EXPLORING URBAN CHANGE USING HISTORICAL MAPS:

THE INDUSTRIALIZATION OF LONG ISLAND CITY (LIC), NEW YORK

by

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DEDICATION

In memory of my father, who loved and collected old maps.

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I would like to thank Karen Kemp for her continued guidance as I worked my way through this research. Her patience and instruction were invaluable.

Thank you as well to my mom and sister for their constant support throughout this process. A great thanks to Florence, whose boundless and persistent spirit motivated me. And finally, to Spencer, for both encouraging me and putting up with me.

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LIST OF ABBREVIATIONS

AAG	Association of American Geographers
GIST	Geographic Information Science and Technology
LIC	Long Island City
LIRR	Long Island Railroad
NYC	New York City
RMS	Root Mean Square
SSI	Spatial Sciences Institute
USC	University of Southern California

ABSTRACT

The goal of this thesis was to develop a process in which historical land use can be tracked in order to gain a better understanding of an area's history. The study area, Long Island City (LIC) is historically an industrial neighborhood within Queens County of New York City. By documenting its land use shifts from 1891 to 1950, it is possible to visualize and analyze the changes that occurred as industrialization took place.

This study compiles a digital historical narrative to provide a foundation for understanding the data, as well as a reference for making new conclusions from the results of the analysis. Old fire insurance maps provide building footprints categorized by use. These were used to digitize locations of interest as points that were catalogued under five different categories: Cultural, Industrial, Residential, Shop, and Vacant at each of five time periods. The resulting spatiotemporal database makes it possible to track a single building and its use through a period of 59 years.

The methodology developed for this thesis collects and classifies building use as points so as to develop efficiently and quickly an accurate historical dataset. In doing so, the project tracked the cultural development of LIC through an examination of a set of key buildings, as well as the overall land use change of a sub-neighborhood, Hunter's Point. It determined that by tracking the use of every building through every map year, one gets a better historical analysis. Such methods can be used not only to help support previously known historical narratives, but also to allow for new conclusions to be drawn.

CHAPTER 1: INTRODUCTION

Long Island City (LIC) is a neighborhood in southwestern Queens County, New York. It is the closest neighborhood to Manhattan in Queens, making it particularly accessible by both public transportation and car (Figure 1). However, unlike many outer-borough neighborhoods that are close to Manhattan, LIC has not experienced the same public popularity. Instead, throughout much of its history, it has undergone rapid and constant industrial business. This thesis enriches the narrative of its industrialization through digital historical analysis.

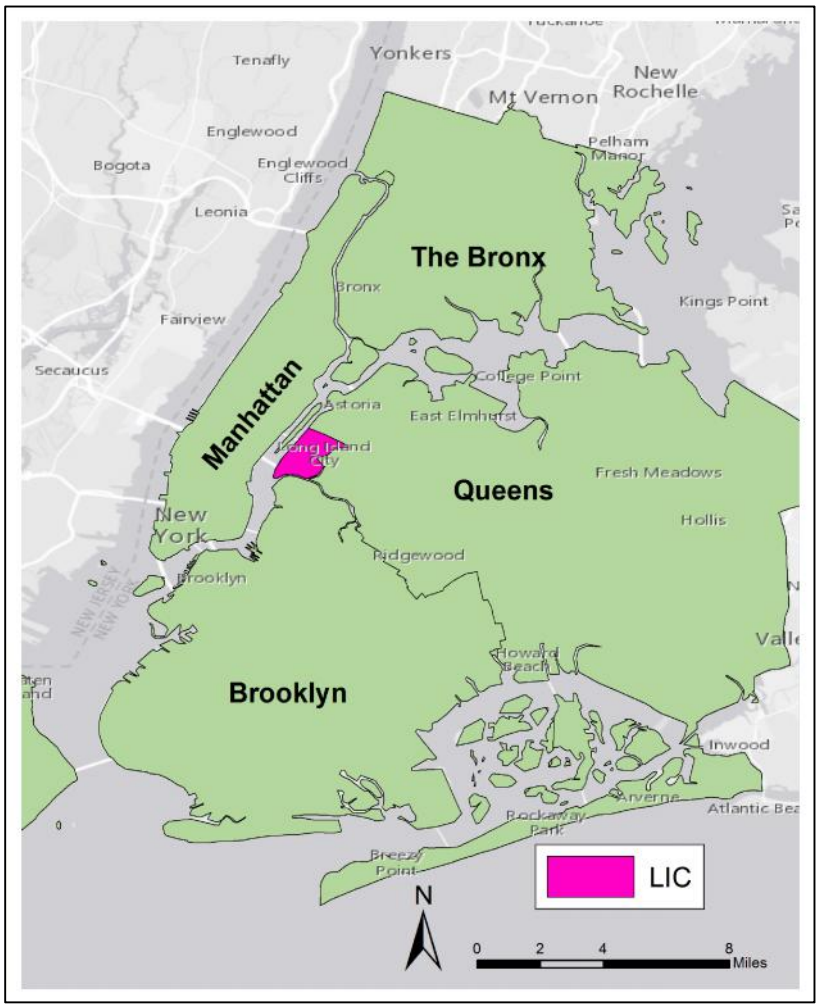

Figure 1 Long Island City in Queens County, New York City.

LIC's urban history began in the late 1850's when farming activity was wiped out to make room for industrial endeavors. By 1912, LIC had the largest number of factories and factory employees in all of Queens (Seyfried 1984). When industry peaked in 1950, much of LIC was covered in warehouses, factories, and refineries.

This study attempts to track the historical development of LIC using a method of collecting, categorizing and organizing point locations of buildings through historical maps. By tracking shifts in building use, the research creates a method for using historical maps to extract data that can be investigated within a single, spatiotemporal database. The results of this process are used to demonstrate LIC's industrialization as it relates to its historical chronicle.

1.1 Motivation

In 1961, when manufacturing was beginning to decline, New York City rezoned Hunter's Point (a sub-neighborhood in the southwest portion of LIC) to encourage further industrialization (Vitullo-Martin 2004). As manufacturing continued to wane in the 1970's, the area maintained the same zoning laws and was therefore, unable to adapt to the changing economy. Freight services, factories and warehouses were abandoned, ultimately being subjected to graffiti and vandalism.

Only within the last few decades has LIC started to move away from its industrial roots. In 1993, New York City developed a new vision for LIC, entitled "Plan for Long Island City: A Framework for Development." This project established a list of goals for the decaying neighborhood, including new parks and a new zoning strategy (NYC Planning 1993). Today, LIC has developed a fresh, unique identity, combining a high-end look with its old industrial flavor. Nevertheless, abandoned warehouses and factories still exist, demonstrating the deep impact industry had on the neighborhood.

This study began with a curiosity about LIC's current conundrum. Although it is successfully moving away from its industrial past, it is apparent that industry had a lasting effect on LIC, leading to the question, where and when did this deep impact originate? This study tracks the process of industrialization in LIC by using fire insurance maps, which provide rich, detailed evidence about land use and its changes through the years. It traces from the very beginning of industrial endeavors in 1891, to the peak of industrialization, in 1950.

1.2 Study Area

This document refers to the study area as LIC, using the neighborhood's current name preference. On February 17, 2013, the *New York Post* published an article entitled, "'Island' nabe [sic]: Call us LIC!". In this article, Gary Buiso, explains that Long Island City officials and leaders want to change the neighborhood's name to simply LIC. Buiso quotes the head of the Queens Local Development Corp. Tourism Council, Rob MacKay, as saying, "It puts us out on Long Island, and that's inaccurate—we are urban and hip" (Buiso 2013, para. 4). While Long Island City is the closest neighborhood to Manhattan in Queens, its name implies that is a part of Long Island, an area that is not only connected to the opposite side of Queens, but that is also not a part of New York City (Figure 2). According to these community members, such confusion poorly affects LIC's economy and growth.

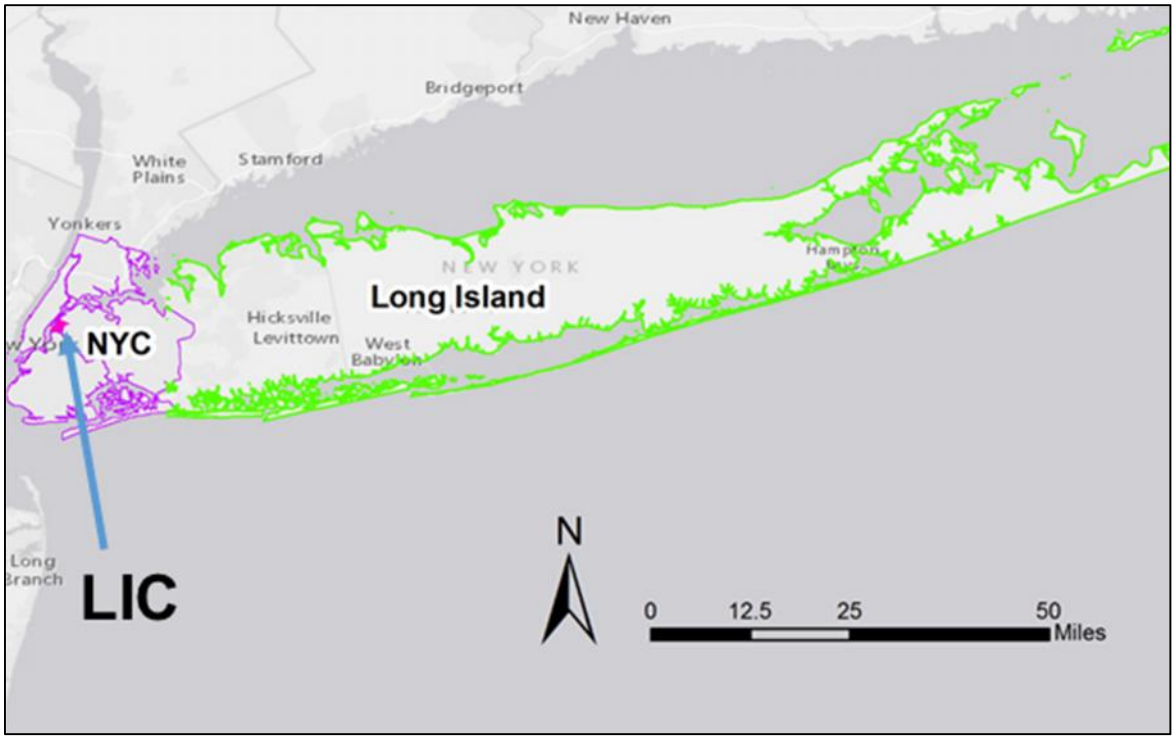

Figure 2 Long Island City and Long Island (2015)

Moreover, this study uses the name LIC so as to differentiate between the historical boundaries of Long Island City and the modern-day boundaries; the latter being the extent of this study. Despite its name, modern day LIC (Long Island City) is not a city. Before Queens was incorporated under New York City in 1898, Long Island City was, in fact, a city unto its own and it covered the whole western shoreline of Queens (Figure 3). The northern part of historical Long Island City is now a separate neighborhood known as Astoria, but in the late 19th century, Astoria was simply known as the residential portion of greater Long Island City (Seyfried 1984). Consequently, the name LIC not only reflects the recent initiative to improve the neighborhood, but also the modern-day boundaries that distinguish it as a neighborhood as opposed to the city it once was. This study will refer to the neighborhood as LIC so as to identify its modern boundaries, as seen in Figure 1.

Figure 3 1896 Long Island City. Retrieved from "History of Long Island City, New York" by J.S. Kelsey

1.3 Research Goals

The purpose of this study was to create a process for documenting urban change using historical maps in order to track LIC's industrialization and its effect on the neighborhood. As a means of selectively mining the data within a large study area, the study began by focusing on the decline of cultural and community institutions as an indicator of industrial growth. The initial hypothesis was that cultural institutions were replaced in the landscape with industrial factories. This project looked to show that LIC became an industrial neighborhood, moving social and cultural conveniences, such as schools and parks, to other, nearby neighborhoods.

The project began by documenting the evolution of LIC cultural institutions through five different years of historical maps. Since cultural institutions are reflective of a community's social capital (that which promotes civic engagement), they are quickly affected when industry permeates a neighborhood (Putnam 1993; Mohan & Mohan 2002; Oulton 2012). Consequently, by tracking changes in these cultural locations it should be possible to identify neighborhood changes. The results of the application of this method to LIC were analyzed to assess its overall efficacy in documenting general historical change.

The initial assessment revealed that further exploration was needed. LIC's industrialization was not explicitly apparent within this method, as many cultural institutions persisted. To better understand the neighborhood's development, the same method of tracking building use was applied to every building—regardless of type—at a smaller, local level. The result provides a more generalized insight into both the industrialization process, as well as the overall urban history of LIC.

This thesis begins by establishing a historical narrative as a foundation for the data. It then delves into the methodology for locating historical maps, georeferencing them, extracting the data, and finally, organizing those data. Following this, it reports on the analysis and manipulation of the data so as to put them in the context of the historical narrative. It compares the results with the recorded events throughout the 59 years to both prove and expand upon the neighborhood's story. As mentioned, while the first method proves insufficient, the second method shows the full process of industrialization and its effects on other building uses throughout time. This thesis ultimately corrects, falsifies and enhances the historical narrative of LIC.

CHAPTER 2: BACKGROUND AND LITERATURE REVIEW

Using GIS to understand industrial development in history brings a scientific process into more conceptual disciplines (Bodenhamer, 2010). To gain a deeper understanding of theoretical concepts, GIS establishes a spatial setting from which one can determine temporal patterns (Kemp, 2009). It gives context to complex phenomena that are often hidden within abstract texts or even empirical data. This chapter delves into both the texts that have documented LIC's history, and the texts that study spatial industrialization so as to provide a background for a GIS analysis.

2.1 Historical GIS

Ian Gregory asserts that there are three concepts that make up GIS: attribute, space and time (2010). Although many GIS studies are temporally stationary, the attributes and space are a reflection of a moment in time. Historical GIS manifests the dimension of time, showing both the cause and effect of time's events on attributes and space.

Combining history and GIS, however, can be a tricky process due to the divergence of the two disciplines. Historians are hesitant to use quantitative approaches and cartographers struggle with the representation of uncertain and ambiguous data in a thorough manner (Knowles 2008). While historians typically study the conceptual factors of time, GIS is often used to analyze data at either stagnant or timed moments. When trying to merge these two areas of study, it can be difficult to maintain the accuracy of normal data manipulation within the theoretical field that is history (Gregory 2010).

Another obstacle of Historical GIS is the myriad of "stories" that arise when combining both space and time (Massey 2013). Neither space, nor time, are motionless and to study both

together brings a, “dimension of multiplicity” in which stories can be never-ending (Massey 2013, par. 5). Add Gregory’s third Historical GIS concept, attribute, and the stories grow further.

Although the breadth of these stories can be overwhelming and difficult to organize, they are also what make Historical GIS so useful. Many historians study history using their own “mental map” of the area, documenting and analyzing events within their own spatial interpretations (Lynch 1960; Pascoe 2010). Historical GIS explores these interpretations by actualizing the mental maps and delving into their myriad of stories. The resulting data can speak to these stories, ultimately substantiating or disproving them.

In order to tackle the effects of such complexity, this study begins by referencing several sources to establish a particular mental map of the neighborhood. It creates a singular and linear historical narrative of LIC, focusing on urban development. Forming a chronicle provides context and is an essential back-drop for representing the data (Raymond 2011). In this way, it is possible to elucidate the mental map to determine its accuracy. Since this study looks to record the development of an industrializing city, the historical narrative documents this aspect of LIC’s history.

