Appendix E-4: Noise Technical Memorandum

Memorandum

Date: *August 8, 2013*

Subject: *Noise*

Prepared by: CDM Smith, Inc.

Introduction

The Chicago Transit Authority (CTA), in cooperation with the Chicago Department of Transportation (CDOT), Department of Housing and Economic Development (DHED), and the Federal Transit Authority (FTA), is proposing to implement Bus Rapid Transit (BRT) features and service along Ashland Avenue in Chicago, Illinois. The limits for the Ashland Avenue Bus Rapid Transit (BRT) Project are:

- Irving Park Road on the north to 95th Street on the south (approximately 16.1 miles)

CTA currently operates local bus service within the Ashland Avenue BRT Project limits. The proposed improvements are limited in scope and would be implemented within existing roadway rights-of-way:

- Construction of 35 median BRT stations with shelters and pedestrian boarding areas
- Upgrade of traffic signal systems to include transit signal priority
- Implementation of queue jump lanes and turn restrictions at intersections
- Removal of travel lanes to accommodate a designated bus lane in each direction
- Pavement milling and resurfacing
- Streetscape improvements including medians, landscaping, and ADA-accessibility upgrades

Purpose

This memorandum presents the noise analysis conducted for the proposed project. The sections that follow include a description of noise fundamentals, noise impact criteria, and the noise analysis results.

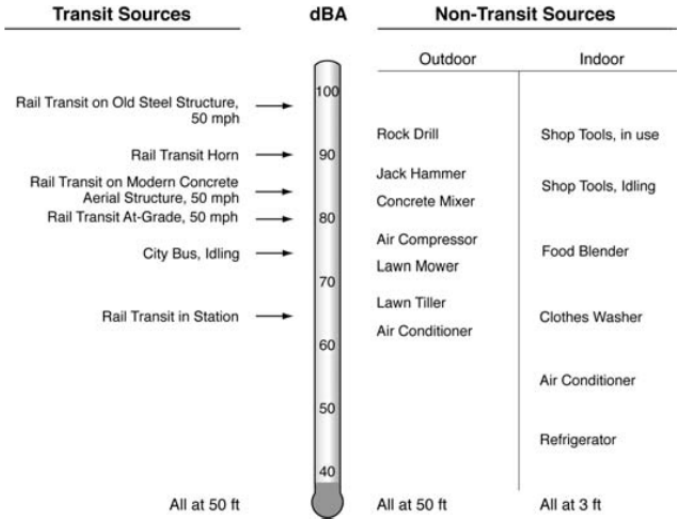
Noise Fundamentals

Noise is "any sound that is undesired or interferes with a person's hearing of something".[1] Noise or sound is a pressure on the ear drum and that is measured on a scale from one to one billion. To simplify this scale, engineers and scientists have established a decibel scale (dB) of 1 to 180 through a mathematical process called a logarithm, which is easier to use. The human ear can only hear certain frequencies of noise, so, in order to show only the level or frequencies that can be heard by the human ear, the scale is given an A-weighting, designated by dBA. The scale of 1 to 180 dBA provides a range for the sound levels that fall within a human's normal range of hearing for various types of noises. **Figure 1** provides an overview of several different types of noises and what the sound level is in dBA. The scale provides a better representation of the actual sound levels and how a person would be affected. Traffic noise, defined as unwanted sound, is associated with highway/transit projects and is usually in form of loud or persistent noises from cars, trucks, and buses. Traffic noises are generated from engines, mufflers, and from tire contact with the roadway.

Noises affect people differently due to their environment and other various factors. Loud noises such as a car honking its horn would bother most people while they were trying to sleep, while a softer noise during the day might bother certain individuals if they were trying to study or concentrate on a difficult task. The FTA has developed Noise Impact Criteria for transit projects to determine when impacts occur as shown in **Figure 2**.

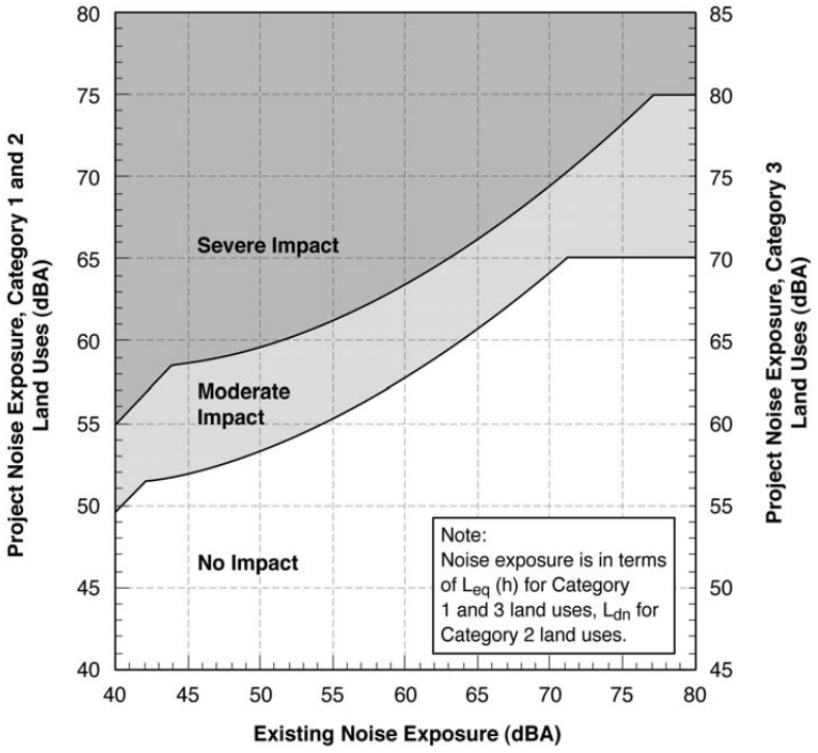
Noise impacts are based on comparing existing outdoor noises levels with future noise levels of proposed transit type projects. This analysis includes the consideration of absolute noise levels and the increase over existing levels in order to determine the severity of the impact caused by the project. An increase of 3 dB(A) is barely perceptible, an increase of 5 dBA is noticeable, and that a

Figure 1: Typical Noise Levels



[1] Webster's New Collegiate Dictionary, 1975. G&C Merriam Company. Springfield, Massachusetts.

Figure 2: Noise Impact Criteria Thresholds



Source: Transit Noise and Vibration Impact Assessment, May 2006

10 dB(A) increase would be perceived by someone to be a doubling of the noise level (loudness). Increases of 5-10 dB(A) would tend to be noticeable to most but not substantial. An increase of 10 dB(A) or more would be perceived by most as a substantial impact.

Land use types are also used in the determining the level and types of impacts and are grouped into three categories (1, 2, and 3), as shown in **Table 1**. These categories were developed to help in determining what dBA levels of noise would disturb people during various activities and at various locations. When dBA levels reach the point that it creates a disruption for an activity, it is considered an impact.

Table 1: Land Use Categories and Metrics for Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor Leq(h)*	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor Ldn	Residences and buildings where people normally sleep. This category includes homes, hospitals and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor Leq(h)*	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds and recreational facilities can also be considered to be in this category. Certain historical sites and parks are also included.

* Leq for the noisiest hour of transit-related activity during hours of noise sensitivity.

Source: Transit Noise and Vibration Impact Assessment, May 2006

Noise Assessment

The FTA's *Transit Noise and Vibration Impact Assessment Manual* (FTA 2006) has three levels of analysis that may be used to evaluate noise impacts of a transit project, depending on the type and scale of the project, the stage of project development, and the environmental setting. The three levels of analysis are:

- Screening procedure
- General assessment
- Detailed analysis

A noise screening procedure was first performed for the project study area. This analysis was completed in accordance with the FTA procedures outlined in the *Transit Noise and Vibration Impact Assessment Manual*. The screening procedure is used to identify noise and vibration-sensitive land uses in the vicinity of a project and whether there is likely to be an impact. The screening procedure takes into account the noise impact criteria, the type of project, and noise-sensitive land uses.

The screening procedure for a bus way was deemed most appropriate for this noise analysis. The screening procedure provides an impact distance, which is the distance from the centerline of the BRT project where noise sensitive receptors would be impacted, which is far enough out to include all probable noise impacted locations. This distance is calculated using a worst case scenario for the

proposed bus way project with a low threshold of 50 dBA as the impact criteria. Based on FTA's guidelines, the screening distances, which are prescribed distances for the noise analysis, for a bus way system is 500 feet (unobstructed) and 250 feet (intervening buildings).

Land uses within the screening distances were reviewed to determine the category types to be analyzed as they correspond with **Table 1**. Land use maps of the corridor are provided in **Attachment A**. The category types associated with this project are primarily Land Use Category "2". Industrial and commercial land uses are also within the project area; however, noise impact criteria do not apply to industrial or commercial land uses due to their higher noise level activities.

