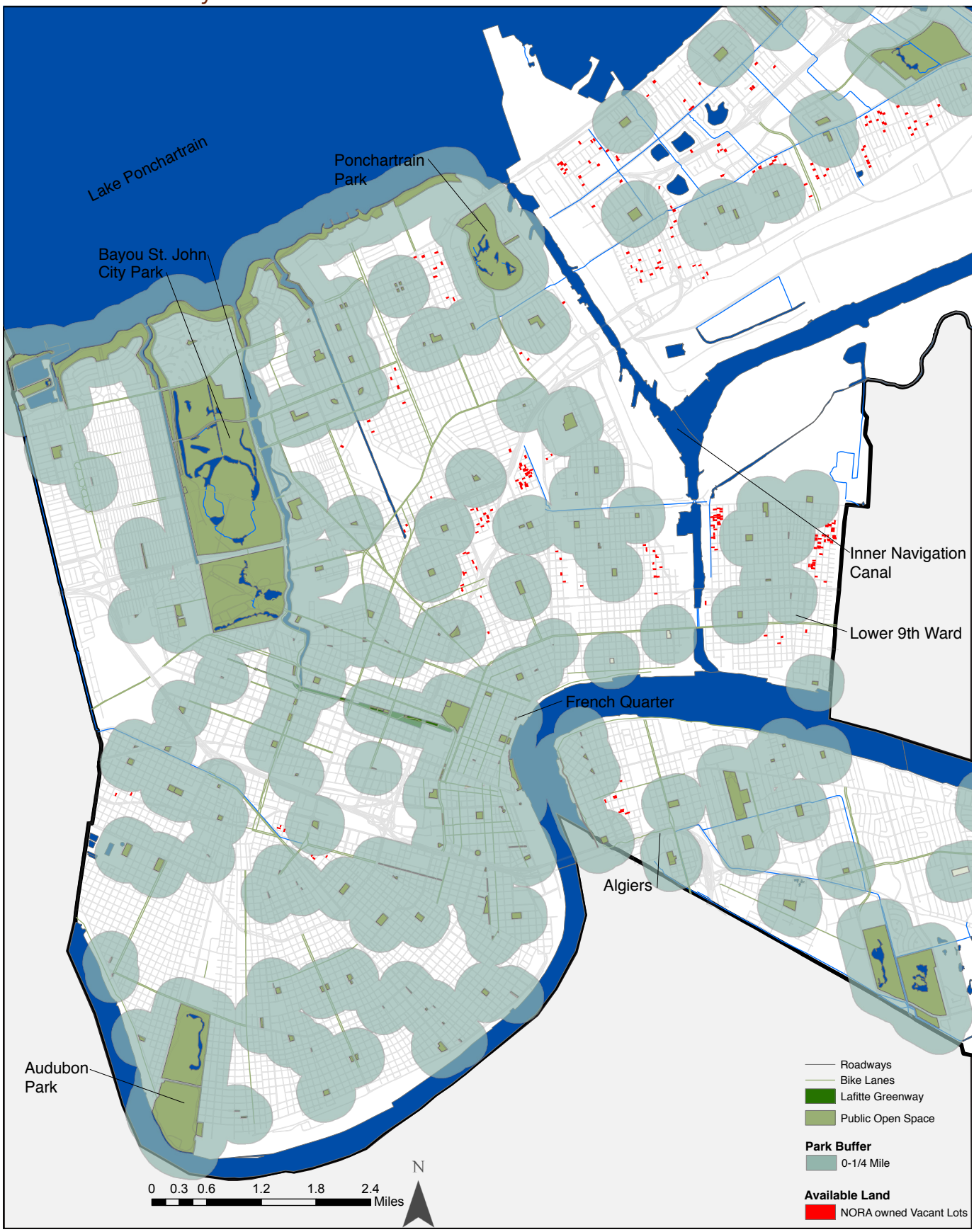

Fig 4.29 - Available Land outside Park Buffer Map

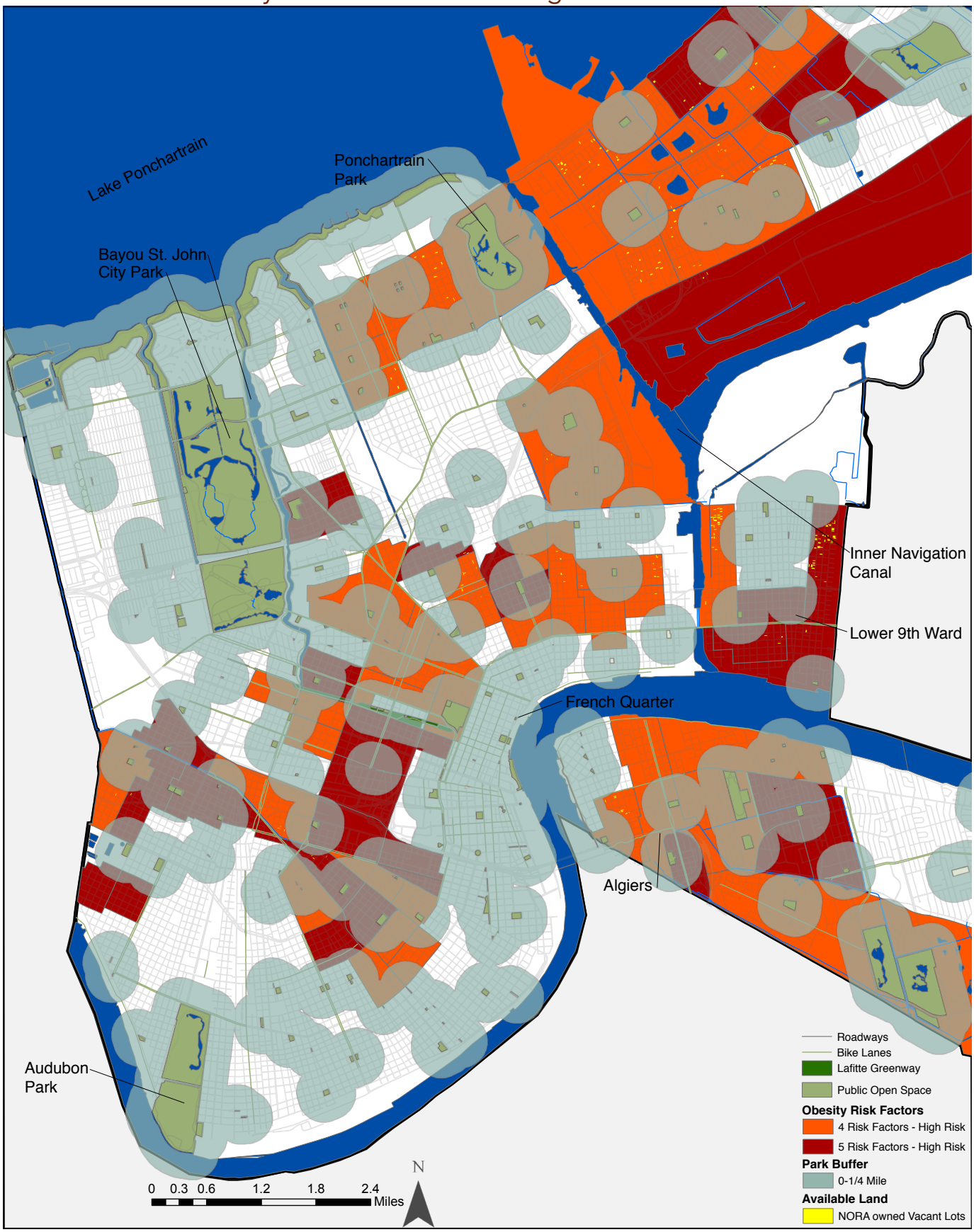

Fig 4.30 - Combined Park Buffer-Risk Map

Prioritization: Census Tracts >19% No Vehicle Access

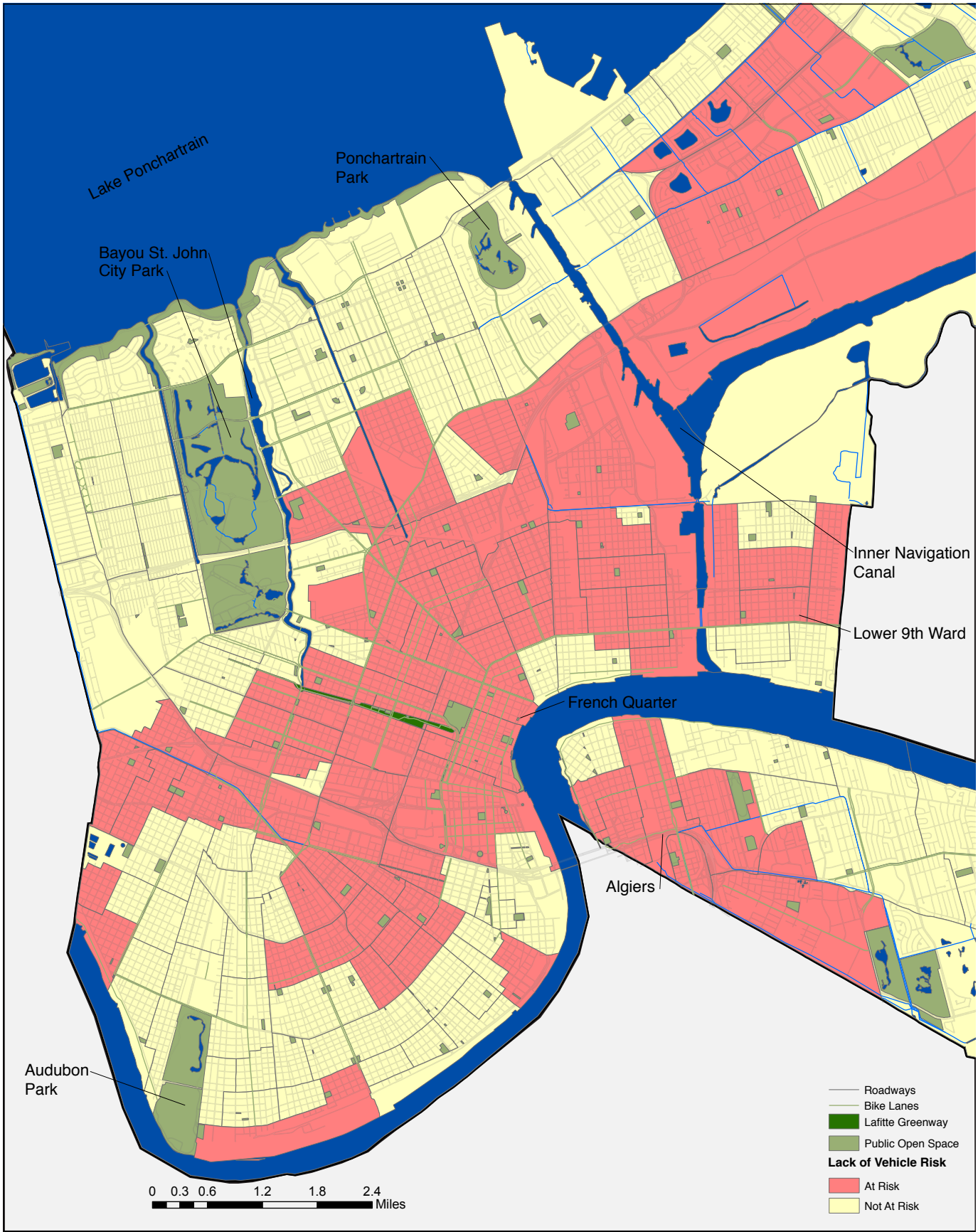

Fig 4.31 - Available Land - No Vehicle Access Map

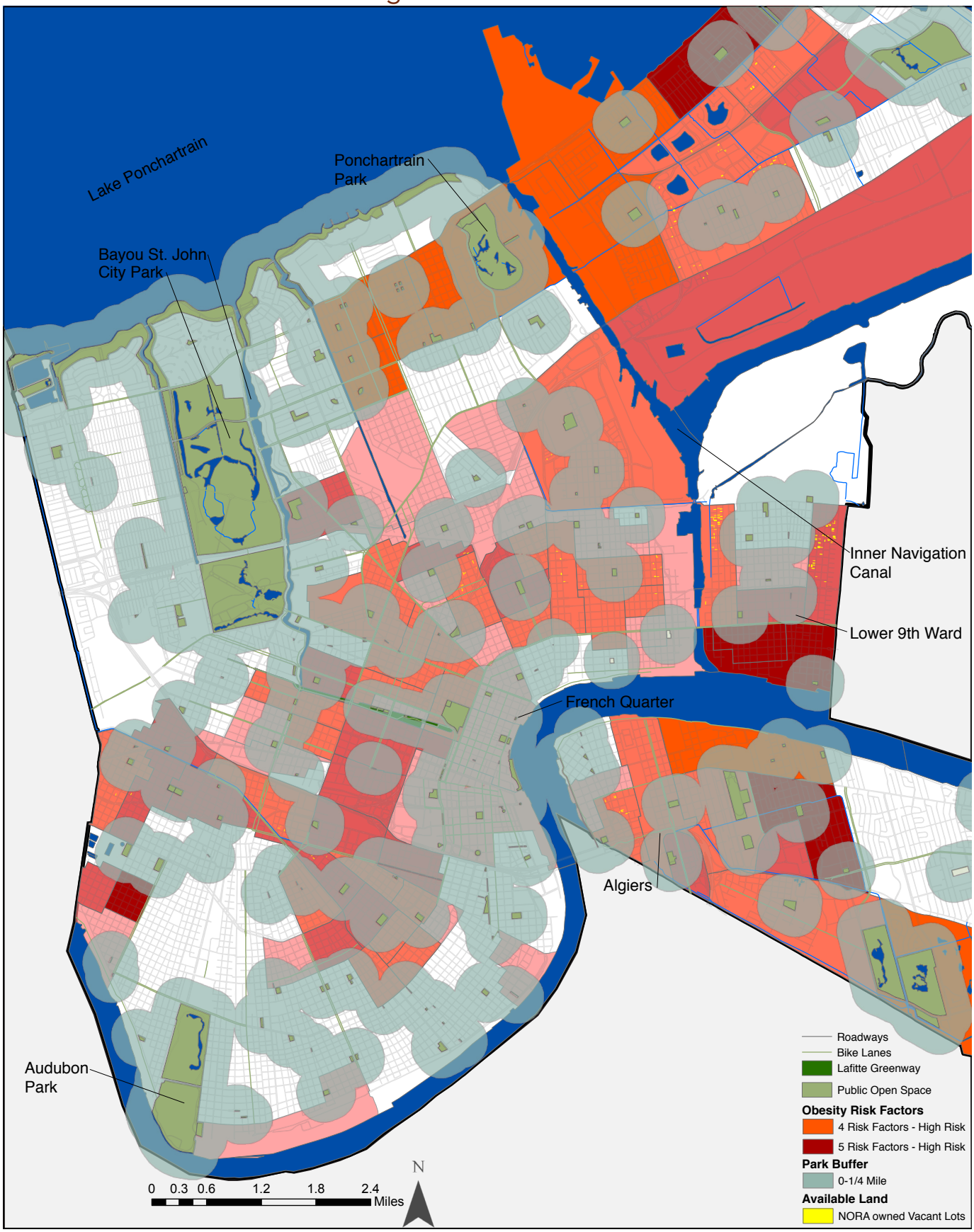

Fig 4.32 - Available Land Composite Map

City	New Orleans Baseline	New Orleans Design
Year Open Space Network Began	1850	
Population in Founding Year	116,375	
Population Density in Founding Year	25.8 people/acre	
Land Area in Founding Year	4500 acres	
Open Space as a % of Land Area Founding Year	2.3 %	
Size of Original Open Space Network	103.5 acres	
Current Size of Open Space Network	2,915 acres	2,930 acres
City Land Area (2016)	108,431 acres	108,431 acres
Current Open Space as a % of Land Area	2.69%	2.70%
Current Population (2016)	389,617	
Current Population Density	3.59 people/acre	
Persons / acre of open space (founding year)	1,125	

Fig 4.33 - New Orleans Open Space Network Changes

coverage with respect to park buffers and walking distances. The remaining vacant lots in all of these neighborhoods could be analyzed to determine the proximity to the closest grocery store or area supplying fresh produce and then developed as community gardens or other types of open space which the community desires in that area.