2.2 Historical Narrative: The Urban Development of LIC

A historical narrative of LIC provides a framework for this study, which helps to identify patterns in building use throughout time. Just as the study is focusing on LIC’s urban development, so does the historical narrative. This section chronicles political, social, and planning changes that occurred throughout the 59 year period during which the study takes place. This research helps to examine whether the events of the narrative had an effect on the neighborhood by providing context for the results.

Figure 4 indicates the various sub-neighborhoods of LIC, as well as the neighborhood to the north, Astoria. While these boundaries are definitive, the sub-neighborhoods are important to the history of LIC and are frequently referenced within the historical resources.

Figure 4 Astoria and historically significant LIC sub-neighborhoods

2.2.1 Pre-industrialization

The greater Long Island City—that now consists of LIC and Astoria as seen in Figure 3—emerged in the 1630's, when the Dutch at New Amsterdam awarded a 160 acre land grant in the northwest peninsula of Astoria (Queens West Villager 2011). Throughout the following decades, this area, known as Jarck's Farm, switched ownership back and forth between the Dutch and the Native Americans. Nevertheless, this settlement marked the first Long Island City community.

LIC, as it is known today and pictured in Figure 1, was established by George Hunter in the early 1800's, supplying the southwest neighborhood with its current name, Hunter's Point. When he and his wife died, their sons sold the 210 acre estate to Reverend Eliphelet Nott for $200,000 (Seyfried 1984). Dr. Nott and his friend, Neziah Bliss, an investor in steamboats and mills, built up the land together. In 1852, they leveled the estate and the underlying hills and installed building lots for homes and factories (Figure 5).

Figure 5 Hunter's Point, LIC. (left) 1849 (right) 1858 after the land had been leveled to install streets. Retrieved from "300 Years of Long Island City" by Vincent Seyfried (1984)

2.2.2 Industrialization

Following the landscape demolition, a ferry service opened, connecting Hunter's Point to east 34th Street in Manhattan. Nott and Bliss also started working with the Long Island Railroad (LIRR) to create a train station that would service more easterly villages in Queens. They won the bid and a terminus station opened up at 54th Avenue and 5th Street of Hunter's Point in 1854

(Kelsey 1896). These improved transportation methods signified the start of LIC's urban development. Seyfried explained, "industry now became possible for the first time with the railroad facilities of an island-wide railroad with its own boats to bring in raw materials and to take out finished products" (Seyfried 1984, p. 87).

At this point, farming had disappeared from LIC, leaving plenty of open space for developers. Furthermore, as transportation methods continued to progress, more companies began bringing their business to LIC. Theodore and William Steinway were two influential brothers, who opened up a piano factory in LIC in 1869. Over time they profited so much from their piano manufacturing endeavor that in 1883, they opened up their own railroad company, Hunter's Point Railroad Company, allowing better access to and from LIC for their workers. (Queens West Villager 2011). By the late 19th century, ferries and railroads all funneled passengers directly to Hunter's Point, creating a commercial, industrial and residential hub (Figure 6).

Figure 6 Hunter's Point on a Sunday in 1898. Retrieved from "300 Years of Long Island City" by Vincent Seyfried (1984)

In other parts of LIC, industrial endeavors expanded. Newtown Creek became a busy waterway as many bridges were torn down to install drawbridges that could allow large boats to pass through. In Ravenswood, many of the old mansions and parks that lined the shoreline were abandoned and demolished. Of this degradation, an 1894 New York Times article entitled "Old Long Island Mansions" wrote:

> Old mansions, with tales to tell, line the East River front in Ravenswood, Long Island and City. Separated by extensive grounds, which were once well-kept parks, these relics of past grandeur stretch along Vernon Avenue, from sooty Hunter's Point quite into Astoria. Not more than twenty years ago famous families of that period filled these great houses with life and fashion. Black clouds of smoke now hang over these once beautiful homes, which are streaked and seamed. The carved stone and iron fences have been demolished, the grounds laid waste… Manufactories and other industries gradually drove nearly all of the old-time residents out of their great houses. (New York Times (unauthored 1894, para. 1)

Steadily LIC became a largely industrial neighborhood; factories and their smoke filled the skyline.

The next big turning point for LIC occurred at the end of the 19th century, when Queens became administratively apart of New York City. On May 11, 1896, Governor Morton signed the bill, leading to the end of the local government on December 31, 1987. Once the local politicians learned that they would have no accountability, they started granting franchise and construction contracts to friends. Consequently, when Long Island City was officially consolidated into New York City in 1898, it had a great amount of construction, but had acquired massive amounts of debt (Seyfried 1984).

2.2.3 Transportation Expansion

After LIC was consolidated, various transportation projects were put into motion in order to connect Queens to Manhattan (Figure 7). In March 1909, Queensborough Bridge opened, connecting 59th Street in Manhattan to LIC. To the northwest of Hunter's Point, Sunswick

Meadow was filled in to make room for the end of the bridge. This area, now known as Queens Plaza, quickly became a transit hub. When World War I began in 1914, even more factories and industrial plants opened in LIC. Newtown Creek, the southern portion in Figure 4, experienced a sharp industrial rise as factories and refineries quickly settled along the shore. Such growth meant a need for transportation for commuters to get to and from work. In 1914, the Pennsylvania tunnels opened at the Hunterspoint Avenue Station, bringing passengers from Penn Station to LIC. Shortly thereafter, in 1915, the Steinway tunnels opened, transporting passengers from Manhattan to the Jackson-Vernon Station in Hunter's Point. Over the next few years, the train continued north, ultimately connecting with the bridge and Queens Plaza.

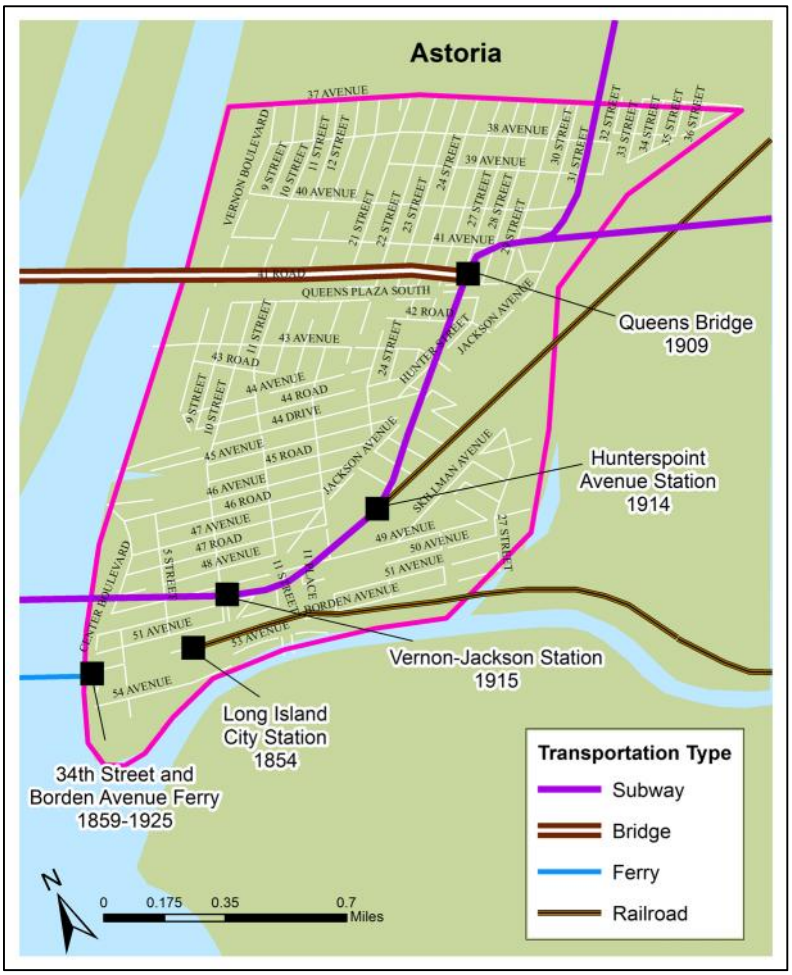

Figure 7 Transportation methods and years in LIC

The Queensborough Bridge, Pennsylvania tunnels, and Steinway tunnels all greatly affected Hunter's Point. From 1909 to 1915, the bridge traffic to and from Queens Plaza grew more than 325%. Conversely, traffic to the Hunter's Point LIRR station decreased by 77% (Seyfried 1984). Many of the commuters who had once used the ferries and LIRR to get to LIC, now began using these other methods, both of which were not located in Hunter's Point. Consequently, the ferries closed in 1925 and downtown Hunter's Point experienced a gradual decline.

2.2.4 Residential Changes

After World War I, Astoria experienced a great residential boom. Vincent Seyfried attributed this to three main causes: young families formed from the war, searching for inexpensive housing, new investors who had profited from the war looking for real estate, and finally, LIC workers, who no longer wanted to commute all the way from Manhattan or Brooklyn, searching for housing closer to their jobs (Seyfried 1984). LIC was already full with industrial and transportation construction, but Astoria still had many open areas for new construction. Consequently, not only did many Brooklyn and Manhattan residents move to Astoria, but so did LIC residents, looking to trade LIC's industrial character, for Astoria's residential one.

Astoria quickly became a busy residential neighborhood whose inhabitants commuted to many other parts of the city. Table 1 describes the number of people commuting through the turnstiles from the first subway stop in LIC (39th Street), up into the subway stops in Astoria (36th, Broadway and 30th Avenues) from 1920 to 1929. The statistics show a drastic increase in commuters at the three stops within Astoria, while the first and only stop in LIC increases steadily, but not with the same extreme increments.

Table 1 Turnstile percentage change at subway stops in LIC and Astoria between 1920 and 1927

Stop	Neighborhood	1920	1920 to 1927	1927 to 1928	1928 to 1929
39th Avenue	LIC	790,360	56.01%	2.72%	8.31%
36th Avenue	Astoria	1,026,600	91.75%	9.48%	20.12%
Broadway	Astoria	2,063,800	101.05%	12.33%	12.28%
30th Avenue	Astoria	2,044,800	106.85%	11.11%	8.78%

Source: Data adapted from Seyfried's "300 Years of Long Island City" (1984 p. 155).

The stock market crash in 1929 ended the housing boom of the 1920's. Queens, as a whole, felt the effects of the Great Depression, however LIC's already industrial character endured. Both the 1939 World's Fair in Flushing Meadows, Queens and the build up to the World War II, kept LIC's manufacturing business afloat. These industrial practices remained consistent throughout the war (Asadorian and Seyfried 1991)

Manufacturing in the United States remained steady throughout the first half of the 20th century and peaked in 1950. However, between 1973 and 1975, production decreased by almost 12% (Federal Reserve Bank of New York Annual Report 1976). LIC experienced much of this deterioration as it had long relied on its industrial character. As factories were abandoned and unemployment soared, LIC experienced a sharp economic decline in the second half of the 20th century.

2.3 Trends in Industrial Societies

Industrialization has a dramatic effect on culture in a city. As production increases, so does the population's income. Such economic growth allows for investment in social capital within the community (Mahdavi and Azizmohammadlou 2013). Consequently, industrialization can help to develop cultural institutions, such as schools and churches, which help benefit the sense of community. For much of the 19th century, LIC experienced these effects. The ferries

brought people from Manhattan to Hunter's Point where saloons, shops and homes were abundant.

However, when Long Island City was consolidated under New York City in 1898, it was no longer a city unto itself. It swiftly became a neighborhood within a much larger city. Despite nurturing economic and cultural development, industrialization can also trigger separation of land uses as dense cultural areas become separated from the industrial neighborhoods where people commute to and from (Gilliland and Olson 2013; Mahdavi and Azizmohammadlou 2013; Pratt 1911). This was especially noticeable for LIC as a new neighborhood in the early 1900's. Rather than live in LIC, factory workers commuted from other parts of New York City in order to work there and consequently, the neighborhood no longer needed to provide the same amount of cultural and social services that a whole city would need (Pratt 1911).

By tracking the late 19th and early 20th century development of LIC, one would expect to see the effects of such segregation on cultural institutions. Knowing both these industrial trends, as well as the events established in the historical narrative, provides context for this study's data. Ultimately, this thesis creates a method for collecting building points and their uses from historical maps so as to identify and analyze both industrial trends and historical events. The resulting data is compared with this foundational research in order to support it, as well as identify new patterns.

CHAPTER 3: DEVELOPING THE DATASET

Having established the historical narrative of the land and time, it is possible to turn to historical maps to provide context. Prior to GIS technology, illustrated maps were a great way of documenting and organizing information about the land. However, such maps were more qualitative than quantitative, since they did not have a proper way of discerning the intricate pieces of data. Lack of quantitative data in these maps, makes it difficult to follow changes in the land from one year to the next. This chapter discusses methods that can be used to find, collect and organize data in historical maps as a basis for quantitative analysis. It specifically examines historical LIC maps to compare their illustration of the neighborhoods to the previously examined historical narrative. In order to use GIS to document change in these maps, it was necessary to first gather and classify data from them so that the relevant information was available and highlighted. This process required five main steps: locating relevant historical maps, georeferencing maps, digitizing features, organizing data, and assigning shift types. The culmination of these steps ultimately helped to confirm the historical narrative, and subsequently, expand upon it.

3.1 Historical Maps as Data Sources

Sanborn maps are fire insurance maps that document buildings in cities all over the United States. Produced from 1867 to present day, these maps provide snapshots in time that illustrate existing building footprints, construction details and building uses, as well as street names and water lines (Figure 8). Sanborn maps were this study's primary resource for documenting historical LIC, as they provide a comprehensive record of the location and functions of buildings throughout the period of interest. Such detail made it possible to track the building uses across several years in order to detect change in the neighborhood's history.

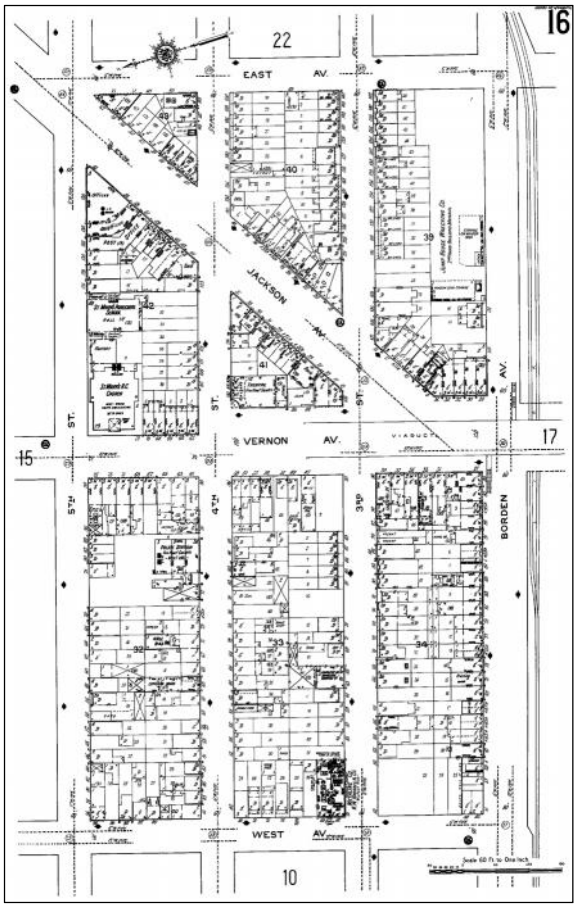

Figure 8 Sanborn map from 1915, Sheet 16

The Atlas of New York also produced maps similar to Sanborn maps. They too documented land use by parcel, however, their maps covered a larger extent of land. Whereas each Sanborn map only covers four to eight blocks, The Atlas of New York Maps cover over a hundred. Furthermore, digitally acquired Atlas of New York Maps tend to appear in color (Figure 9). This is due to the fact that they were directly scanned, whereas the Sanborn maps were scanned from microfilm. Since the earliest Sanborn map of LIC is 1898, this study also used an Atlas of New York map from 1891. This allowed for the study period to reach further back in time.