In order to analyze and compare specific categories of noise impacts associated with the Build Alternative, two noise assessment buffers at 500 feet and 250 feet from the centerline of the bus way facility (center of the noise-generating activity) were developed. The existing noise environment was assumed to be 60 dBA based on the *FTA Transit Noise and Vibration Impact Assessment Manual (Figure 2-17)*. Based on the screening analysis, land uses included in the residential land use category were found to be located within the noise buffers. Therefore, a general assessment was conducted to determine the noise levels using the FTA's Noise Impact Assessment Spreadsheet (see **Attachment B**). The average number of buses per hour was assumed to be 12 buses in each direction for the daytime as well as nighttime hours traveling at 15.9 miles per hour.

The proposed project would be located along an existing roadway corridor, in an urban setting, and would not be substantially increasing the number of transit vehicles on the roadway. **Table 4** shows the noise levels at 50, 100, 150, 200 feet from the proposed alignment measured from center of noise generating activity.

Table 4: Noise Level Impact Summary

Distance	Project Ldn	Existing Ldn	Moderate Impact Criteria	Severe Impact Criteria	Impact
50 ft	59 dBA	56 dBA	58 dBA	63 dBA	Moderate Impact
100 ft	55 dBA	52 dBA	58 dBA	63 dBA	No
150 ft	52 dBA	49 dBA	58 dBA	63 dBA	No
200 ft	50 dBA	47 dBA	58 dBA	63 dBA	No

At 50 feet from the Ashland Avenue alignment, the increase in noise level is expected to be 3 dBA and the receivers would meet the Moderate Impact Criteria of 58 dB(A). The contour distance to moderate impact is 62 feet and for severe impact is 26 feet from the center of noise generating activity.

Environmental Impacts

No-Build Alternative

Under the No-Build Alternative, the project would not be constructed and no impacts to current noise levels would occur.

Ashland Avenue BRT Project

The Ashland Avenue BRT Project would have no direct impacts on land uses in the corridor and is consistent with existing land use, zoning and relevant community land use plans. The City of Chicago is committed to the proposed effort and additional land use studies are proposed to identify further improvements to land use policies in the corridor to support development of the proposed project. In addition, the implementation of BRT would further support economic development plans by proving greater cohesion between land use and transportation. The BRT service and street enhancements could incentivize new transit oriented development (TOD) in the corridor, which would be consistent with zoning.

Based on the anticipated frequency and speed of the proposed BRT service, the proposed project is not expected to result in any severe noise impacts to the project area within the existing right-of-way. Receivers within 62 feet from the Ashland Avenue alignment measured from center of noise generating activity would experience a moderate impact, or a 3 dBA increase. An increase of 3 dBA is barely perceptible change and is not expected to create disruption of normal activities. Also, noise levels are expected to be lower with the re-designation of one travel lane in each direction as a center running, dedicated bus lane. The overall traffic volume within the Ashland Avenue corridor is expected to be reduced by 35 percent with implementation of the proposed project. Roadway noise is the predominant noise influence in the area and the additional contribution from BRT traffic would be relatively minor. As indicated in **Chapter 3 of the Environmental Assessment**, diverted traffic will be absorbed throughout the robust, Chicago road network and no other notable increases to noise are anticipated on any one roadway within the network absorbing this traffic diversion.

Construction Noise

No-Build Alternative

Under the No-Build Alternative, the project would not be constructed and no impacts to current noise levels during construction would occur.

Ashland Avenue BRT Project

The major construction activities of this project are expected to be earth removal, hauling, grading, and paving. Generally construction noise impacts, such as temporary speech interference for passersby and individuals living or working near the project, can be expected. In some areas, construction noise impacts can be expected to be greater due to the close proximity of existing housing. However, considering the relatively short term nature of construction noise, these impacts

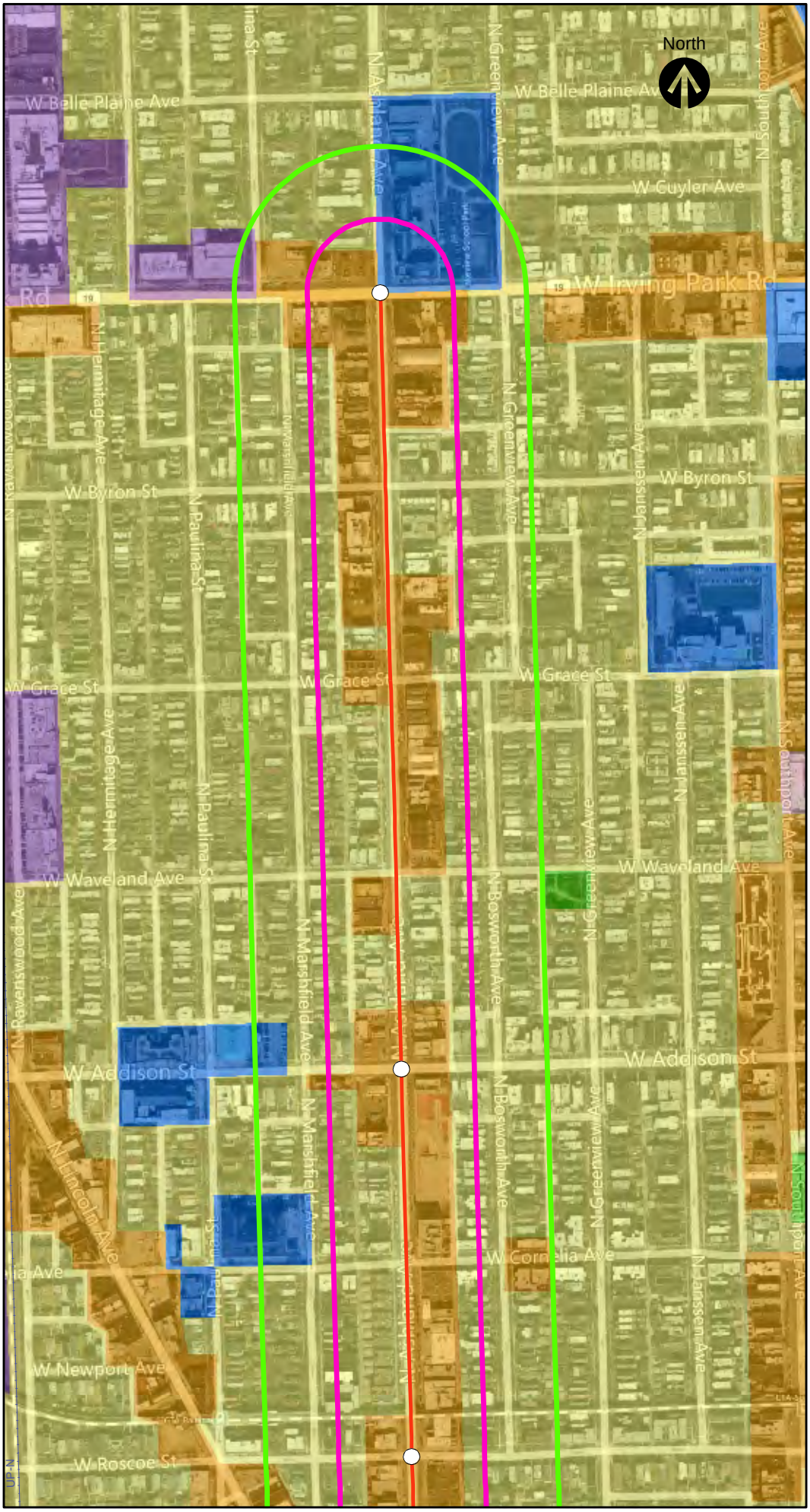
are not expected to be substantial. The contractor can limit times for which certain types of construction operations may be undertaken. This would assist in minimizing impacts to sensitive receptors in the project vicinity.

References

Federal Transit Administration (FTA). 2006. Transit Noise and Vibration Impact Assessment, Department of Transportation, Federal Transit Administration, Report No. FTA-VA-90-1003-06, 10 May 2006. Available at: http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf . Accessed: May 17, 2013.