Chapter Summary

This chapter described the prioritization process of analyzing the existing open space network of New Orleans, defining and identifying at risk communities, identification of opportunity in the form of available land, and prioritized development based on need. A four step process was described for prioritization to enable cities to define for themselves how broad or fine of grain they would like to take in addressing new public open space development. If they have many resources at their dispose of, the broad approach would be best fit. If the city's resources are limited, using the fine grain and targeted approach is best.

Chapter 5: Limitations, Transferability, Conclusions

Limitations

In the Introduction and review of the literature for this project, it was noted that the existing research that has been done to link obesity with physical activity and public parks and open space only shows correlation, not causation. As such, there is no direct evidence that expanding the open space network in New Orleans as prescribed in the last chapter will result in a guaranteed reduction in the obese population in the city.

Similarly to the argument surrounding correlation, Dahlgren and Whitehead (1991) illuminated the many different levels of factors (Individual, Social, Environmental) that can have an impact on an individual's health and wellbeing. If public open space exists within 1/4-1/2 mile of individuals, its proximity cannot solely address obesity. A person's family medical history, diet choices, activity levels, and habits could render all the physical activity in a nearby park moot. Environmental and landscape design, like the work that constitutes this project, is the one realm within individual health where landscape architects can have an impact. By addressing some of the socio-economic factors and environmental inequities which many people have no control over, we can remove some of the barriers to health and wellbeing that aren't even considered when planning open space.

There are also issues that arise with the creation of new public parks and open space in economically disadvantaged communities. Similar to the creation of Central Park, the High Line, and many other urban open space projects, this new public open space can help to drive up housing costs, spur development, and exacerbate inequalities within these communities. Wolch et al. (2014) examine park provision through the lens of environmental justice for unhealthy communities and discusses how park creation in underserved areas can positively impact health but also create gentrification. I acknowledge that this issue is a very real possibility as a result of this project being implemented, but addressing this issue is beyond the scope of the work.

In collecting information relevant to the case studies, often times I ran into issues with certain types of information not being available - i.e. land area for a given year. To address this, I attempted to find maps of the city as close to the year as possible, and utilized AutoCAD to scale the map and roughly outline the area of the city. Additionally, given that education in European countries is often structured differently from US countries, the resulting information in the comparative table doesn't always cut equally across the same categories. This is also true for the obesity rates for children. Often times, adult obesity information was available, but the age ranges for childhood obesity was not consistent from case to case.

Finally, time was a constraint for this project in terms of what the project could achieve in the time available. Initial Land-Use/

Land Cover data was not available for use, and much time was spent gathering GIS information, joining it together with census and socioeconomic data, and understanding the constraints and processes that I was working within. As a result of this added time, I was not able to tackle making connections with multi-modal streets between new nodes/ clusters of open space sites I identified for the open space network of New Orleans.

Transferability

This prioritization process has the opportunity to be layered in with other values and strategies at work within a city. Initiatives that could dovetail with this work include urban agriculture or community gardens, flood control, and habitat to build in complexity and result in a multi-functional open space network.

Method as Part of a City Planning Process

Most cities today have developed a masterplan or comprehensive plan that serves as a framework to guide city development towards goals outlined within the plan. The purpose of these plans is to help protect the public health, safety, and enhance the general welfare of the public (includes economic vitality and public services). Additionally, many cities also have developed public health plans that serve to identify health and wellbeing priorities for the city and inform actions that the city takes to achieve them. The theme of this project, "Open Space Planning to Reduce Obesity," can fit within both of these strategic planning documents as outlined in Fig 5.1. Cities have two methods that they can employ at a land use planning scale study and potentially reduce obesity.

The Los Angeles case study illustrated how city health departments can implement a spatially explicit comprehensive health analysis to determine where the neighborhoods and communities with the most obese populations are located. (Health Atlas for the City of LA 2013) Using this information, the city can then identify vacant, blighted, or underutilized sites within 1/4 mile of these areas to develop as public open space. This knowledge gained from the case study is seen in the left rectangle under Landscape Scale in Fig 5.1.