Figure 9 1891 New York Atlas Map of LIC

Ultimately, this study examined a total of five time periods using The Atlas of New York and Sanborn maps (Table 2). The maps spanned from 1891, when LIC had begun to move away from its farming past, to 1950, when LIC was at its peak of industrial production (Greenberg 2008). This time span allowed for a comprehensive evaluation of an evolving industrial area and its effects on the cultural aspects of the neighborhood.

Table 2 Map years and sources

Year	Company
1891	The Atlas of New York
1898	Sanborn Maps
1915	Sanborn Maps
1936	Sanborn Maps
1950	Sanborn Maps

3.2 Georeferencing

To begin the process of documenting the neighborhood's evolution, it was necessary to first georeference the raster maps. Consequently, these maps were aligned to modern-day LIC

under coordinate system, NAD 1983 State Plane New York Long Island**.** Intersections between streets provided the control points for all the maps. Although the latest maps (1950, 1936, and 1915) included modern-day street names, the earlier maps (1891 and 1898) did not. The 1915 Sanborn series proved to be a useful reference for these older maps, as it recorded the modern-day streets, but also included their former names in parentheses. This information helped to ensure that all control points were linking the correct historical intersections to modern-day streets.

While the 1891 Atlas of New York covered the entire study area of LIC, it took forty-seven Sanborn maps per year to cover the same extent (Figure 10). The Atlas of New York map required a total of fifteen control points, for a root mean square (RMS) error of 5.17 under the third polynomial. This indicates that there was approximately a five meter residual between the control points.

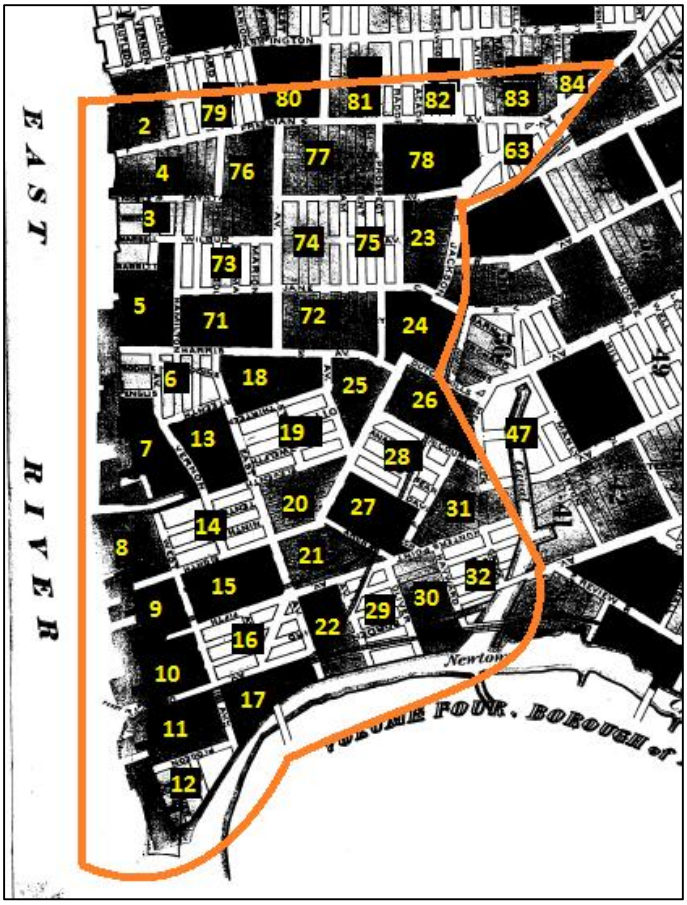

Figure 10 The black and white key, showing all forty-seven Sanborn maps covering LIC

Each of the 47 Sanborn maps required five control points, but the shoreline maps did not always meet this requirement. Since shorelines can change drastically over time, it was impossible to use any portion of it as a reference point (USGS 2011). Consequently, many of the shoreline Sanborn maps only had three or four control points, making their RMS errors greater. Ultimately, this was not a serious source of error. Since the maps were referenced and digitized according to modern-day LIC as a baseline, it was more important that the maps lined up with one another. Therefore, when the next process of feature digitization began, each feature simply needed to align with the location of its historical counterparts.

In order for quick rendering, the forty-seven Sanborn maps from each year were placed into mosaics, the results of which are provided in Appendix A. This ensured quick image

rendering, but it also highlighted the areas of each individual map that had overlapping blank map margins. Since the images were not trimmed prior to georeferencing, the borders of each of the 47 maps overlapped one another (Figure 11). This ultimately made it difficult to view certain portions of the study area on the mosaic, particularly when trying to digitize attributes that appeared in the white areas. Nevertheless, when white space occurred in an area that needed to be digitized, the corresponding original map was inserted to overlap the white space.

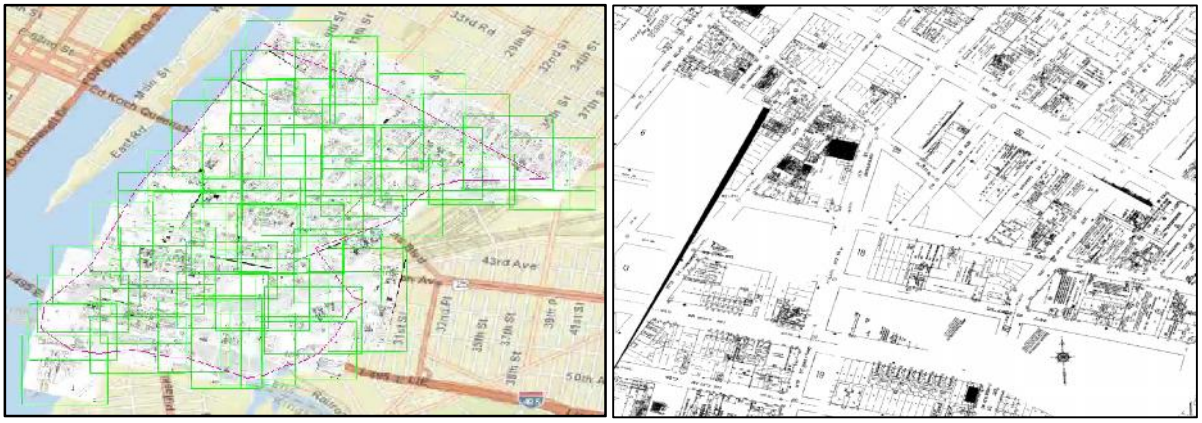

Figure 11 Mosaic of 1936 Sanborn maps georeferenced to modern-day LIC. (left) Each footprint highlighting all forty-seven maps. (right) A portion of the mosaic without footprints showing overlapping white spaces and mapsheet edges.

3.3 Digitization

To document and measure culture in an industrial society, it was first necessary to define it. The classification of cultural points incorporated both available historical spatial data, as well as previous literature on cultural institutions. In his essay, "Managing the unmanageable: The politics of cultural planning", Cliver Gray argues that culture can be categorized under two categories: material and valuative (Gray 2004). Material culture, according to Gray, is formed from resources and activities, such as playgrounds and recreation, while valuative culture is formed from a society's makeup, such as the people's ethnicity, religion, and background. In this case, this project evaluated culture from a material point of view, as this is the data that was

present in the historical maps. By examining these maps, it was possible to locate and digitize any illustrated institutions that constitute material culture as defined by Gray. Ultimately, each cultural category was defined first by Gray's definition, and secondarily according to data available on the historical maps as building labels and names. Consequently, material culture fell into one of five physical categories: Religious Center, Museum/Library, School, Social Service (such as Police Stations and YMCA associations), or Park.

Fire insurance maps contain an enormous amount of information. Digitally capturing and categorizing all of that information comprehensively would take a great deal of time. In an effort to develop a methodology that would be both effective yet efficient, only the locations of buildings housing four of these five cultural categories—excluding parks—were digitized as points on each of the five maps. By documenting these civic resources (places of material culture) as points in each map year, it was possible to track their presence—or lack thereof—over time while not worrying about matching evolving building footprints. Limiting the digitization effort to only points at cultural locations significantly reduced the magnitude of the digitization task while still allowing the study question to be addressed. Related studies may ultimately benefit from documenting every building within the study area as a point, and analyzing its change throughout the years, but with such a large study area, the process would be onerous. This approach, however, is time-effective and puts a greater emphasis on the cultural points and their shifts, ultimately reducing—albeit limiting—the data.

To record these building use shifts, each digitized point that referenced a cultural institution in at least one year, needed to be classified for all five years. For instance, a building that was a school in 1915, was also classified by use for all other four years: 1891, 1898, 1936 and 1950. Sanborn maps meticulously categorize building use based on "size, shape, and

construction of dwellings, commercial buildings and factories," as well as providing "widths and names of streets, property boundaries, building use, and house and block numbers." (Ristow 2014, para. 1) Such details were used to determine the use of a building as it evolved through time. This study generalized the Sanborn building use types into five categories: Cultural, Shop, Residential, Vacant, and Industrial. The Cultural type was then given the previously stated cultural institution subtypes (Table 3).

Table 3. Building use type and subtype

Type	Subtype
Cultural	School
	Religious Center
	Social Service
	Museum/Library
	Park
Shop	Shop
Residential	Residential
Vacant	Vacant
Industrial	Industrial

While points represented religious centers, museums/libraries, schools and social services, polygons represented parks. This is due to the fact that the study is not about building use footprint, but the building use *presence*. Consequently, the first four categories were digitized as points to emphasize quantity and magnitude of building use shift over time. Parks are the exception to this rule, as they hold a bigger footprint and can be overtaken throughout time by multiple buildings. This study focused on point data to understand cultural shifts, but also digitized park polygons in order to have a complete visualization of the area's cultural development. For instance, Figure 12 shows a close up view of the changes that occurred over time to Ravenswood Park, a large park that resided in the center of LIC in 1891. By simply

digitizing and classifying the Sanborn and Atlas of New York maps, it was possible to observe the conversion from an initial cultural institution, to an area occupied by factories.

Figure 12 Ravenswood Park lot changes from 1891 to 1950

3.4 Data Organization

Once all the points were digitized, it was necessary to organize them. Since each point was digitized according to individual historical maps, all the points were in separate feature classes corresponding to their year. However, in order to grasp how these points had shifted from one year to the next, it was necessary to combine them. In the essay, "Denny Regrade, 1893-2008: A Case Study in Historical GIS", Aaron Raymond explains that this approach to organizing a historical dataset allows for a comprehensive analysis of both the feature's presence at a singular moment in time, as well as its existence from year to year (Raymond 2011).

To organize the point data once it was digitized, a ModelBuilder model (provided in Appendix B) streamlined the process of merging, arranging, and assigning ID numbers to digitized cultural institutions. It accomplished this by gathering all points that were once cultural institutions into a single file and deleting any duplicates that indicated points that had remained or reoccurred throughout the years. Then it assigned each feature an ID and copied them into five additional feature classes, one for each year. It then assigned each class a year and combined the features into one complete dataset by appending all years' feature classes back into the first year's feature class. This model ensured that all cultural features identified on every map were documented, had a point location ID, and included a year.

Such categorization readied the data to be organized by shift type, but also allowed for preliminary analyses of building use types and placement. For instance, Figure 13 illustrates the cultural institution subtypes for each year. While the data does not explicitly show the shifts in points from year to year, it does give an introductory look into the types of cultural institutions. It begins to give context to the historical narrative that was discussed earlier in Chapter 2 and it starts to point out new stories. For instance, the Northwest corner slowly loses cultural

institutions, both religious centers and parks. This could possibly be attributed to the development of factories along the shoreline, as described in Chapter 2.

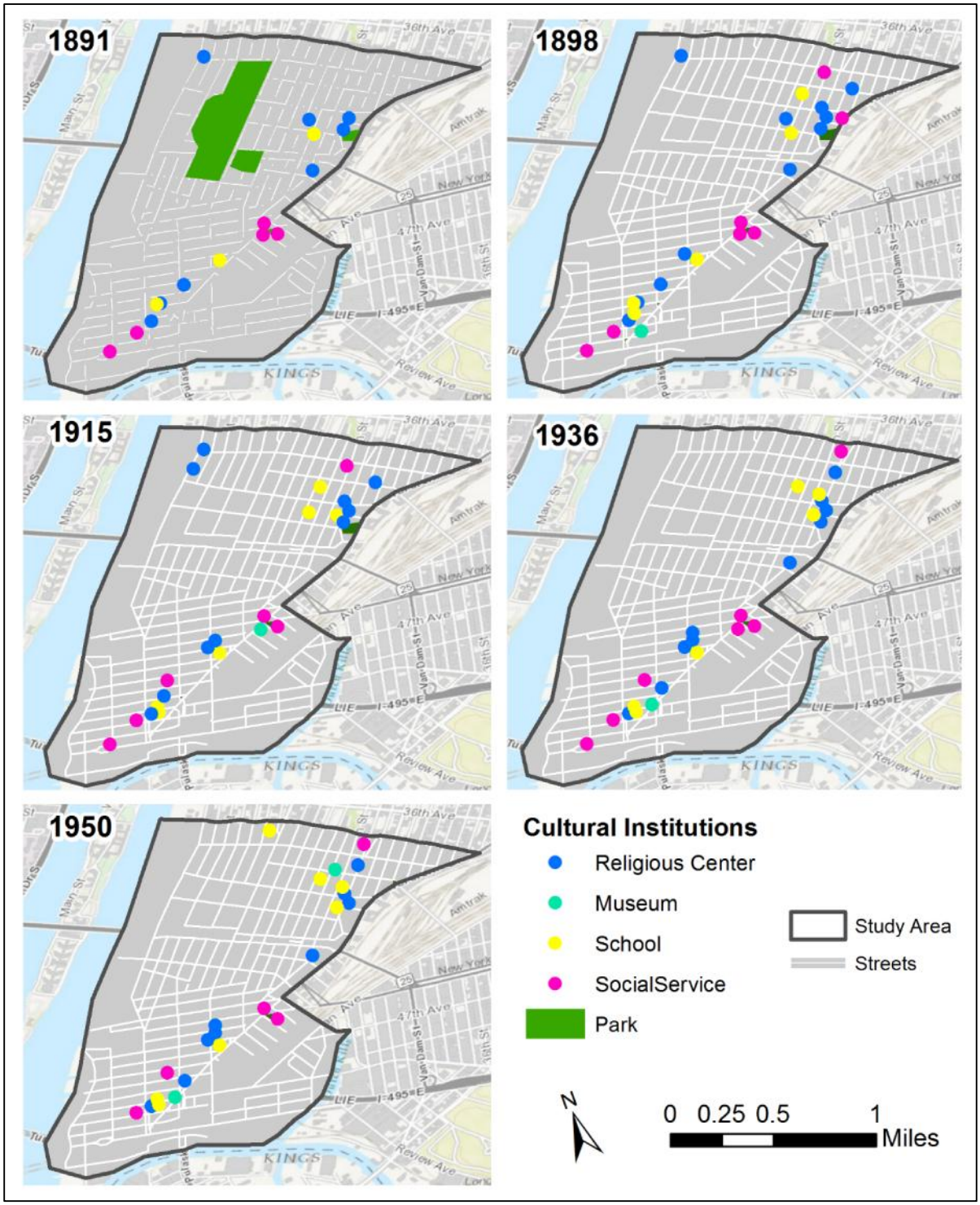

Figure 13 Type and subtype of cultural institutions for all five years.