Attachment A

Land Use Maps



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Land Use

- Proposed BRT Station
- Proposed BRT Route
- 250 Ft Buffer
- 500 Ft Buffer
- Residential
- Retail/Service
- Office/Professional
- Urban Mix
- Other Commercial
- Institutional
- Industrial, Warehousing, and Utilities; Open Space
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Data source:
Cook County Assessor

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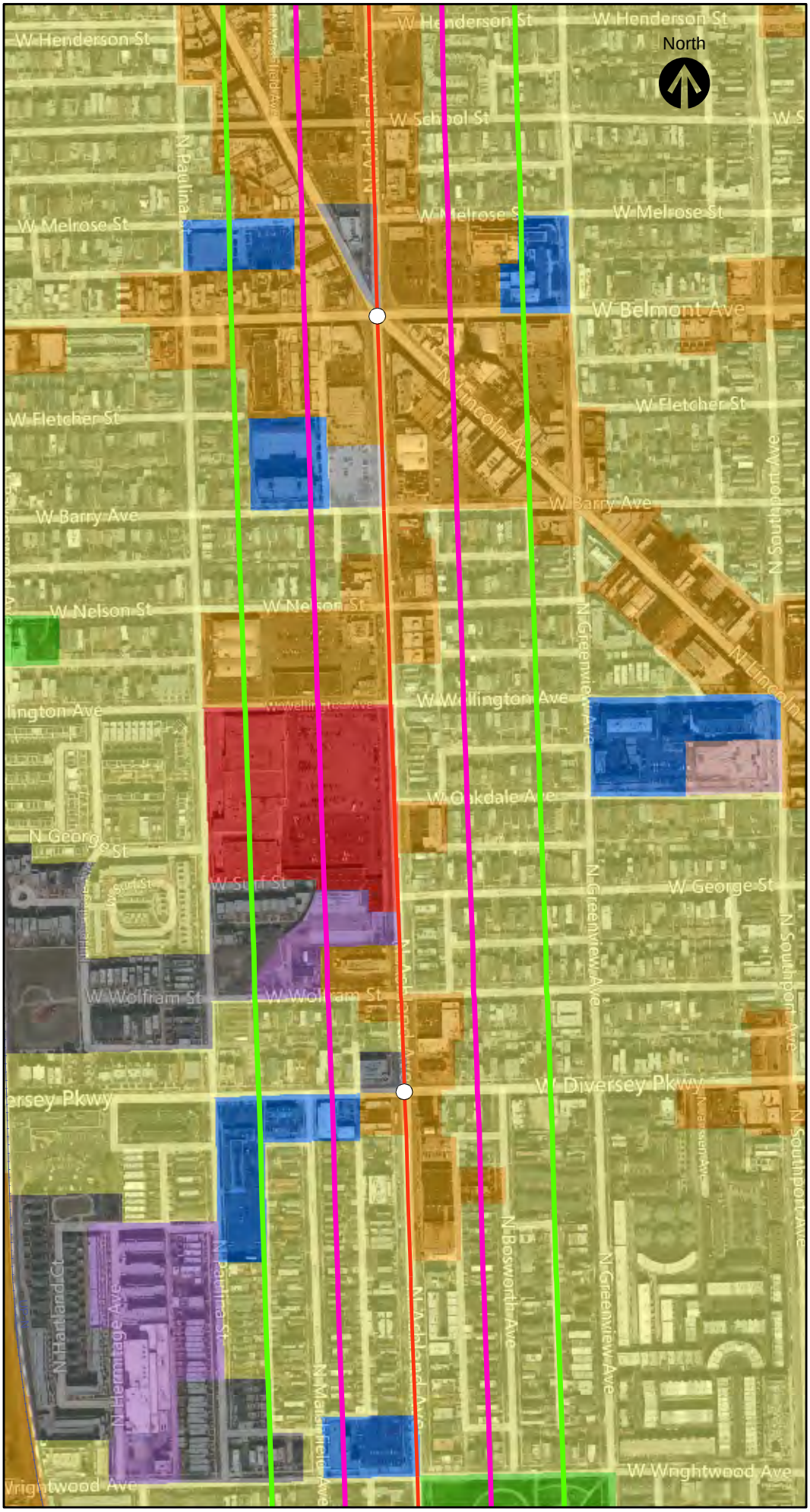

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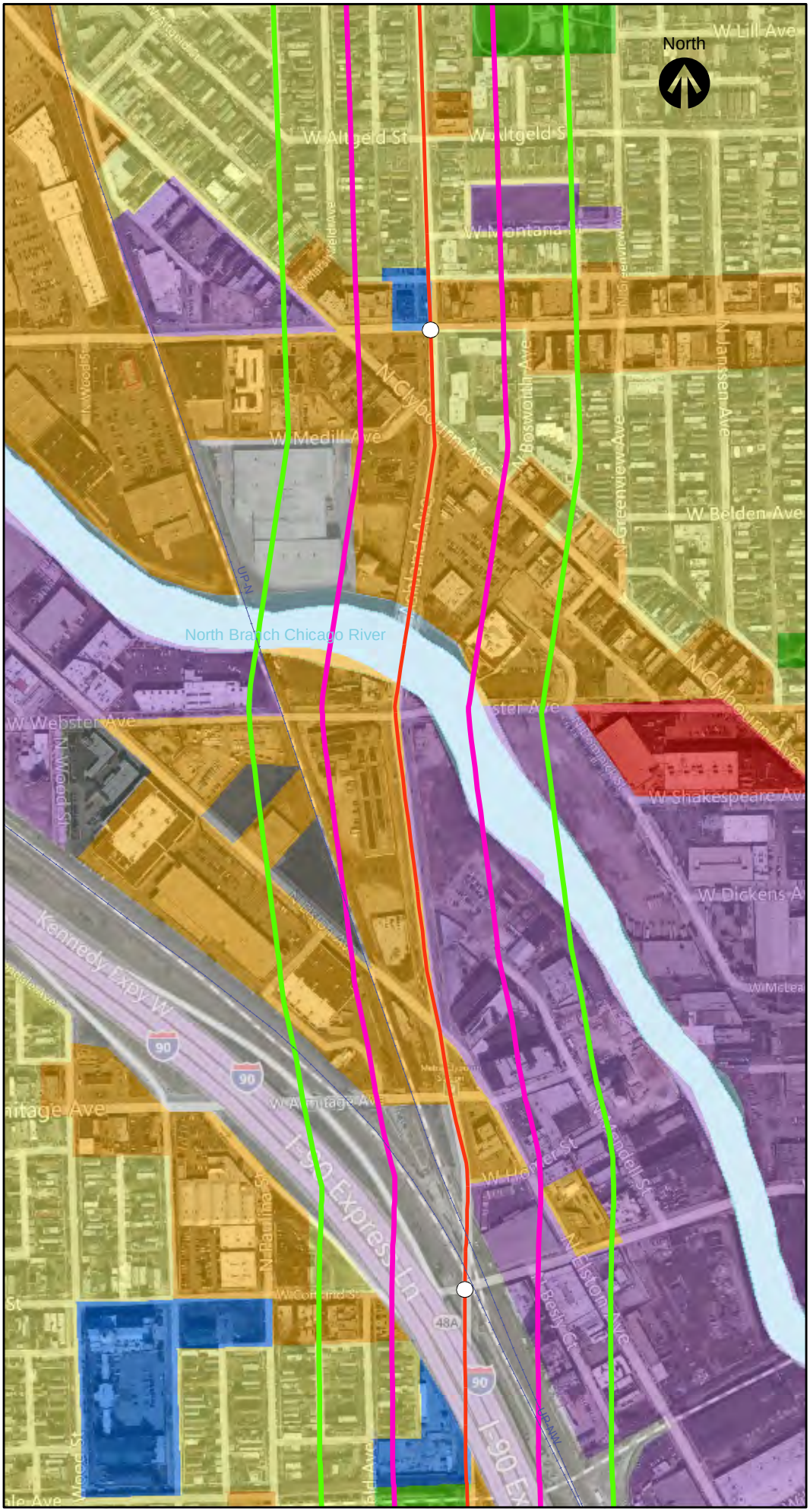