The prioritization process that this project used can also be used to identify areas most at-risk of obesity if funding or ability to complete a spatially explicit comprehensive health analysis is lacking. The city would employ the process undertaken in Chapter 4 of this project to identify communities that are the most at risk for obesity and where available land is, then prioritize sites using 1/4 mile park buffers and vehicle availability. However, these patches of open space do

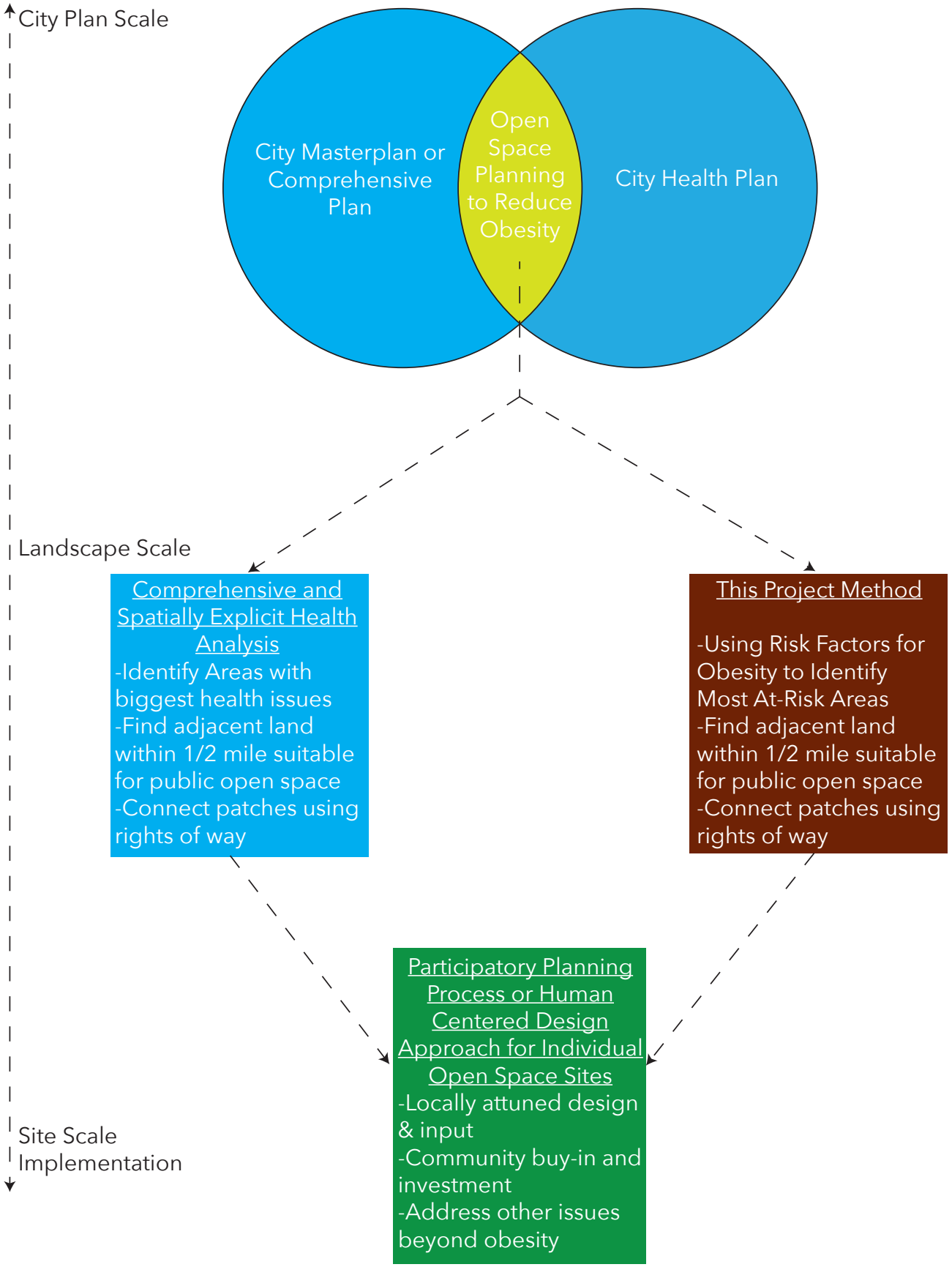

Fig 5.1 - Ideal City Planning Process

not constitute a network on their own. As in landscape ecology, an effective network is composed of patches and corridors within a matrix. (Forman 1995) Compared to designing for wildlife and ecosystems, this project holds humans as the species of interest and public open space within the city as both patches and corridors they need to be physically active and healthy.