Organizing and categorizing the data in this way also allowed for a preliminary examination of all building types for each point from year to year. Table 4 shows the number of each building use type over all five years. Furthermore, Figure 14 illustrates the use type of points that had once been a cultural institution. A visual analysis of this is used to understand how they changed throughout the years. Table 4 shows that next to cultural institution, which will predominate due to the nature of the data collection, vacant and industrial uses were most prevalent at other times. Again, by considering the historical narrative, one could conclude that the vacancies decreased as the area was built up, and industrial points increased as manufacturing intensified. These types of conclusions, as well as the stories that can be uncovered from the data, are discussed further in Chapter 4.

Table 4 The count of each building use type for each year.

Type	1891	1898	1915	1936	1950
Cultural	17	24	23	24	23
Industrial	2	0	3	8	14
Residential	5	6	3	1	0
Shop	1	3	7	4	2
Vacant	16	8	5	4	2

Although these data and maps are useful as a basis for understanding building use at these individual points from year to year, it is difficult to visualize change. One can perhaps review the data to get a static understanding of the points, but it is nearly impossible to understand the changes temporally. Furthermore, the spatial pattern of change cannot be clearly tracked. To assess these changes, this study took the point data and analyzed how they shifted from one map to the next.

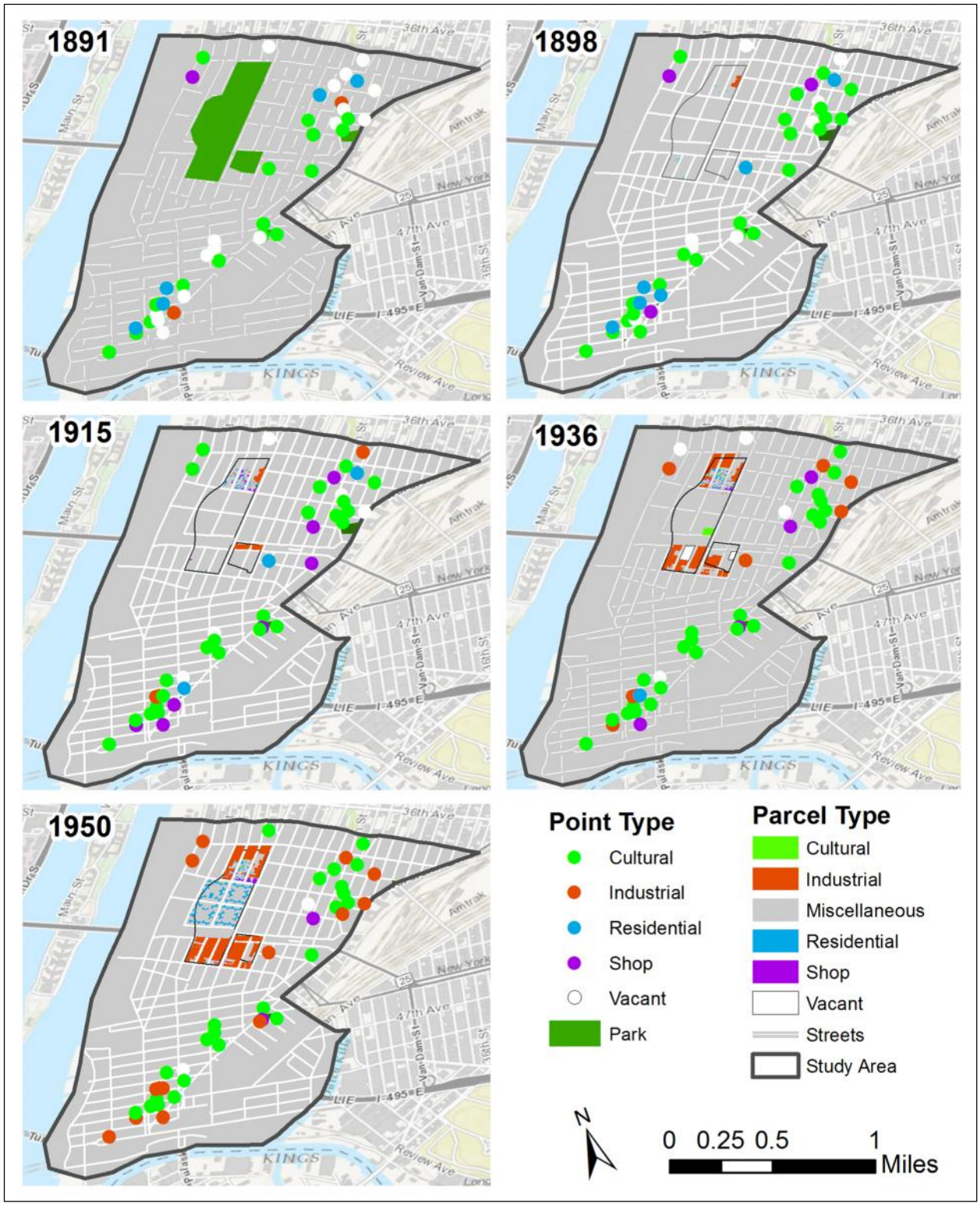

Figure 14 Cultural institution locations over all five years

3.5 Assign Shifts

To incorporate the aspect of time, these points were compared to one another in a forward and linear context. Shifts between points recorded the type of change that occurred at that location from one map year to the next. Consequently, there were four periods of shifts: 1891-1898, 1898-1915, 1915-1936 and 1936-1950. The shift types were classified by comparing the point of the originating year with the consequent year. If the latter year did not match the originating year type, then the shift type reflected the building use type of the latter year. Conversely, if it did match, then the shift type would indicate that there was no change in building use type. This produced ten different shift types (Table 5).

Table 5 Classification of shift type from originating year to the consequent year

Originating Year Type	Consequent Year Type	Shift Type
Other	Cultural	Cultural
	Shop	Shop
	Residential	Residential
	Vacant	Vacant
	Industrial	Industrial
Cultural	Cultural	Cultural No Change
Shop	Shop	Shop No Change
Residential	Residential	Residential No Change
Vacant	Vacant	Vacant No Change
Industrial	Industrial	Industrial No Change

A ModelBuilder model helped to simplify the process of establishing shift types. This model is illustrated in Appendix B. It started out by assigning ratings for the type of point (Table 6). Then, using Calculate Field, a Python script added the previous point's value to the current feature's value.

Table 6 Shift ratings for each point type.

Point Type	Rating
Cultural	5
Residential	4
Shop	3
Vacant	2
Industrial	1

Another Python Script then used an If-Else statement to detect when there was no change in building use type. It did this by identifying when the last feature's rating was the same as the current feature's rating. For instance, if the "Shift Rating" (sum) was 6 and the current feature's Rating was 3, then that feature had remained a shop from one year to the next. All other Ratings with a value of 3 indicated that the point had shifted to a shop, regardless of the previous year's category. Finally, every fifth entry was deleted, since this row incorrectly summed ratings for different locations that were simply adjacent in the list.

These two ModelBuilder models produced a dataset containing four periods of shifts. Each entry represents a point and documents how it has shifted from one year to another. Table 7 provides a sample of the dataset, showing the points' ID, type, year, rating and sum of rating from the previous year, and finally, type of shift that occurred.

Ultimately this data preparation provided the foundation for exploring the stories of building uses in time and place. Aided by the historical narrative, the data gives context to the development of the land, and even illustrates stories that may not otherwise be apparent. The stories uncovered by the spatial and numerical analysis are explored in the following chapter.

Table 7 Sample of the resulting dataset, documenting Types, Subtypes, Ratings and Shifts through time periods

OBJECTID	Time	ID	Subtype	Type	Rating	Shift Rating	Shift Type
149	1891-1898	39	Residential	Residential	4	8	Residential No Change
150	1898-1915	39	Police Station	Cultural	5	9	Cultural
151	1915-1936	39	Police Station	Cultural	5	10	Cultural No Change
152	1936-1950	39	Police Station	Cultural	5	10	Cultural No Change
153	1891-1898	40	Library	Cultural	5	7	Cultural
154	1898-1915	40	Shop	Shop	3	8	Shop
155	1915-1936	40	Shop	Shop	3	6	Shop No Change
156	1936-1950	40	Factory	Industrial	1	4	Industrial
157	1891-1898	41	YMCA	Cultural	5	10	Cultural No Change
158	1898-1915	41	YMCA	Cultural	5	10	Cultural No Change
159	1915-1936	41	YMCA	Cultural	5	10	Cultural No Change
160	1936-1950	41	Factory	Industrial	1	6	Industrial
161	1891-1898	43	Residential	Residential	4	9	Residential No Change
162	1898-1915	43	Residential	Residential	4	8	Residential No Change
163	1915-1936	43	Industrial	Industrial	1	5	Industrial
164	1936-1950	43	Industrial	Industrial	1	2	Same Industrial

CHAPTER 4: EXPLORING THE STORIES

This method of data collection and organization produced a dataset of cultural points and their transitions over time. The historical narrative developed in Chapter 2 provided background for the data collection, laying a foundation through which to understand it. By using the extracted data to further examine the historical narrative, it was possible to see if the data was in fact telling the same story, or if additional analysis was needed. This chapter explores the dataset, as well as its shortcomings in order to show its insufficiency. It then describes the use of the same data collection process to develop a more robust dataset and explores the historical implications as it relates to the narrative.

4.1 Enumerating the Shifts

Although some locations remain in the same category from year to year, many changed. Table 8 lists the total number of each kind of shift in each year. There are naturally more cultural shifts because cultural points were used as the basis for finding points, but there are other conclusions that can be drawn from this data.

Table 8 Each type of shift for each period

Change to:	1891-1898	1898-1915	1915-1936	1936-1950
Cultural	8	8	7	2
Industrial	0	3	6	6
Residential	2	0	1	0
Shop	2	5	0	0
Vacant	1	2	2	0

One of the most noticeable changes in the data is the reduction of cultural shifts and increase in industrial shifts as time moves forward. By 1950, industrial shifts surpassed the cultural ones, meaning that more buildings had been industrialized than any other type of shift. This is a contrast to the 1891 to 1898 time period, when there were eight cultural shifts and zero

industrial shifts. However, while these changes are noticeable, the numbers are not particularly significant. Due to the nature of this data collection, cultural institutions will tend to have larger numbers, making the comparison to industrial shifts negligible.

4.2 Visualizing the shifts spatially

More still can be uncovered by exploring the points' shifts spatially. Such visualizations not only back up the tabular results, but they also allow one to identify and track spatial trends and relationships that may not have otherwise been noted (Knowles 2008). Figure 15 illuminates these shifts, including both the points that have remained the same and the points that have shifted to a different category. Similar to the tabular data, it is evident by viewing the maps that there were no industrial shifts at these cultural points from 1891 to 1898, but industrial shifts increased as time continued. By the 1915 to 1936 time period, there were many apparent industrial shifts throughout LIC.

Throughout all four time periods, there were two areas that appeared to have the strongest cluster of points; the southwest section, known as Hunter's Point, and the northeast area, known as Queens Plaza. These are the same areas that are historically significant for Long Island City because they were both major centers of transit at different points in time. As discussed in Chapter 2, in the late 19th and early 20th centuries, Hunter's Point was considered the downtown (Stadler 2014). However, when the Queensborough bridge opened in 1908, and the Long Island Railroad (LIRR) extended into LIC in 1915, Queens Plaza became the new bustling center, as Hunter's Point lost many of its commuters. By July 1918, the number of commuters to Hunter's Point had fallen over 99% and in 1925, the ferries traveling from Manhattan to Borden Avenue in LIC were shut down (Seyfried 1984).

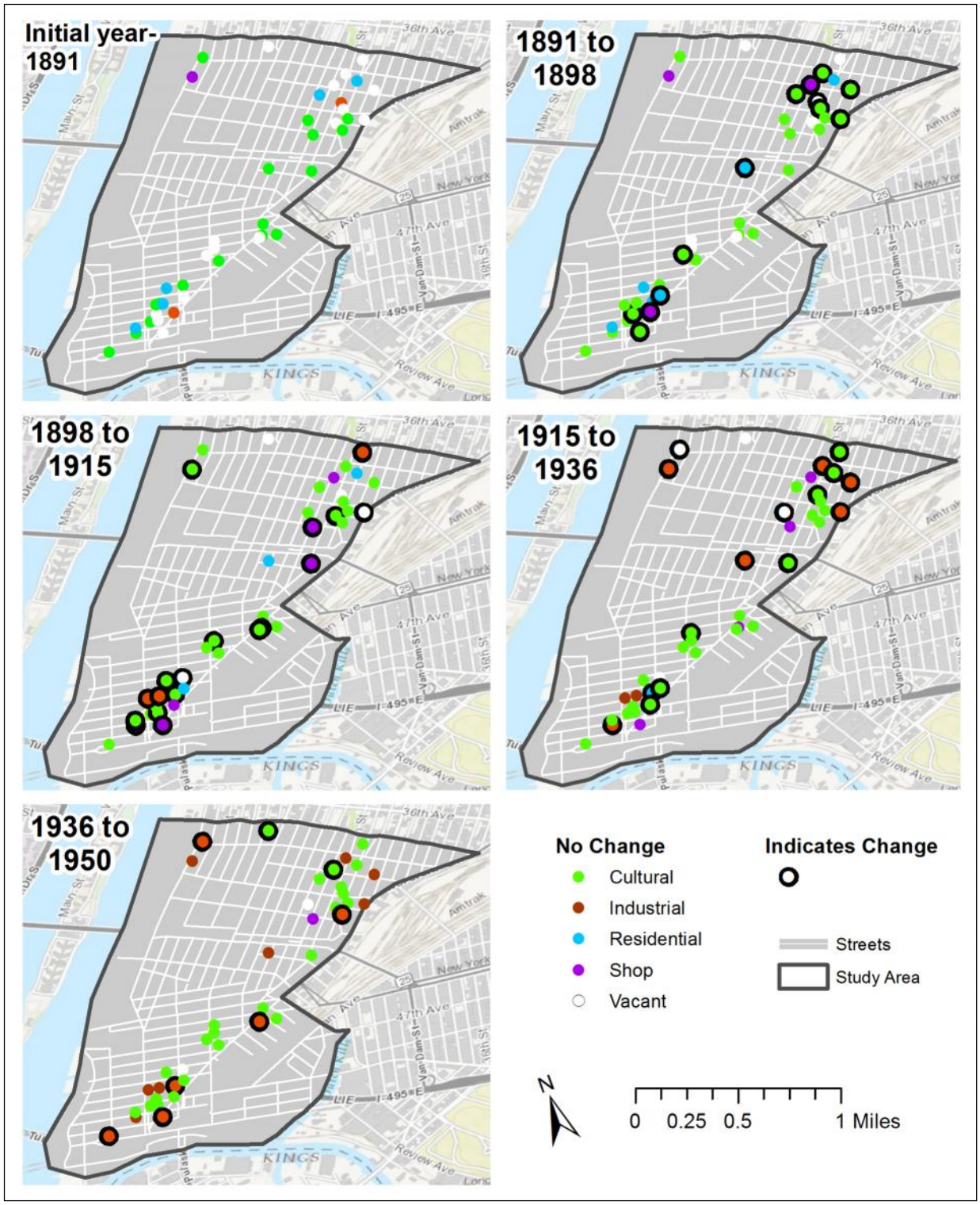

Figure 15 Shift types for each time period

4.3 Drawbacks of the Widespread Culturally-Focused Method

Although industrial shifts appeared to increase in LIC over time, the hypothesis that loss of cultural institutions would indicate industrialization did not hold true. In reviewing the data and the map, many cultural institutions persisted through time. For instance, out of the twenty-three cultural locations in 1950, only two had shifted from another type. The other twenty-one had remained cultural institutions from the previous map year. Such results differ from the hypothesis, as they show that many cultural institutions were not altered by the industrialization of LIC, but were instead grounded in their existence.