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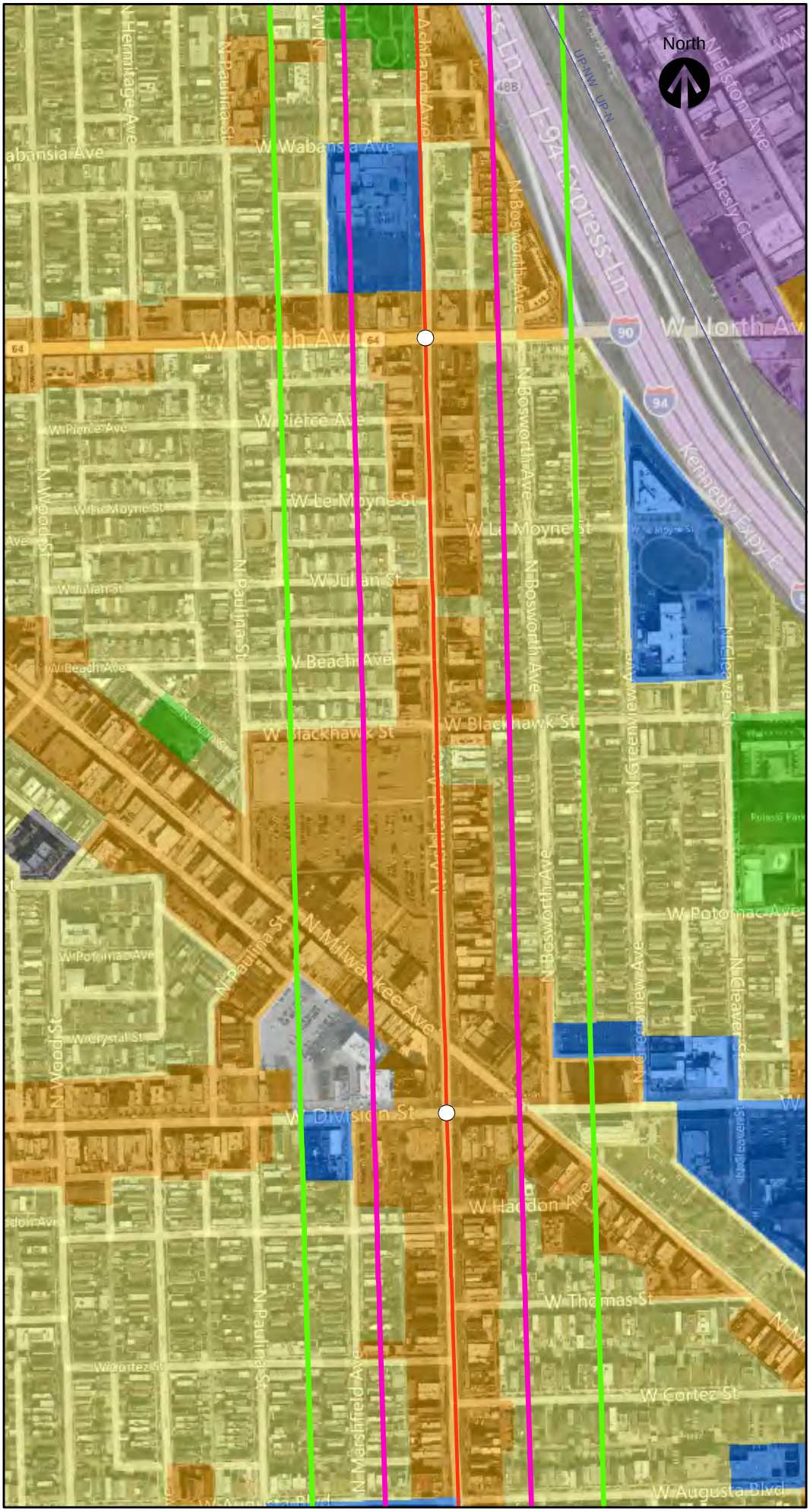

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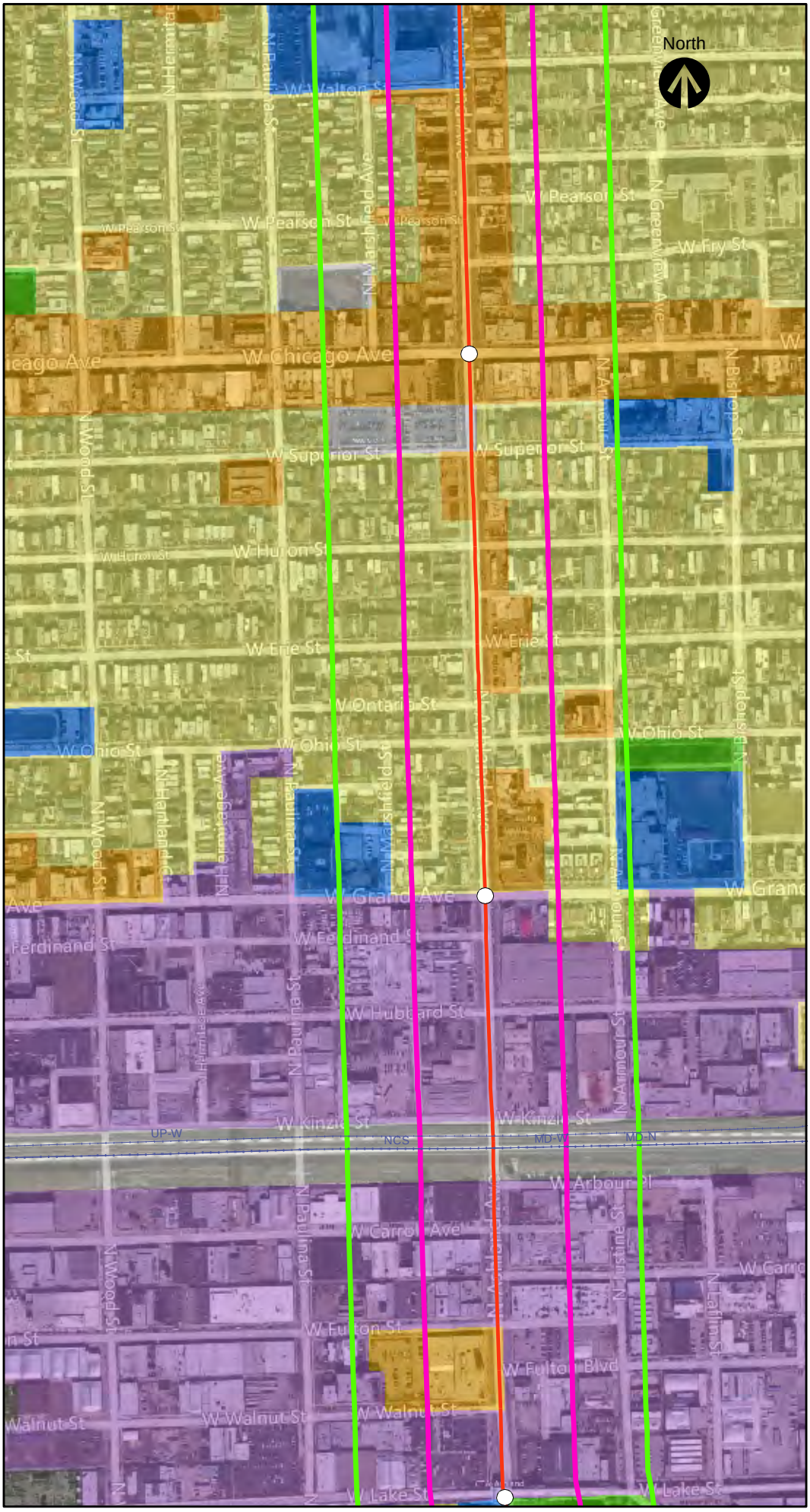

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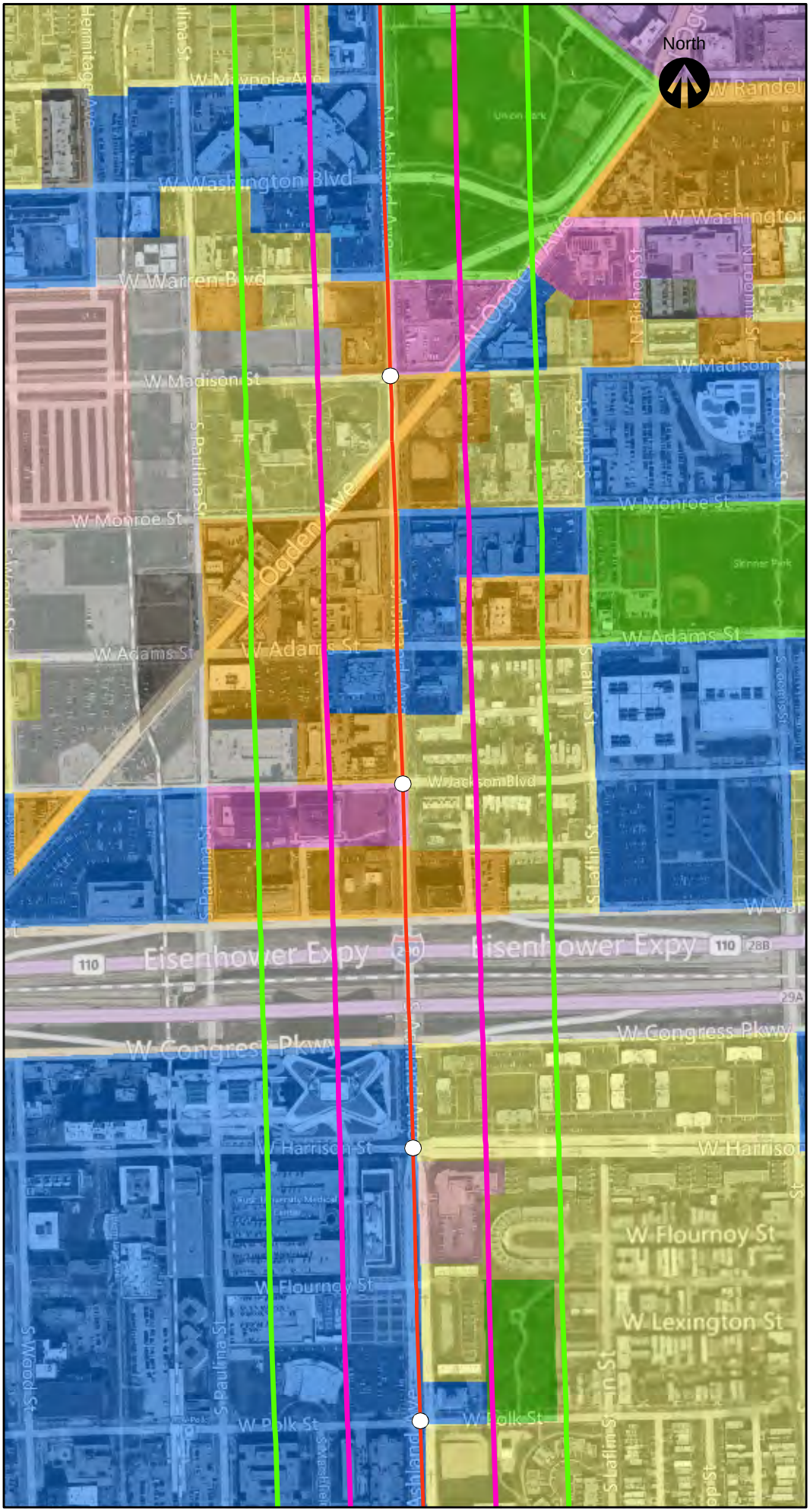