After the sites are identified using either this project's prioritization process or alternatively a comprehensive health analysis like the LA case study, a finer grain design of individual open space could be the next level of focus in the overall process. At the community or site scale, a participatory planning process or Human Centered design approach would be an ideal method to employ. This ensures the design of these open space areas is locally attuned to community needs, has the buy-in and support of the surrounding community, and can address other issues beyond reducing obesity rates.

The New Orleans Redevelopment Authority owned vacant lots are unique to New Orleans and there's no guarantee that other cities seeking to implement this process would have a similar resource of aggregated city-owned vacant land. The lack of such a database would make identifying land available for development as public open space more difficult and could theoretically involve much more time intensive ground truthing.

Adapting Thresholds and Values for Cities

In Chapter 4, Thresholds for Obesity Risk Factors were identified. For the purposes of this project, New Orleans statistical averages were used to define threshold levels. If this project were to be replicated, future researchers could coordinate with individual cities in order to help determine appropriate threshold levels. For instance, if a city was also working to reduce poverty to under 5% in addition to battling obesity, they could set the threshold level for poverty at 5% to correspond with their cultural values. This prioritization process allows for customizing each of the obesity risk factors, the park buffer distance, and how many factors they would like to use in prioritizing sites for new public open space. The chapter illustrates each of the options available to cities, whether they want to employ a very targeted approach or if they have large amounts of funding available and want to paint with broad strokes.

The census data and American Community Survey Tables can be acquired by researchers and used for the risk factor analysis of other cities. Critical to recreating the work completed in this project is the existence of readily available spatial (GIS) data for a given city. The City of New Orleans maintains an Open Data website with publicly available dataset for use.

Future Research

If future researchers were to build upon the work done in this project, one key area of interest would be to utilize the Network Analysis Tool in GIS instead of using 1/4 mile buffers around existing open space for prioritization of sites and be employed at a census block scale. This tool has been employed in other projects (Comber et al. 2006 & Sevtsuk and Mekonnen 2012) in order to determine actual travel distances to open space along roads, sidewalks, and bike lanes. This would produce a more accurate output for the individuals traveling to and from open spaces and working at the scale of a census block would be much more precise.

Additionally, this project set out to design an open space network for the city of New Orleans. While sites for new open space (patches) were identified, time constraints meant that I was not able to complete the connections portion of the project. Given the time involved, this could be an entirely separate project. Future researchers could take the sites that were prioritized in this project and begin to work on designing connections between both the new sites and existing open space within the city of New Orleans using rights of way and waterways as available land for these connections.

Conclusions

This project set out to develop a new approach for identifying locations for new public open space in New Orleans to address communities that are most at risk of obesity. While this project originally set out to complete an open space masterplan for New Orleans, what was actually produced was an on-demand method for identifying sites for new open space. Even though New Orleans lacks a central authority for parks and recreation, this project could easily be incorporated by the Parks and Parkways Department's current approaches for developing open space. There's no comprehensive planning document that would have to be amended and approved by various city departments before this approach would be able to be implemented.

The project represents an Opportunistic model of open space development within a larger Garden Cities model. This prioritization process could be revisited yearly, bi-annually, or whenever a city has funding to design and construct new public open space. Through this project's method of evaluative tool and prioritization process, new sites for public open space in New Orleans were identified that addressed communities that were at risk of obesity, didn't have access to existing open space, and did not have access to a vehicle to reach other open spaces. This fills

a gap in the existing literature pertaining to open space planning that addresses human health and presents one approach for cities to employ in their planning processes. Landscape architects can use this work to help build the case for more public parks projects and build in systems complexity of green infrastructure, habitat, and local food systems on top of addressing obesity. This work also presents a unique opportunity for landscape architecture profession to play a part in addressing larger societal problems like the obesity crisis through the design of urban landscapes.