Thus the chosen methodology not only appears to disprove the hypothesis, but it also did not corroborate the complete historical narrative of LIC. The decision to focus only on collecting cultural institution points from the historical maps was made deliberately to control the amount of data that had to be extracted, making the effort more efficient and manageable, while still acquiring the key data about the locations of cultural shifts. However, reducing the data also meant limiting it, and in not documenting all the building uses through all of these time slices, the story was incomplete.

In “Denny Regrade, 1893-2008: A Case Study in Historical GIS”, Aaron Raymond asserts that there are three different data validation techniques for historical GIS: continuing data validation during and after digitizing elements, verifying datasets against source material, and testing datasets with sample selection queries (Raymond 2011). This study followed all three techniques, however, upon executing the second, it was apparent that the data did not fully support or enhance the historical narrative that had been created. There were certainly trends that could be visualized from the current set of data, and it began to support the historical narrative, but many of the more specific stories were not apparent. For instance, the historical narrative suggests that as Queens Plaza was built up through several transportation initiatives, Hunter’s

Point began to decline. However, these maps do not indicate significant transformations in either of these two sub-neighborhoods. Ultimately, this method helped to understand in what time period cultural points shifted and what they changed into, but it was not useful in introducing a truly detailed historical analysis of LIC.

Furthermore, as Ian Muehlenhaus explains, "It is particularly important to note that if a sample is not randomly selected, it is impossible to infer your results upon a larger population of maps" (Muehlenhaus 2011, p. 13). When the data is not sampled, as in this case, conclusions cannot necessarily be applied to the whole area. This study's method of data collection does not sample data, but only documents the building use of a point that at one moment in time was a cultural institution.

4.4 Diving Deeper

To overcome the drawbacks of the original un-sampled and limited dataset, a historically significant section of Long Island City was chosen for a more in-depth analysis. Hunter's Point, the area in the south of Figure 4, was chosen as a new, more-localized study area that had undergone a diverse transformation in the first half of the 1900's. Ideally, a more detailed analysis would show that Hunter's Point thrived in the earlier part of the 20th century, but experienced a large amount of industrial growth and vacant lots once the Queensborough Bridge was built and the LIRR expanded to Queens Plaza. Since the commuters no longer came to Hunter's Point on their way to and from work, the cultural institutions and shops did not benefit from the same amount of patronage anymore. Rather than focus on cultural institutions, this new method documented the building use for every point that was once a building in the 5 x 3 block area using the same methodology described in Chapter 3.

The 1891 Atlas of New York map could not be used for this more detailed study as its classifications and illustrations differed too much from the four Sanborn maps and could not be reconciled for lack of detail. Furthermore, since this dataset was to be more granular, there were a variety of footprints to be accounted for. Digitizing building footprints would certainly be an intriguing, though time-consuming, approach. However, this study continued documenting points so that it would, firstly, utilize the same methodology and, consequently, be compared to the previous, limited dataset.

To overcome the challenges of changing footprints—such as a group of buildings that become an industrial complex—all identifiable buildings were digitized as a single point in all map years, regardless of footprint (Figure 16). Since the maps were georeferenced to modern-day LIC, a group of points that covered a large area that eventually became one building or complex would be assigned the same category as the area that they existed in on the later map. Each and every point that was once a building in all four years was digitized and categorized in every other year using the same process as described earlier. By documenting the buildings as points in this way, the expansion and retraction of footprints were taken into account.

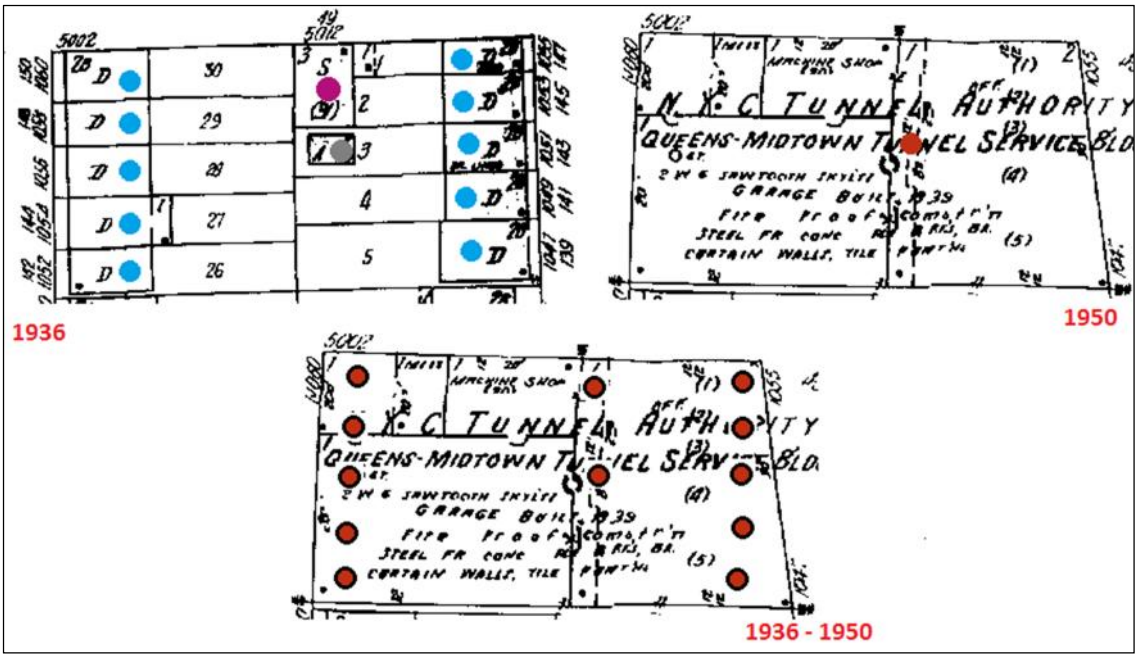

Figure 16 Diagram demonstrating how shifts were determined based on the footprint of the latter year's categorization. Parcels at the corner of 11th Street and 50th Ave shifted from residential lots (*D*), one shop (*S*), and one garage (*A*) to an industrial complex, which is represented in the shifts of the points from 1936 to 1950.

Using the same method for identifying shifts (as described in Chapter 3), each point was assigned a rating and each rating was compared to the previous year's so as to determine the type of shift that occurred. This allowed for a similar spatial analysis to be conducted while meticulously tracking each and every building and how its use transformed through the time periods.

Due to the nature of the collection of the first dataset, cultural points would logically occur the most, but this does not lend itself to a comprehensive analysis of the study area. For instance, when digitizing the new study area, it became apparent that a new category needed to be included. In addition to the original five building types (Cultural, Industrial, Residential, Shop, and Vacant) a new categorization known as "Other" was added, which grouped together subtypes that were previously unneeded (Table 9). It was not that these subtypes had been

disregarded in the previous methodology, but they were simply not observed within the smaller dataset. Such new categories were captured under the "Subtype" field, but grouped under the "Other" type to consolidate the data. Whereas the vacant type describes a building that was specifically labeled as such on the Sanborn map, the absent subtype described a space that either had no building, or no label to indicate a building.

Table 9 Subtypes included under the Other type in the new dataset

Type	Subtype
Other	Garage
	Storage
	Absent
	Livestock
	Transportation

4.5 The Story at the Local Scale

By not concentrating on cultural institutions and examining every building, it was now possible to focus on all shift types (Table 10). In analyzing this data, however, it is important to acknowledge that not every single point represents a building location in every year. These points, as described in Figure 16, keep track of changing footprints, but do not denote the total amount of building use types. Nevertheless, in studying the results, there are clear trends in shifts of building use types.

Table 10 Number of each type of shift in Hunter's Point

Type	1898	1915	1936	1950
Cultural	9	13	14	13
Industrial	27	47	114	141
Other	122	109	77	107
Residential	301	269	254	205
Shop	158	176	153	144
Vacant	1	4	6	7

Continuing by documenting the percentage increase from year to year, many more fluctuations in point type became apparent (Table 11). Ultimately, within this smaller study area, it was apparent that the cultural institutions did not, in fact, alter significantly in comparison to many of the other building types. While there was a decent increase of cultural points between 1898 and 1915, the other time periods showed negligible changes. Other categories, such as industrial and residential, had substantial variations from year to year. From 1898 to 1915 and 1915 to 1936, industrial points grew by 74.07% and 142.55%, respectively. Conversely, residential points steadily decreased, losing 31.89% of the points between 1898 and 1936.

Table 11 Percentage change in point types between each time period

Type	1898 to 1915	1915 to 1936	1936 to 1950
Cultural	+44.44%	+7.69%	-7.14%
Industrial	+74.07%	+142.55%	+23.68%
Other	-10.66%	-29.36%	+39.96%
Residential	-10.63%	-5.58%	-19.29%
Shop	+11.39%	-13.07%	-5.88%
Vacant	+300%	+50%	+16.67%

While these percentages are telling for the time, it is important to consider the difference in range of years for each time period. While there are 17 years in the first time period, there are 19 in the next, and 14 in the final. The differences in ranges could explain why the shifts are greater from 1915 to 1936. In order to take these variances into account, the following formula calculated the relative rate of shifts per year in that time period:

$$Shift\ Rate = \frac{(S_{Latter} - S_{Initial})}{(Y_{Latter} - Y_{Initial})}$$

where the Shift Rate identifies the increase or decrease of the type of shift (*S*) between two map years (*Y*). Such a formula provides more context for the range of years and puts certain types of shifts into perspective (Table 12).

Table 12 Shift rate in shifts per year

Type	1898 to 1915	1915 to 1936	1936 to 1950
Cultural	+.24	+.05	-.07
Industrial	+1.18	+3.53	+1.93
Other	-.76	-1.68	+2.14
Residential	-1.88	-.79	-3.50
Shop	+1.06	-1.21	-.64
Vacant	+.18	+.11	+.07

While this interpretation of rate does not necessarily indicate what changes occurred from year to year, it does show the increases and decreases as it relates to the map year differences and total number of type variations. For instance, vacant shifts are given less importance due their overall low count and their overall rate change is minimal. However, it is still evident that industrial shifts show a dramatic increase throughout time. What is more, industrial shifts increase at the same rate from 1915 to 1936 as residential shifts decrease from 1936 to 1950. These two are the largest rates of change, which was not as evident in the percentage change.

Just as Figure 15 illustrates the shift of cultural institutions, Figure 17 illustrates the shifts from 1898 to 1950 for *all* building uses. Within these maps, shifts, in general, seem to peak from 1915 to 1936, and by 1950, there are a large number of industrial locations. It is not only more apparent in this denser dataset that Hunter's Point experienced steady industrialization, but it is more accurate to conclude that this was the case. Every point is accounted for, and therefore, the entire study area, and not just a sample, is considered.

Figure 17 Building use shifts in Hunter's Point from 1898 to 1950

As mentioned, the Hunter's Point study area was chosen based on its historical relevance within LIC. With this clearer and more diverse dataset, it was possible to compare the results to the historical narrative developed in Chapter 2. This study's principal reference for historical LIC, "300 Years of Long Island City" by Vincent Seyfried, declares that Hunter's Point became, "a ghost town of shabby and neglected buildings" once the Queensborough bridge and Steinway tunnels were opened (Seyfried 1984 p. 139). The sharp increase in industrial points and decrease in residential points demonstrates the decrease in commuter patronage.

However, the other types of shifts do not speak to Seyfried's assertion that Hunter's Point became a ghost town. In fact, despite increasing over time, vacant points only made up 1% of the total points in 1950. The results ultimately challenge this portion of historical narrative.

In her essay, *City as Space, City as Place: Sources and the Urban Historian,* Carla Pascoe attributes historians' various views of the past to the types of sources they use (Pascoe 2010). She argues that oral history is the primary and most-reliable source, while urban planning documents tend to be more skewed, since they were specifically created to solve a problem. In forming his chronicle of Long Island City, Seyfried used a variety of historical references in order to form his own mental map of the area. This mental map could be influenced by the types of sources he used, forming a different representation of the area than that which had occurred. Although it is well known that Hunter's Point experienced decay during industrialization, it is apparent that it was not necessarily a "ghost town", since several cultural institutions persisted and many shops still lined the streets. The results help to illuminate this remaining activity in the sub-neighborhood, showing an area that could not solely be defined by industry and vacant buildings.

4.6 Looking Backwards

The study of history is useful in documenting causes and effects throughout time (Bodenhamer 2008). So far, however, this study has only documented what the locations have shifted *into*, but not what they have shifted *from*. Determining the initial location type is important so as to identify any transformation triggers. By rearranging the Python script in the original ModelBuilder model, it was possible to track changes in the point based on its initial category. Just as before, the script used an If-Then statement to compare the Shift Rating (sum) to the Rating for that particular feature. It determined both to and from categories by assessing the difference between the sum and the current feature's Rating. For instance, if the sum was 5, and the current feature's rating was 1 (industrial), then the point had shifted from a residential location (Rating = 4) to an industrial location. A copy of this script is provided in Appendix B. Table 13 shows the totals that the ModelBuilder model produced. Only transformations that had at least one entry in one year appear, so if a specific type of transformation is not listed below (such as Vacant to Shop) it did not occur.

As expected, many locations simply remained the same type of building, as this requires the least amount of investment. However, "Other to Industrial" was the biggest type of shift. Since the "Other" type consists of several subtypes, Table 14 shows how these "Other to Industrial" shifts were split. Locations that shifted from absent (no building) to industrial were the most numerous in this category. As the "Absent" subtype describes a nonexistent plot that was not labeled "Vacant", the data demonstrates that many of the industrial shifts occurred on land that had not yet been developed. Since the original dataset did not capture the "Absent" subtype, this could explain why there were not as many industrial shifts as expected. Many industrial areas were not built on existing plots, but were built anew, which is supported by

Seyfried's explanation that LIC was seen as a great area to install factories due to underdevelopment of the land and proximity to Manhattan (Seyfried 1984).