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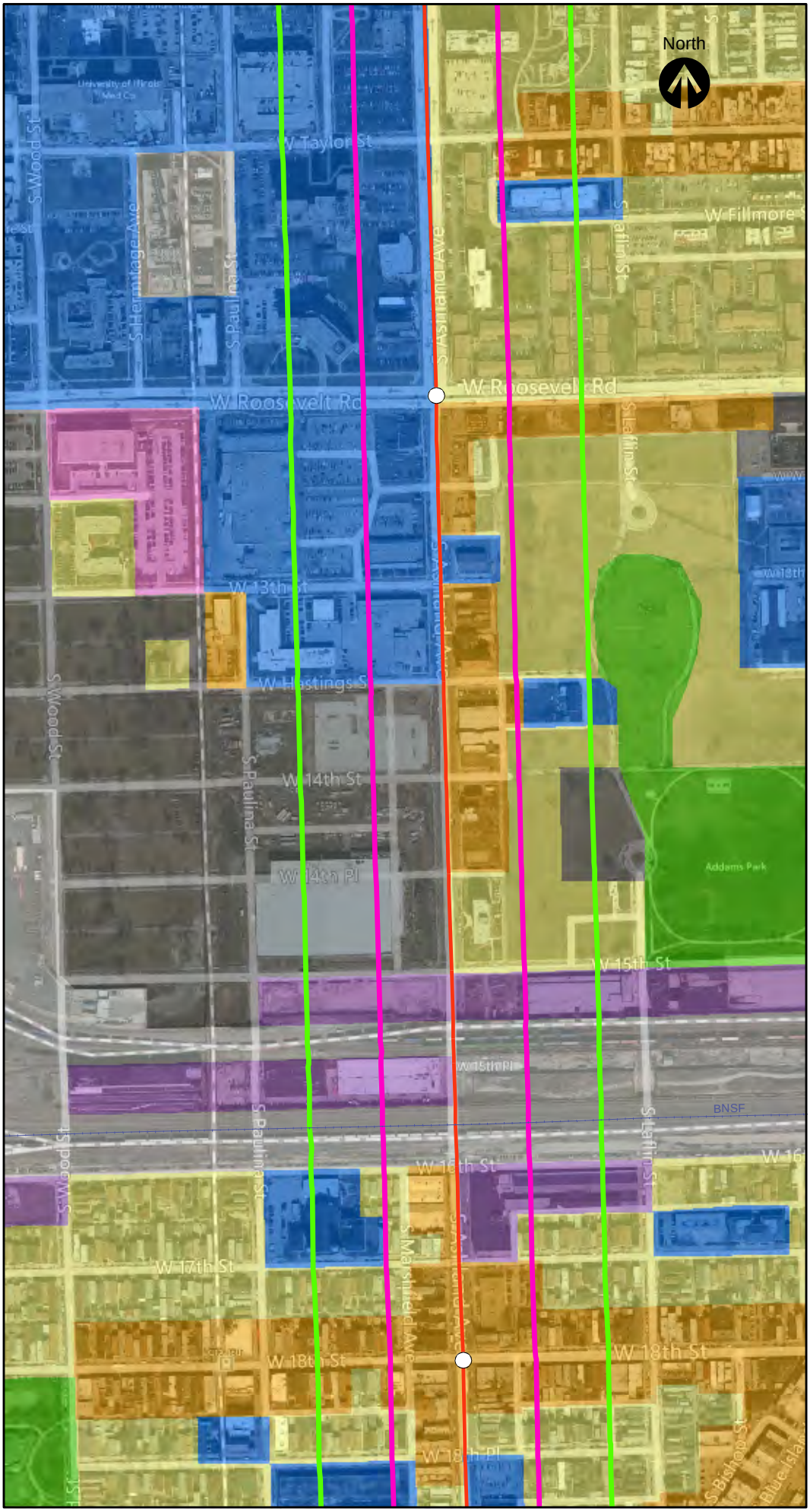

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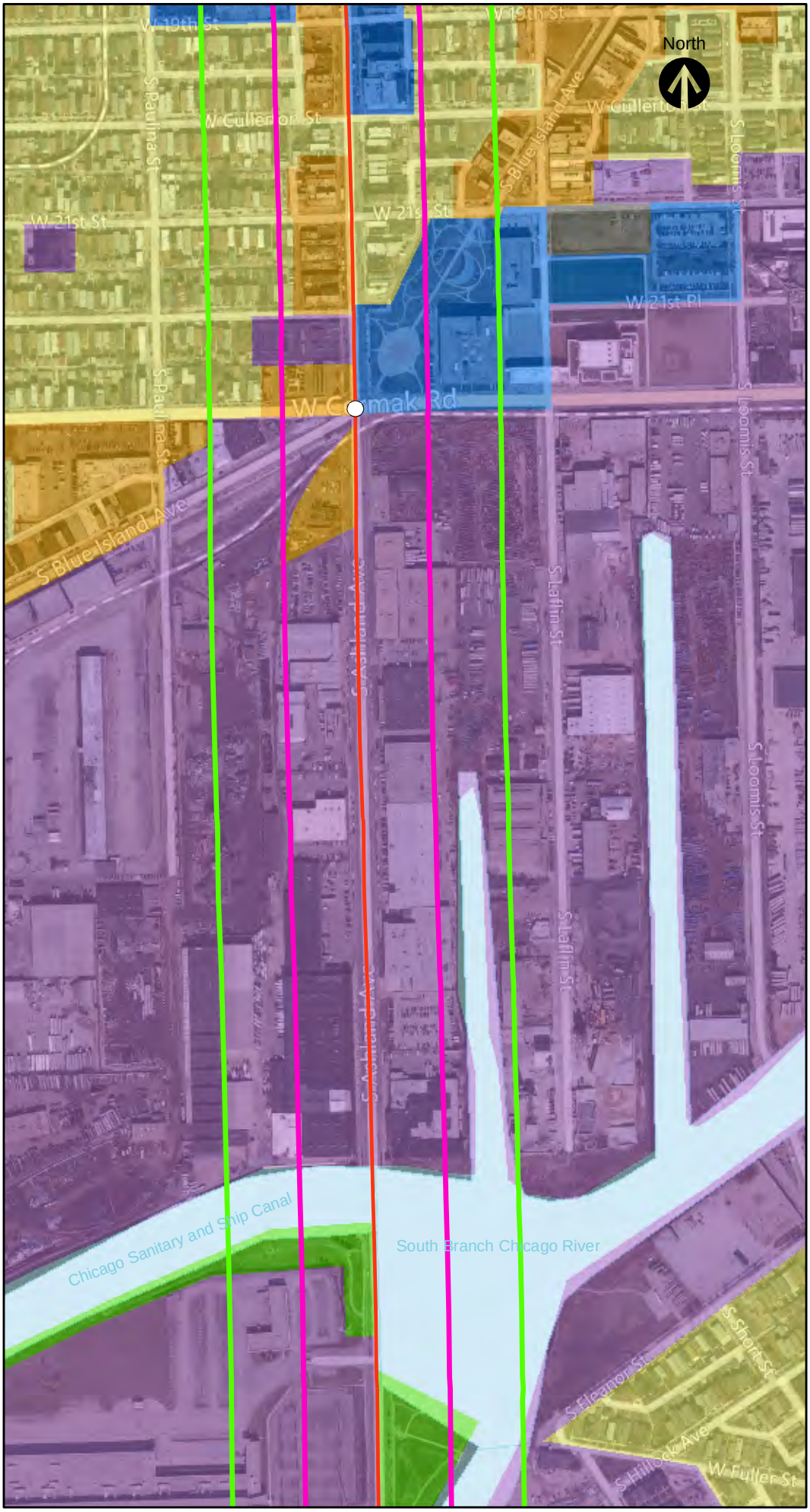