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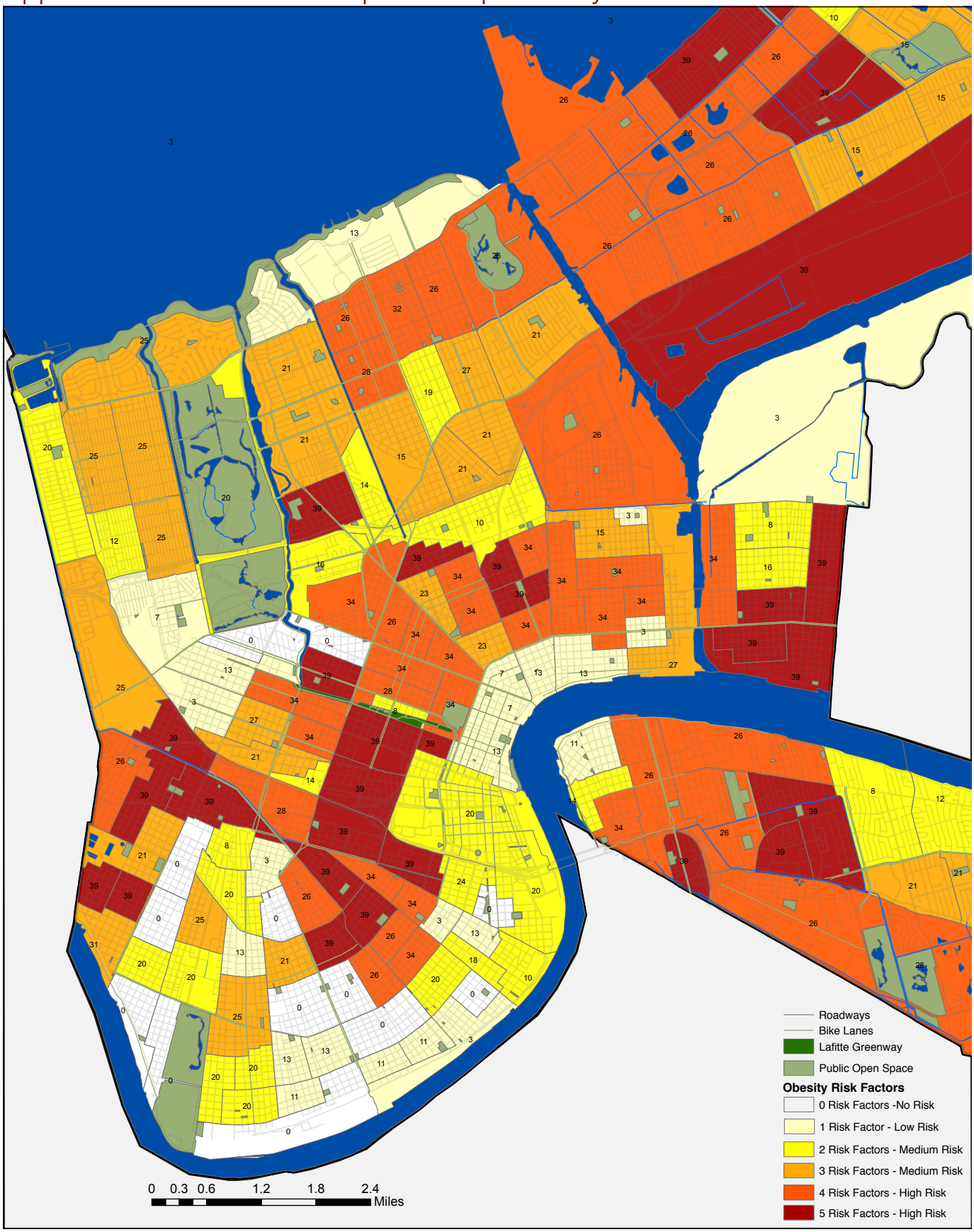
Appendix A - Risk Factor Composite Map with Key



Census Tracts - Number of Risk Factors & Type