Table 13 Initial building type and consequent building type through three time periods

Shift Type	1898 to 1915	1915 to 1936	1936 to 1950
Cultural no change	3	12	13
Cultural to Industrial	2		
Cultural to Other			1
Cultural to Residential		1	
Cultural to Shop	3		
Cultural to Vacant	1		
Industrial no change	14	38	93
Industrial to Other	5	6	15
Industrial to Residential	3		
Industrial to Shop	4	2	6
Industrial to Vacant	1	1	
Other no change	72	36	60
Other to Cultural	2		
Other to Industrial	21	48	13
Other to Residential	8	10	
Other to Shop	18	10	2
Other to Vacant	1	5	1
Residential no change	252	231	200
Residential to Cultural	6	1	
Residential to Industrial	7	8	21
Residential to Other	19	19	26
Residential to Shop	16	10	2
Residential to Vacant	1		5
Shop no change	135	131	134
Shop to Cultural	2	1	
Shop to Industrial	2	19	10
Shop to Other	13	13	4
Shop to Residential	6	12	5
Vacant no change			1
Vacant to Industrial	1	1	4
Vacant to Other		3	1

Table 14 The subtypes "Other" type and its shifts to industrial locations

Type	1898 to 1915	1915 to 1936	1936 to 1950
Absent to Industrial	20	42	11
Garage to Industrial			3
Livestock to Industrial	1		
Storage to Industrial		4	

Another predominant transformation occurred from residential to industrial building types. As previously seen in Table 10, where residential points decreased from 301 to 205, these latter results also show that residential buildings decreased over time. However, it is worth recalling that due to the reuse of points during the data collection, each point does not necessarily equate to a single building. It is likely that, as seen in Figure 13, several residential homes were taken over by a giant industrial complex. Conversely, a large, singular building footprint could turn into several, separate building points. Consequently, this data is telling, but does still not represent the full story.

4.7 Identifying Other Types of Change

Documenting every single location allows one to look at the complete distribution of individual categories and their shifts. For example, Figure 18 shows the distribution of industrial shifts versus that of residential disappearances through all three time periods, which is an aspect that the historical narrative did not address, and likely could not address, without GIS. The ovals in the figure are standard deviational ellipses which summarize the general distribution and trend of the points of each type.

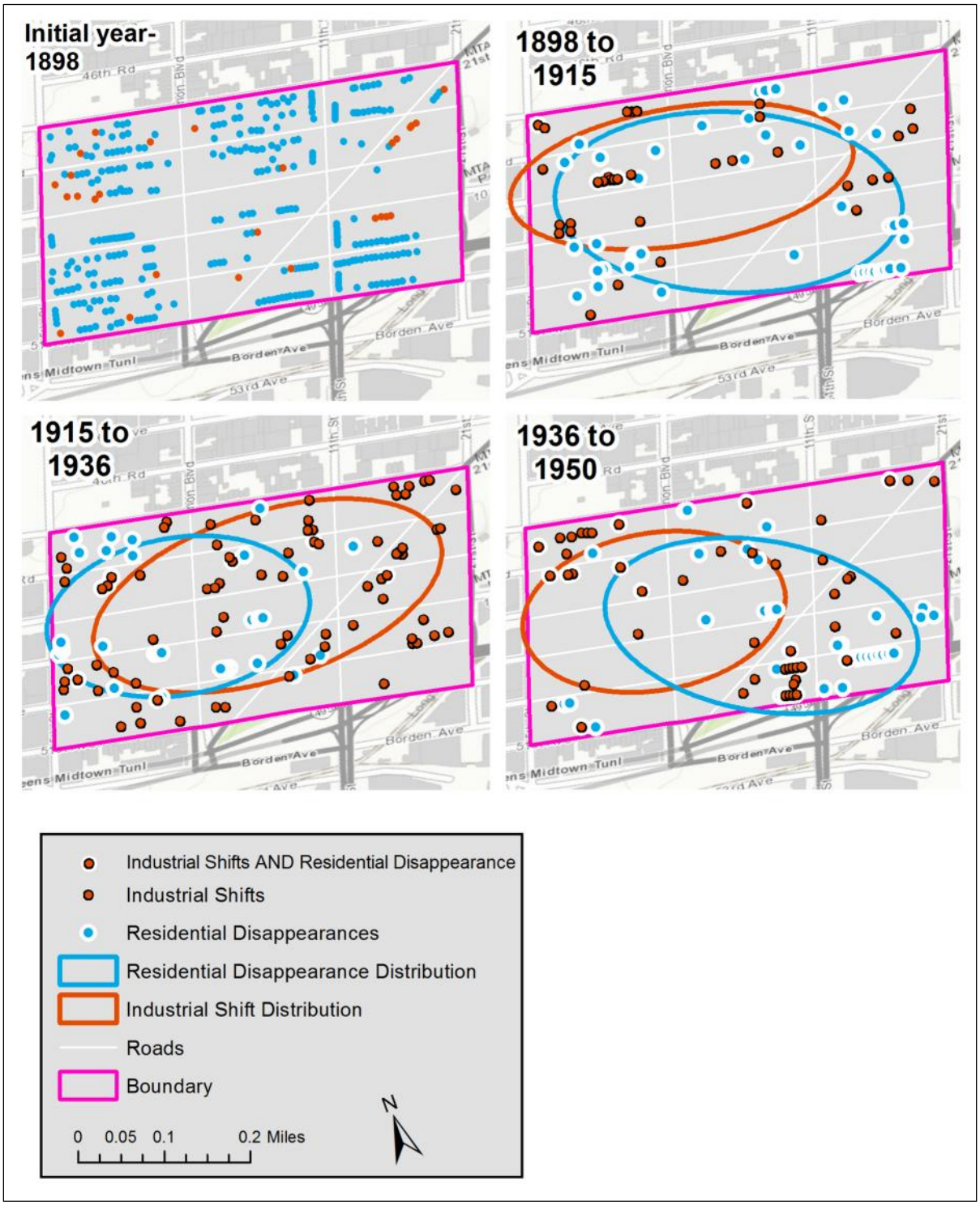

Figure 18 Industrial Shifts and Residential Disappearances and their distributions over three time periods

There does not appear to be a significant relationship when comparing the two distributions, however, it is interesting to look at the results separately in relation to history. In the 1898 to 1915 era, industrial shifts appeared to center in the northwest corner of the neighborhood. This is likely due to the fact that the southeast corner contained the main downtown area and had not yet felt the same effects of the Queensborough Bridge and Steinway Tunnel construction.

In the following time period, 1915 to 1936, the industrial shift distribution seems to disperse, while the residential disappearances align to the northwest. Since the ferries on the western border had closed in 1925, it was likely that many inhabitants were no longer able to easily commute to Manhattan so the residences were given up.

Finally, the 1936 to 1950 time period shows the residential disappearances tilting southeast. While many residents had already moved out of the northwest, residents in the southeast were now moving out. The benefit of such visualizations demonstrate the timing of these effects. While the overall results challenge Seyfried's assertion that Hunter's Point became a ghost town, these maps provide evidence to show that the sub-neighborhood still experienced great industrialization and residential decline. Furthermore, the data and maps can help to show where and when it occurred. A similarly in-depth study of other parts of LIC would surely reveal more stories, specifically in Queens Plaza, which felt many effects contrasting to those of Hunter's Point.

CHAPTER 5: DISCUSSION AND CONCLUSIONS

This study tracked building use in LIC, New York in order to understand the neighborhood's industrial development. The category shifts in a point from one time period to the next demonstrated what type of changes had occurred at a specific location. In documenting the category of the location in both the preceding year and following year, it was possible to determine what kind of changes took place in the neighborhood. These results can support, disprove, and expand upon the historical narrative.

5.1 Implications and Limitations

In the first approach—using cultural points as a means of managing the magnitude of the data collection—there were signs of industrialization as the number of industrial shifts picked up from 1915 to 1950. However, the hypothesis was disproved, as many of the cultural institutions persisted throughout time. In fact, there were five cultural institutions that persisted from 1891 to 1950, and seven that persisted through three out of four consecutive map years. This means that these cultural locations did not experience any shift, whether it be industrial or another type. Such lack of change demonstrates that cultural institutions were not significantly affected by industrialization. Additionally, since only cultural locations were collected from year to year, the dataset appeared limited. It was a singular story about the development of the cultural institutions, but it did not give enough insight into the rest of LIC's history.

The second approach, completed at a more localized scale, tracked the building use category for all locations. Ultimately, it was concluded that to get more accurate results, it is necessary to track every building through time. While this is more time consuming to collect, it produces a complete documentation of the area and how it has developed. In this case study, Hunter's Point displayed more telling results. It showed that there were over five times more

industrial locations from 1898 to 1915. At the same time, it challenged the historical narrative, showing that while Hunter's Point experienced industrialization, the sub-neighborhood did not become desolate.

The results also demonstrated a significant change in residential locations. Although historical census information is not available at the neighborhood or parcel scale for LIC, the data reveals a sharp decrease in residential points. The historical narrative addressed the decrease of population in LIC as residents moved north to Astoria and this data shows exactly where and when residential locations disappeared (Figure 18).

While this methodology cannot prove a connection between two events, it can help to support it. In his own historical narrative of LIC, Vincent Seyfried attests that Hunter's Point declined due to the opening of the Steinway tunnels, which took residents away from the once popular sub-neighborhood. The Vernon-Jackson station opened in 1915, and consequently connected up to Queens Plaza, moving many residents out of Hunter's Point. The 1936 map helps support the cause and effect of this event by illustrating the decrease in residential points. A good way of continuing to explore the cause and effect of this particular event would be to do the same study of Queens Plaza, which will be discussed in the following section.

Nevertheless, there were still issues with digitizing all building points. For instance, it was difficult to digitize every single point within every single year, while taking into account footprint change. It was handled by setting categories for every point in every year within that footprint, but this meant that there could be multiple points to represent one building. Consequently, the tallies for all categories in these time periods do not accurately represent the total number of the building types. In a way, the total numbers represent the total size of each category, but even this cannot be precisely concluded.

In addition, by digitizing all points, a very detailed map is required. For historical maps, this can be particularly difficult to find. In the case of this study, the 1891 Atlas of New York map had to be passed over during the in-depth analysis, as it did not have the same detail as the other Sanborn maps. To do such an analysis, one would need to locate historical maps that documented the type of building use for every parcel and/or building.

5.2 Further Historical Conclusions

Creating a historical narrative is not only a foundation for the design of the data collection process, it also offers a comparison for the results so that new historical insights can be uncovered. Vincent Seyfried claimed that Hunter's Point had become completely unoccupied after the Queensborough Bridge and Steinway tunnels were built, but the data suggested that this was not entirely true. Instead, these results—attained through the use of GIS—offer other stories that the historical narrative had not considered.

In Figure 17, there are a few trends that are noticeable. For instance, in the southeast block of Hunter's Point, there is an area that experienced significant change. While it was primarily residential in 1898, many of the points changed to the "Other" type in this area. Looking at the Sanborn maps for 1915 and 1936, it appears that the parcels were wiped out, and then in the 1950 map, the Midtown Highway appears, producing the "Transportation" subtype points under the "Other" type. This structure was not documented in the historical narrative, but in seeing this data, it is possible to go back and find the information that the narrative originally overlooked. The Midtown Tunnel was built in 1940 to provide another passage for automobiles to go to/from Manhattan and Queens (MTA 2015). The tunnel emerged at Vernon Boulevard and Borden Avenue and continued as a highway over this portion of Hunter's Point. The Midtown Highway did not necessarily cause the disappearance of the residential buildings, but the results

help to show changes in Hunter's Point that were not previously considered. Furthermore, it may explain why the area surrounding the highway experienced industrial and absent shifts.

Some of the results were simply out of scope of the historical narrative, but now pose new and intriguing questions about the area at the time. For instance, it appears that the northwest portion of Hunter's Point experienced the greatest amount of industrialization. While it had a large amount of residential and shop locations in 1898, it was full of industrial points in 1950. If Vincent Seyfried had seen this data, he might have questioned why Hunter's Point did not appear to be a ghost town, as he had contended. Nevertheless, this northwest portion seemed to have experienced some of the effects he suggested. This might have caused Seyfried to wonder why this specific area of Hunter's Point became particularly industrialized, while the rest remained active.

Another interesting observation is the shopping corridor that runs north to south on Vernon Boulevard. Locations change building type throughout Hunter's Point, but this street in particular seems to alter very little. Instead, the shops persist throughout all other changes. This is another aspect of LIC's history that was not addressed in the historical narrative, but would nevertheless be interesting from a historian's perspective. One might ask why these shops persisted when and where they did. Perhaps there were zoning laws, or perhaps these stores retained adequate patronage sufficient enough to keep them in business. These are aspects of LIC's history, discovered through GIS, which help form new stories of the area.

5.3 Future Work

After exploring the various methods for documenting change using historical maps, it is evident how this method can be extended to other regions and studies.

5.3.1 Applying Methods Elsewhere

As the Hunter's Point analysis proved effective in tracking change, it would be beneficial to use the same approach for the entire area of LIC. In documenting every building use location, it would be possible to see how the neighborhood changed and whether there were any particular patterns that could be identified. Both the cultural points and historical narrative demonstrated that Hunter's Point and Queens Plaza were, at different times, transportation hubs. There was an inverse relationship between these two areas, for once Queens Plaza was built, Hunter's Point declined. Such relationships would be interesting and beneficial to visualize, especially in relation to the rest of the study area.

Including Astoria in the study area would also be valuable. This neighborhood in many ways, was the antithesis of LIC. Although it did experience a brief stint of industry in the late 19th century, it eventually turned into a residential area. Just as Hunter's Point experienced residential decline, one would expect Astoria to experience a drastic increase in new homes. These type of historical events and relationships could be explored if the same process was carried out on these larger study areas.

Ideally, this study could also be completed in other areas, even those that do not have the same industrial history. While LIC's history in particular is industrial, this process can be used to track land use of any type of neighborhood with any types of categorizations. The main benefit to this method is the way in which it collects and organizes data from historical maps. In managing building use as points from a historical map, one can analyze shifts from year to year. These shifts can have a variety of categorizations that are specific to both the neighborhood and the time, making it useful for other study areas.

5.3.2 Expanding the Research

Generally, an important aspect of land use is footprint. Whereas this project deliberately focused on points to emphasize existence rather than size, another study could develop a similar process that not only looks at shifts in building usage, but shifts in the total area, and even volume of the building. For instance, Figure 12 did this for the large Ravenswood Park that disappeared from 1891 to 1898. The results are certainly noticeable and impressive as factories took over the area. Such results provide other insights into how the land was used and how a single building developed spatially over time. The negative aspect of this approach, however, is that the manual process cannot be streamlined in the same way. It would be necessary to turn to automated line and feature recognition tools to move this to a much larger area. Furthermore, the buildings cannot be compared easily, as footprints will move and shift over the landscape. Using points allows one to compare a singular location from one period to the next, despite its magnitude.

In Lehigh University's digital library project, *Beyond Steel*, a group documented Bethlehem Steel's employees within Bethlehem city. The project not only used Sanborn maps, but also books, photographs, and oral histories to get a complete spatial representation of the employees, as well as a detailed database organizing their names, jobs and spouses. Building a database such as this is time-consuming, yet the result is highly informative. It appeals to both GIS analysts and historians alike in that it gathers both quantitative data and historical details unique to the person and place. While outside of the scope of this research, forming a similarly detailed database would be a great continuation. Like *Beyond Steel*, it would be informative to see the location and movement of the LIC factory workers. This thesis demonstrated a movement

of residents, conjecturing that the workers of the factories moved to Astoria to live in a more residential and less industrial area, but tracking this explicitly would be insightful.