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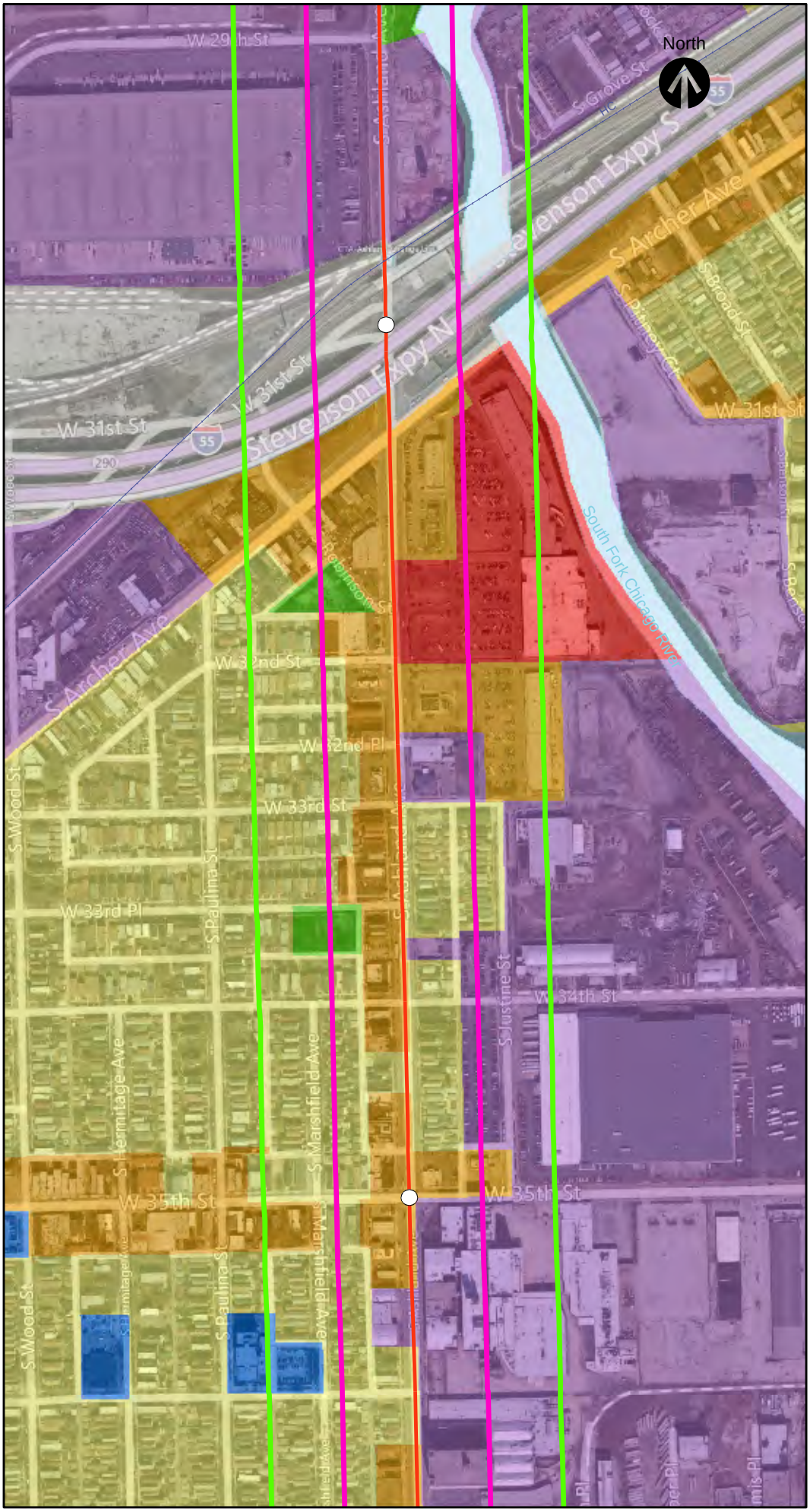

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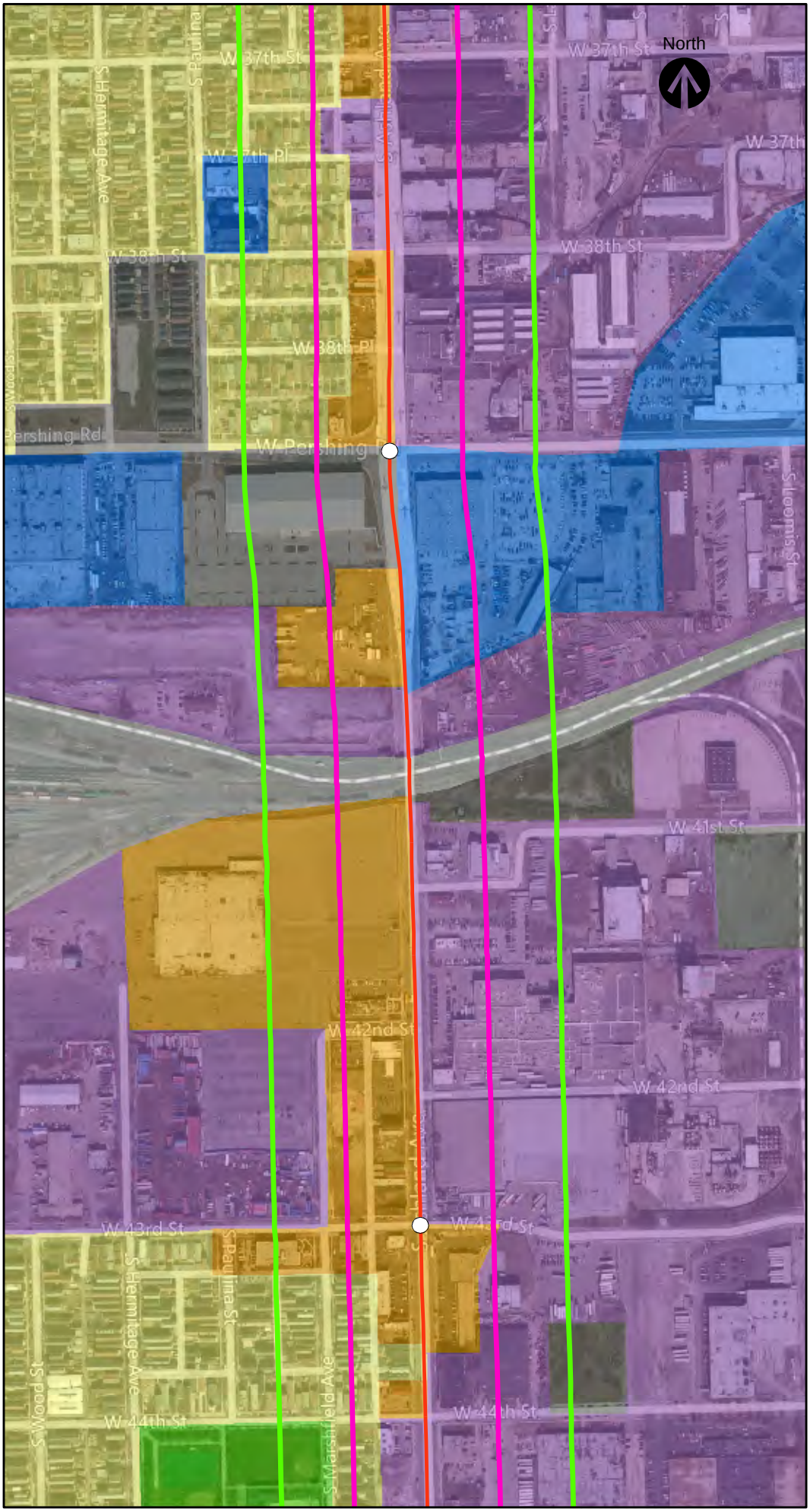

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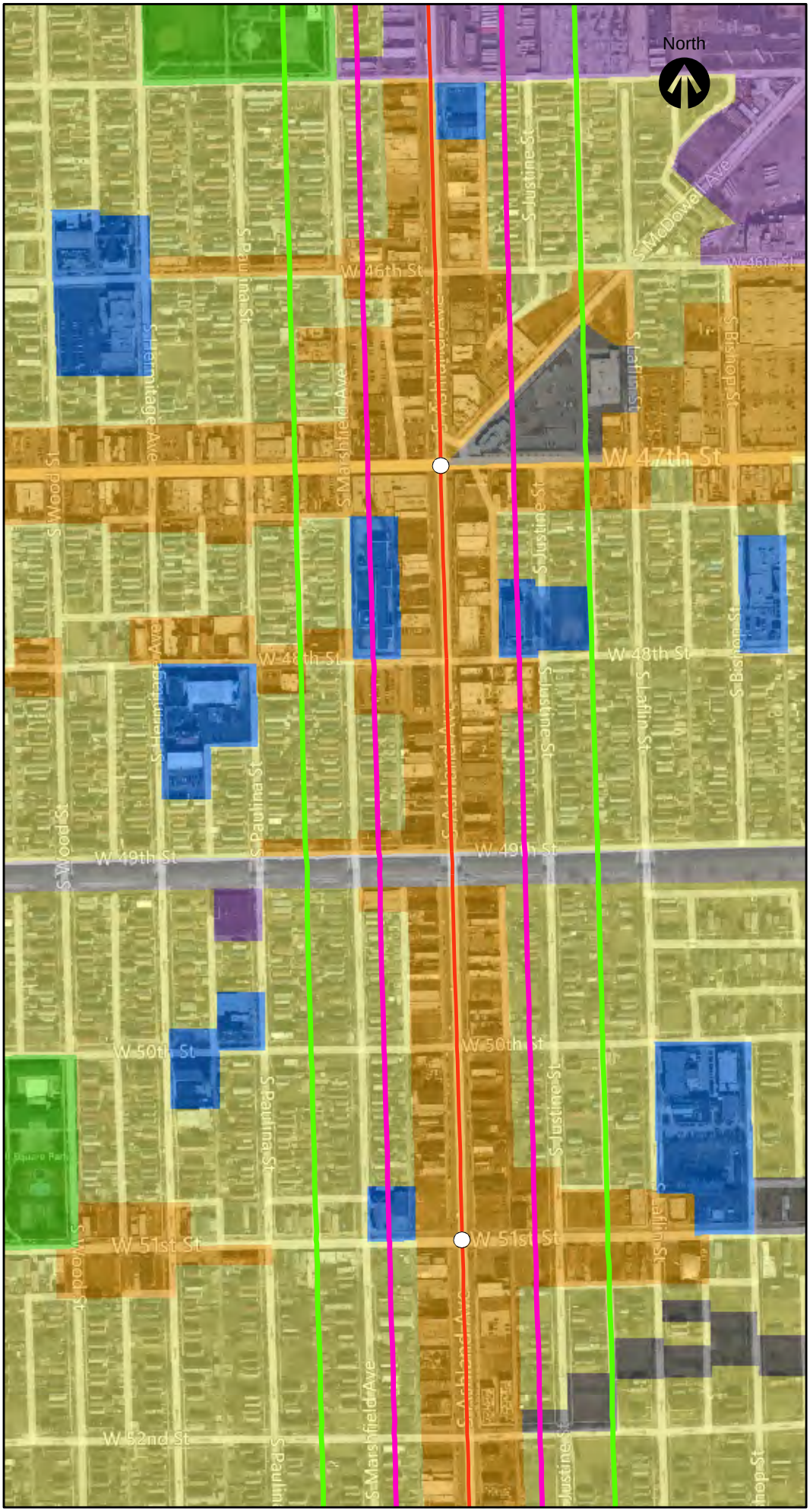

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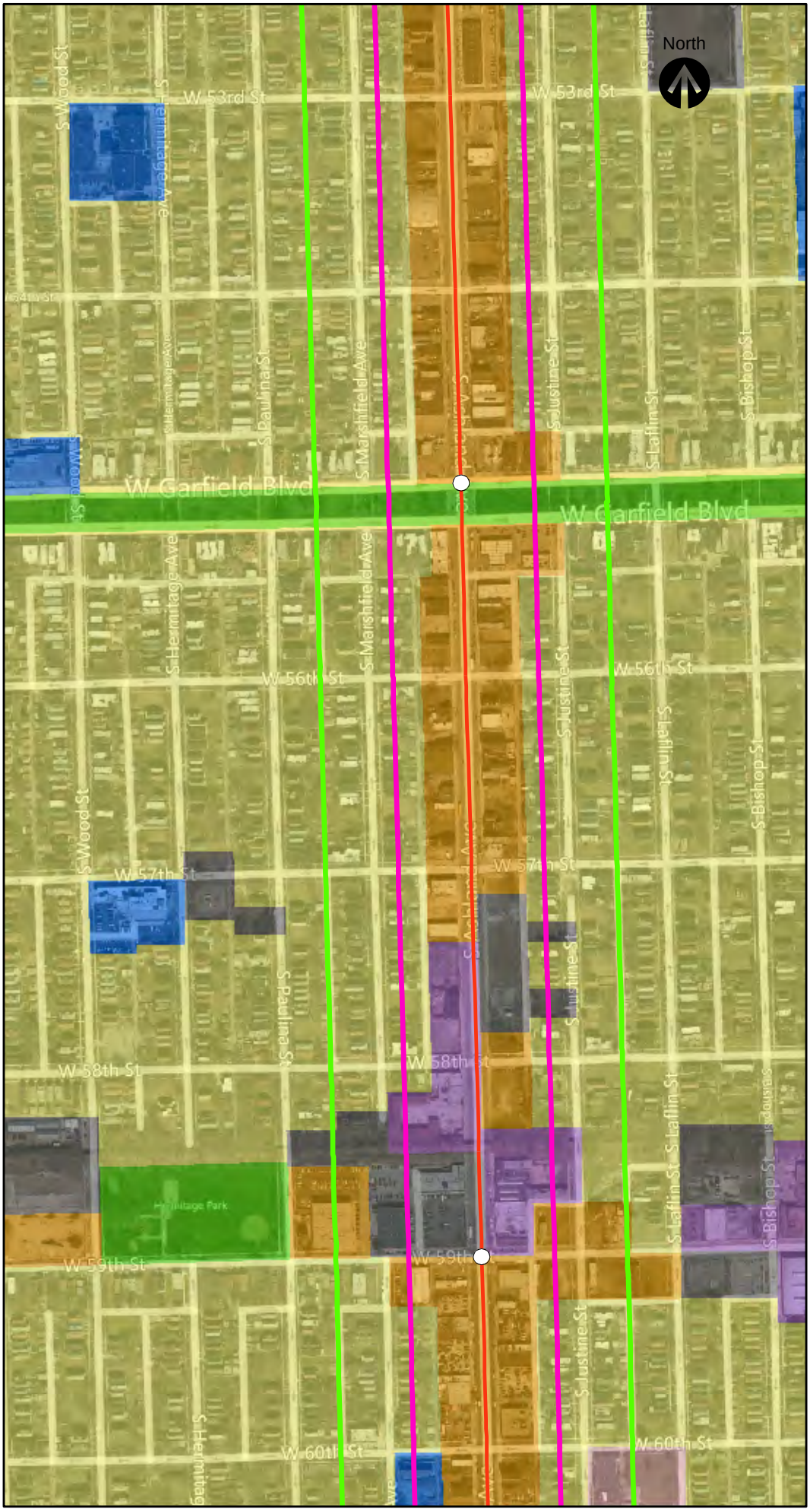

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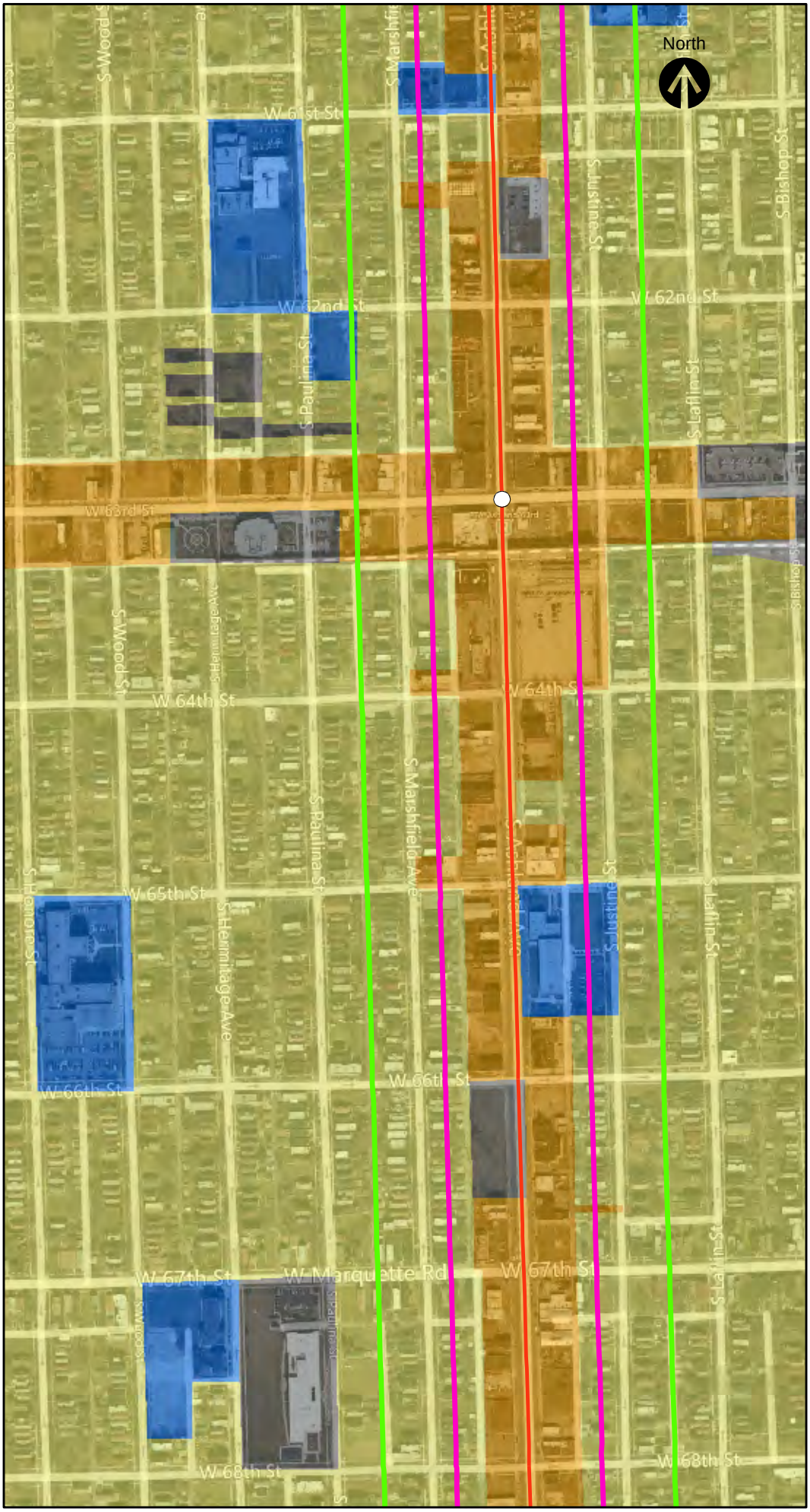