5.4 Summary

This thesis ultimately created a process for creating a spatiotemporal database from historical fire-insurance maps. While the approach to data collection changed from cultural institutions to all building points in order to gain a greater insight into land use change, the overall process provides a way of digitizing, organizing and analyzing data within historical maps. The results helped to document LIC's industrialization and its effect on other aspects of the neighborhood as it related to the historical narrative. Ultimately, this method can be expanded upon and used within other study areas under different search criteria to gain a greater understanding of the land and time.

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APPENDIX A: Georeferenced Maps

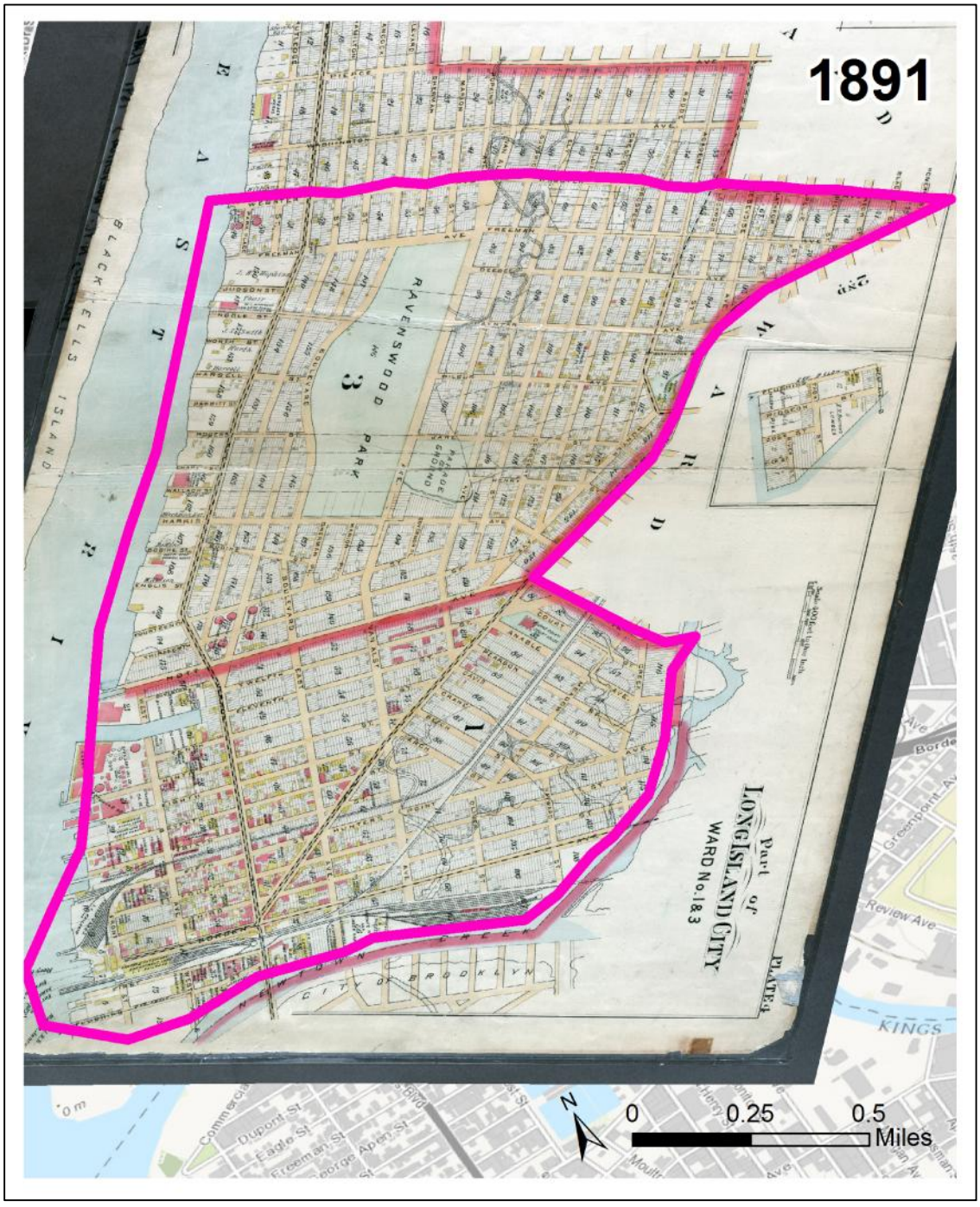

Figure 19 The Atlas of New York 1891 Long Island City map georeferenced to modern-day LIC

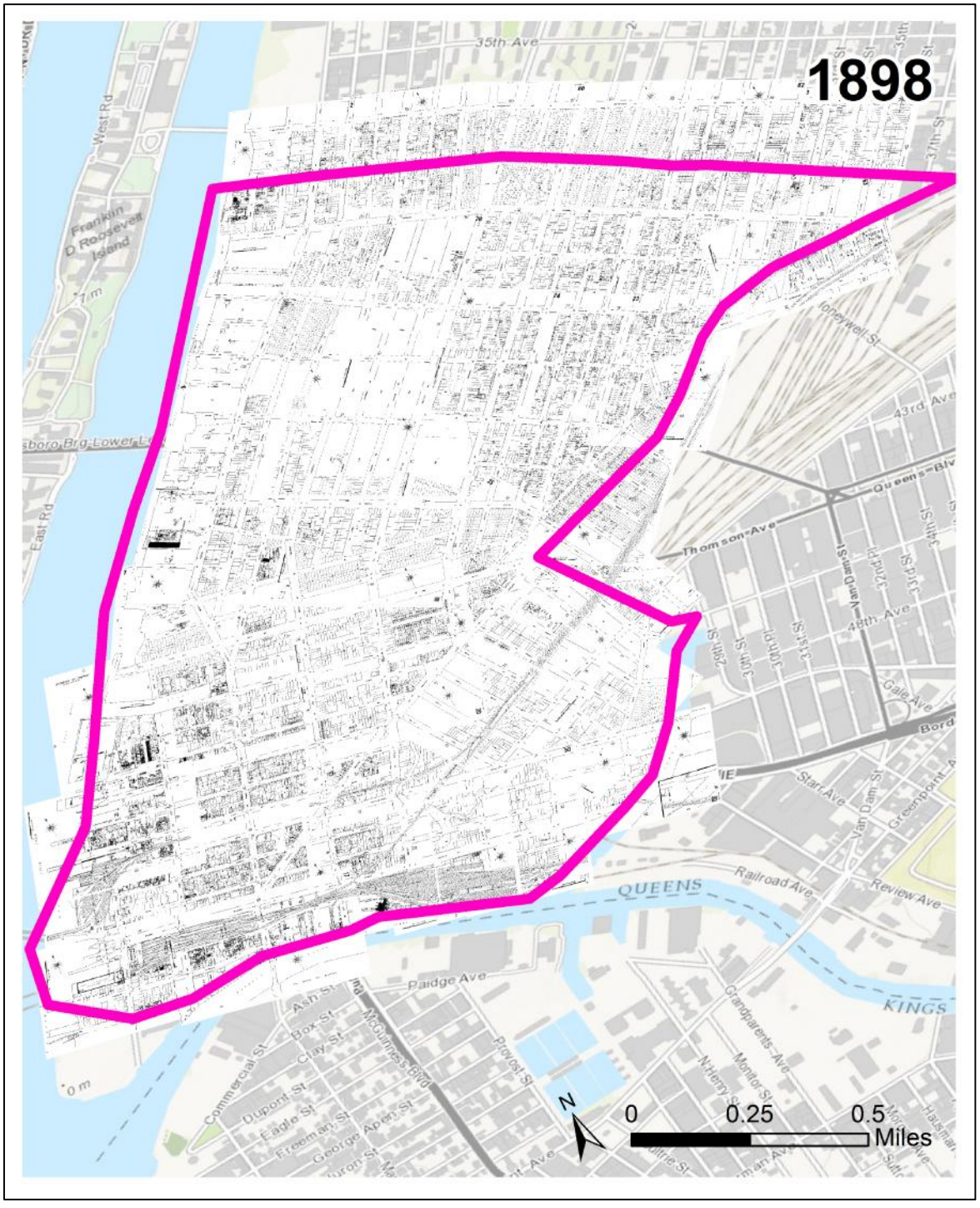

Figure 20 Sanborn 1898 Long Island City map georeferenced to modern-day LIC

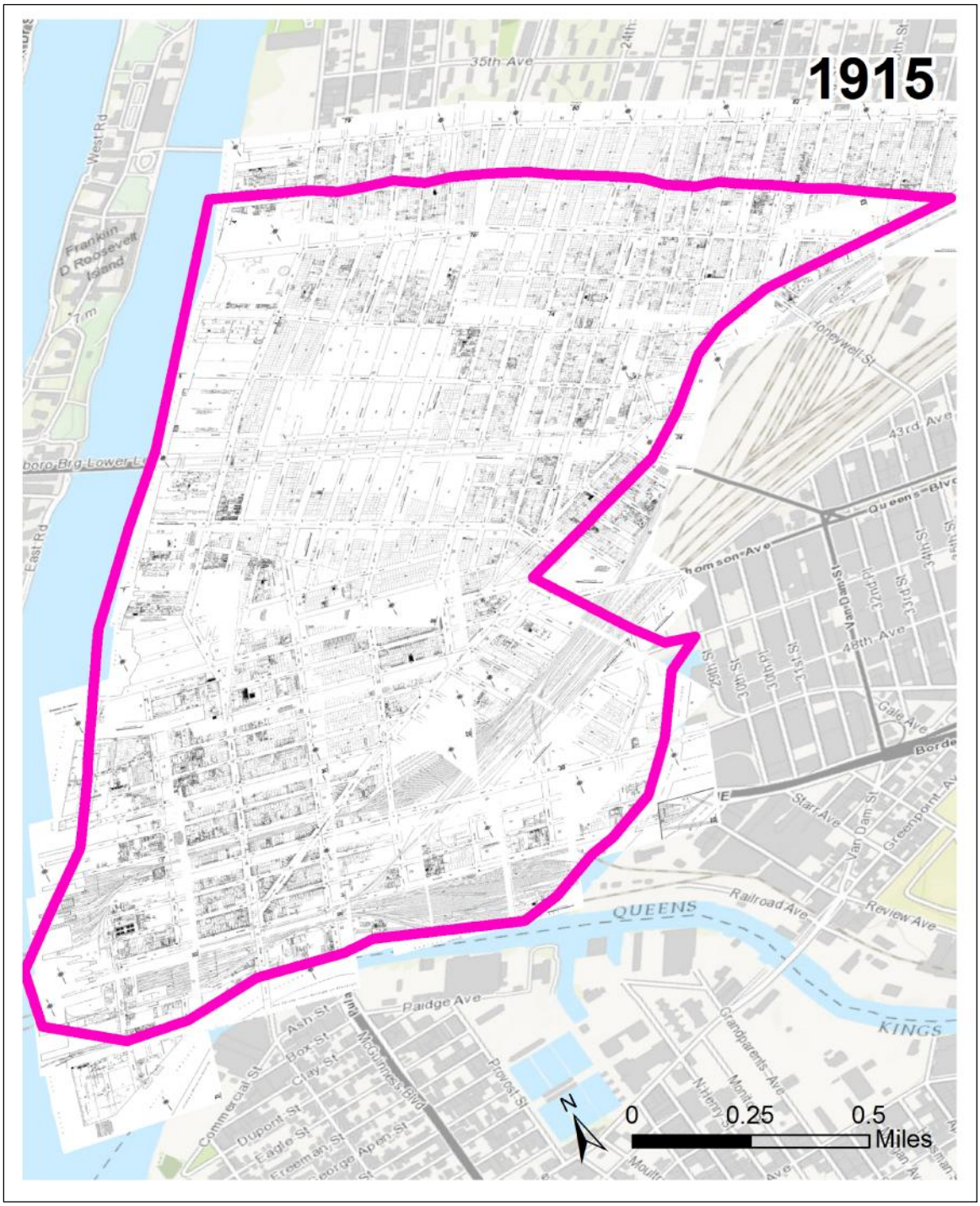

Figure 21 Sanborn 1915 Long Island City map georeferenced to modern-day LIC

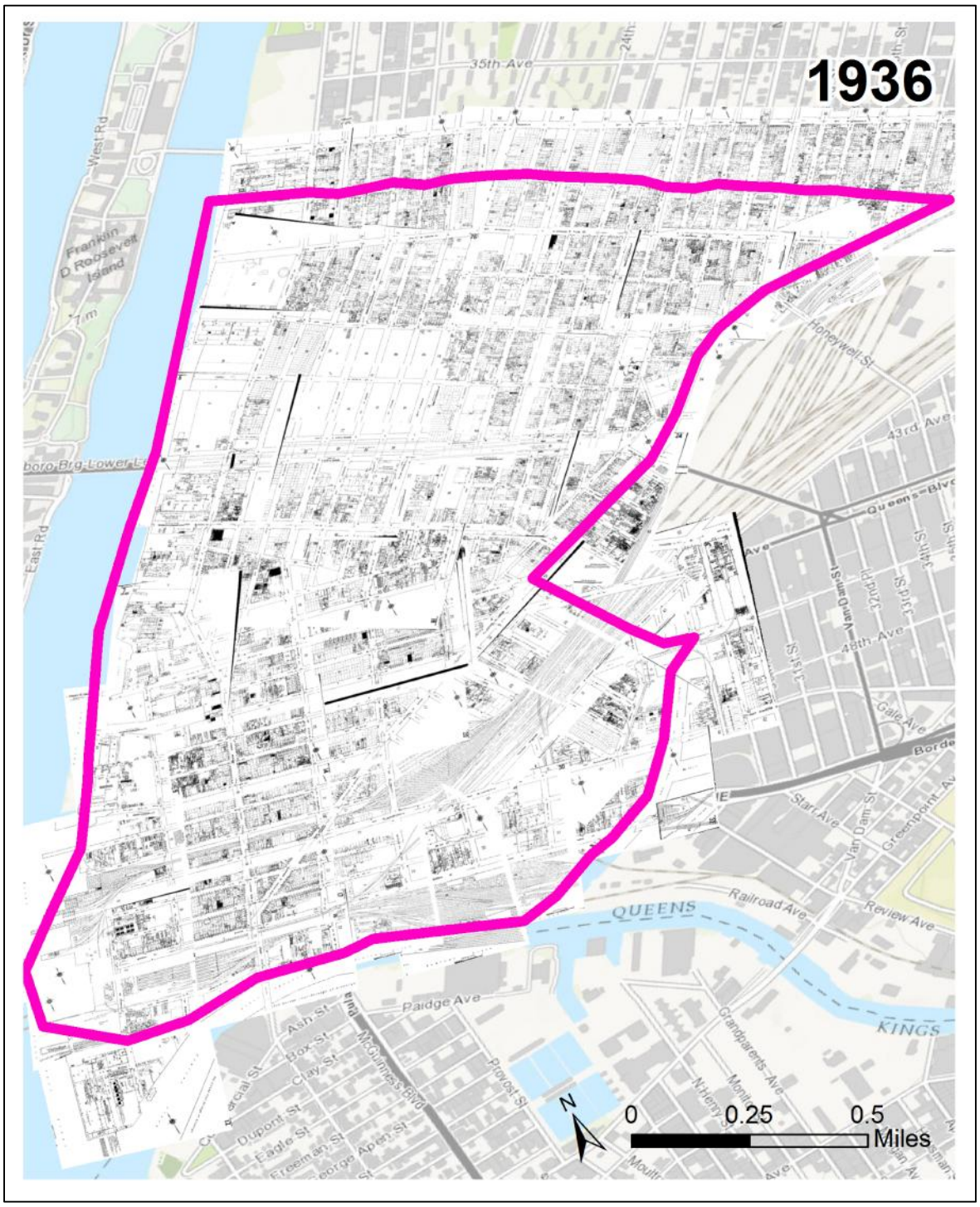

Figure 22 Sanborn 1936 Long Island City map georeferenced to modern-day LIC

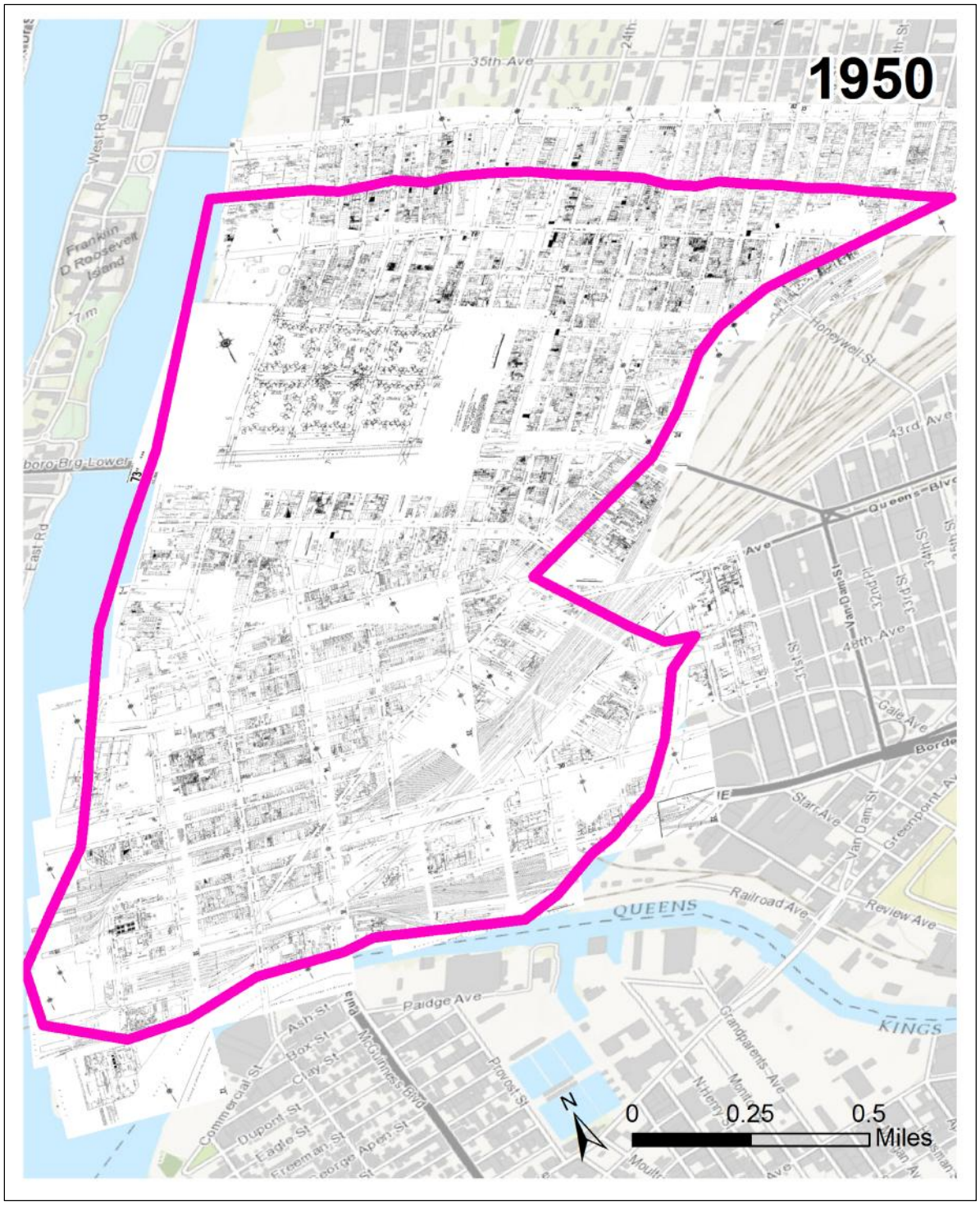

Figure 23 Sanborn 1950 Long Island City map georeferenced to modern-day LIC

APPENDIX B: Model Builder Model

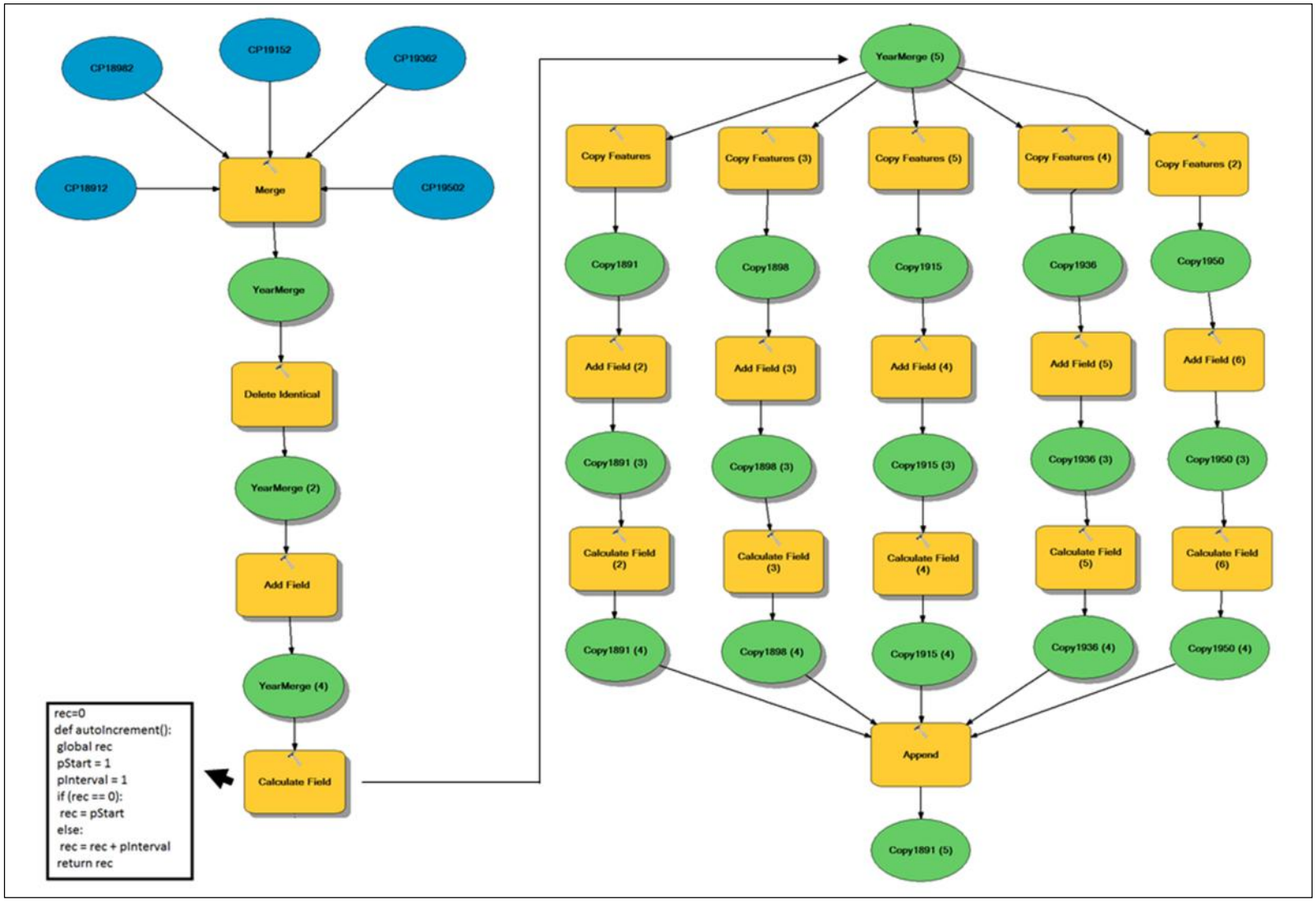

Figure 24 Model Builder model that organizes cultural institution point data.

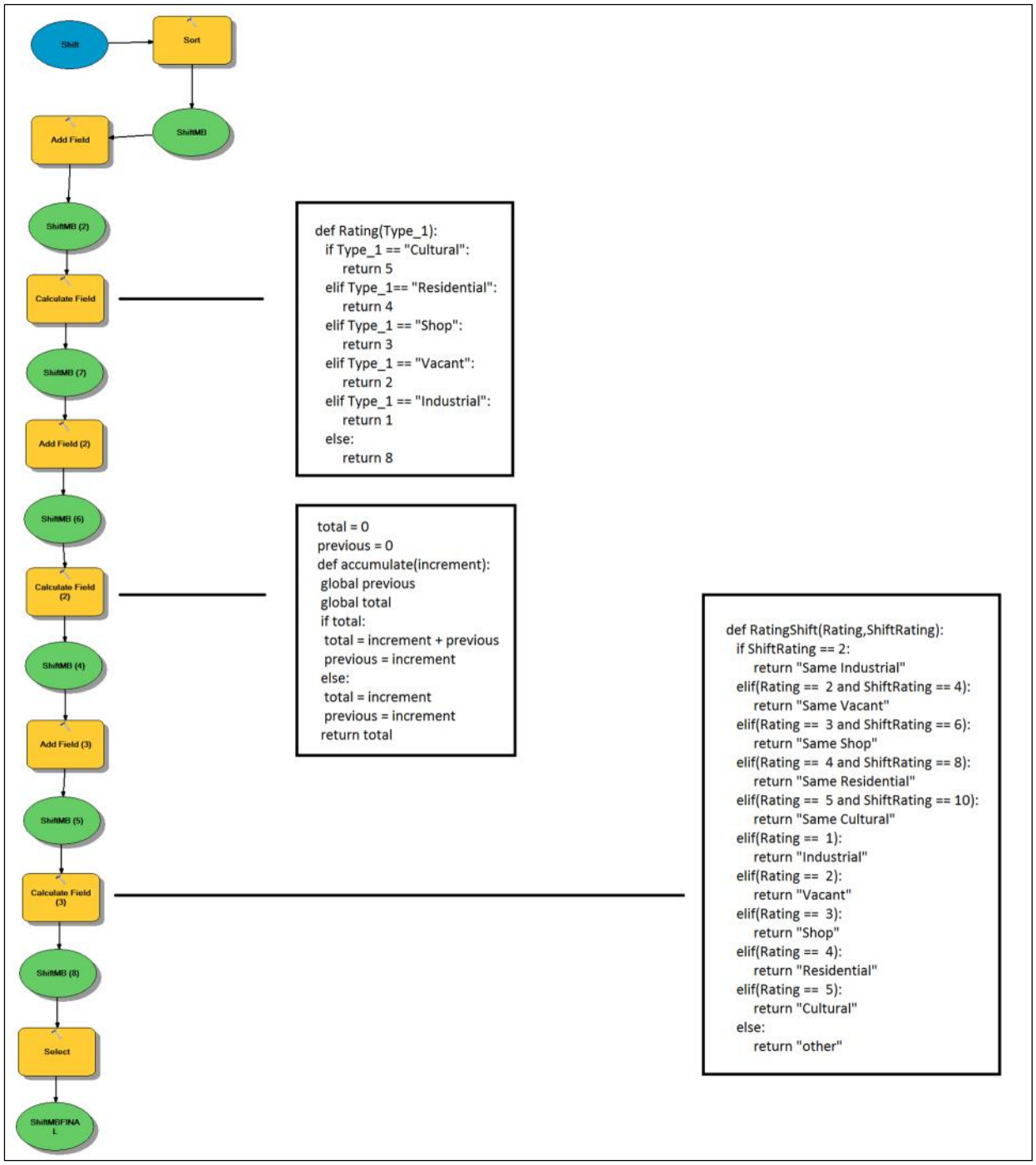

Figure 25 Model Builder model to determine type of shifts in between time periods

```
def RatingShift(Rating,ShiftRating):
    if ShiftRating == 2:
        return "Same Industrial"
    elif(Rating ==  2 and ShiftRating == 4):
        return "Same Vacant"
    elif(Rating ==  5 and ShiftRating == 10):
        return "Same Cultural"
    elif(Rating ==  3 and ShiftRating == 6):
        return "Same Shop"
    elif(Rating ==  4 and ShiftRating == 8):
        return "Same Residential"
    elif(Rating ==  6 and ShiftRating == 12):
        return "Same Other"
    elif(Rating ==  2 and ShiftRating == 4):
        return "Same Industrial"
    elif(Rating ==  5 and ShiftRating == 9):
        return "Residential to Cultural"
    elif(Rating ==  5 and ShiftRating == 8):
        return "Shop to Cultural"
    elif(Rating ==  5 and ShiftRating == 7):
        return "Vacant to Cultural"
    elif(Rating ==  5 and ShiftRating == 6):
        return "Industrial to Cultural"
    elif(Rating ==  5 and ShiftRating == 11):
        return "Other to Cultural"
    elif(Rating ==  4 and ShiftRating == 10):
        return "Other to Residential"
    elif(Rating ==  4 and ShiftRating == 9):
        return "Cultural to Residential"
    elif(Rating ==  4 and ShiftRating == 7):
        return "Shop to Residential"
    elif(Rating ==  4 and ShiftRating == 6):
        return "Vacant to Residential"
    elif(Rating ==  4 and ShiftRating == 5):
        return "Industrial to Residential"
    elif(Rating ==  6 and ShiftRating == 11):
        return "Cultural to Other"
    elif(Rating ==  6 and ShiftRating == 10):
        return "Residential to Other"
    elif(Rating ==  6 and ShiftRating == 9):
        return "Shop to Other"
    elif(Rating ==  6 and ShiftRating == 8):
        return "Vacant to Other"
    elif(Rating ==  6 and ShiftRating == 7):
        return "Industrial to Other"
    elif(Rating ==  3 and ShiftRating == 9):
        return "Other to Shop"
    elif(Rating ==  3 and ShiftRating == 8):
        return "Cultural to Shop"
    elif(Rating ==  3 and ShiftRating == 7):
        return "Residential to Shop"
    elif(Rating ==  3 and ShiftRating == 5):
        return "Vacant to Shop"
    elif(Rating ==  3 and ShiftRating == 4):
        return "Industrial to Shop"
    elif(Rating ==  2 and ShiftRating == 8):
        return "Other to Vacant"
    elif(Rating ==  2 and ShiftRating == 7):
        return "Cultural to Vacant"
    elif(Rating ==  2 and ShiftRating == 6):
        return "Residential to Vacant"
    elif(Rating ==  2 and ShiftRating == 5):
        return "Shop to Vacant"
    elif(Rating ==  2 and ShiftRating == 3):
        return "Industrial to Vacant"
    elif(Rating ==  1 and ShiftRating == 7):
        return "Other to Industrial"
    elif(Rating ==  1 and ShiftRating == 6):
        return "Cultural to Industrial"
    elif(Rating ==  1 and ShiftRating == 5):
        return "Residential to Industrial"
    elif(Rating ==  1 and ShiftRating == 4):
        return "Shop to Industrial"
    elif(Rating ==  1 and ShiftRating == 3):
        return "Vacant to Industrial"
    else:
        return "Other"
```

Figure 26 Python script assigning shift types based on previous year's category