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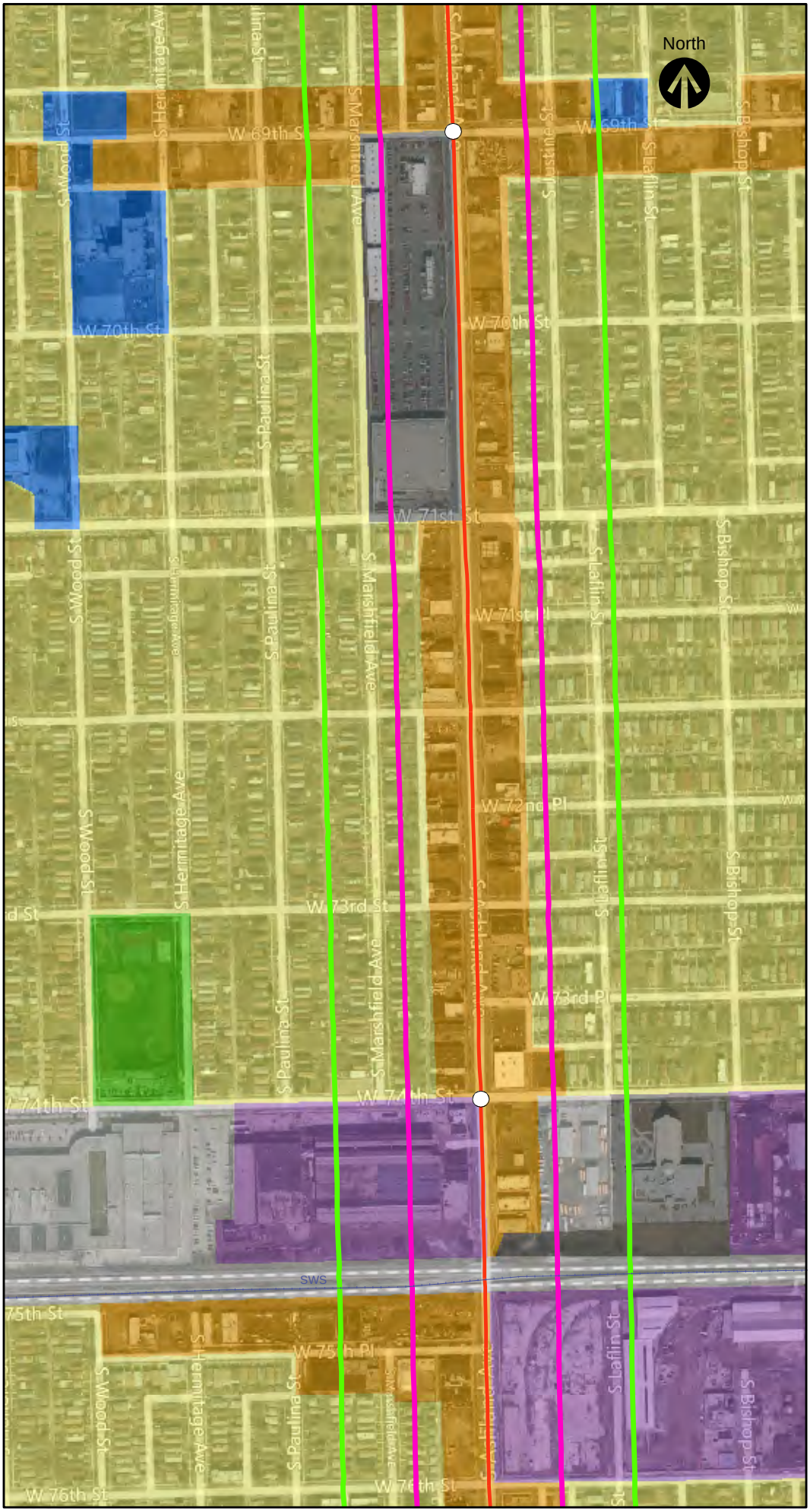

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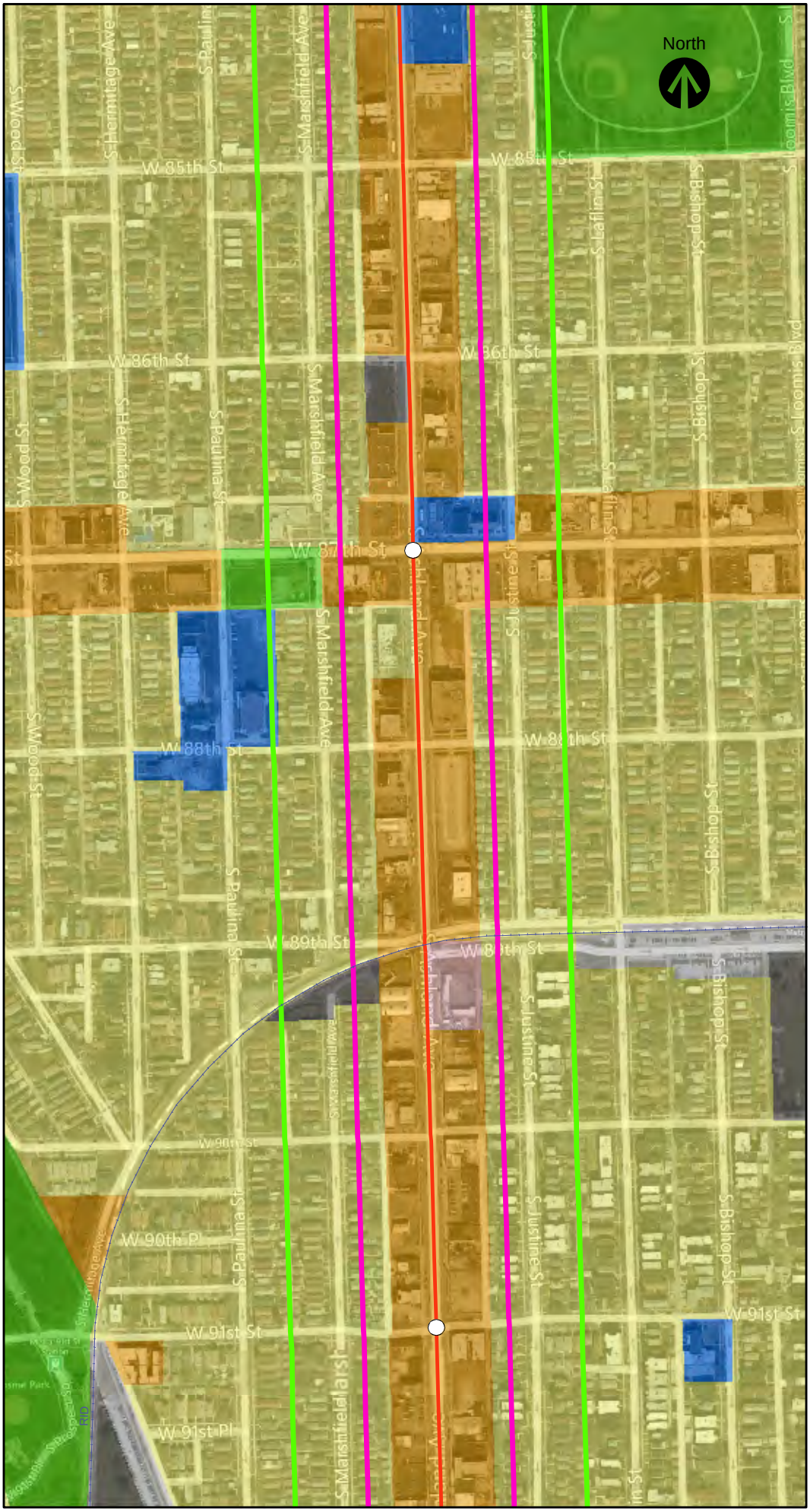

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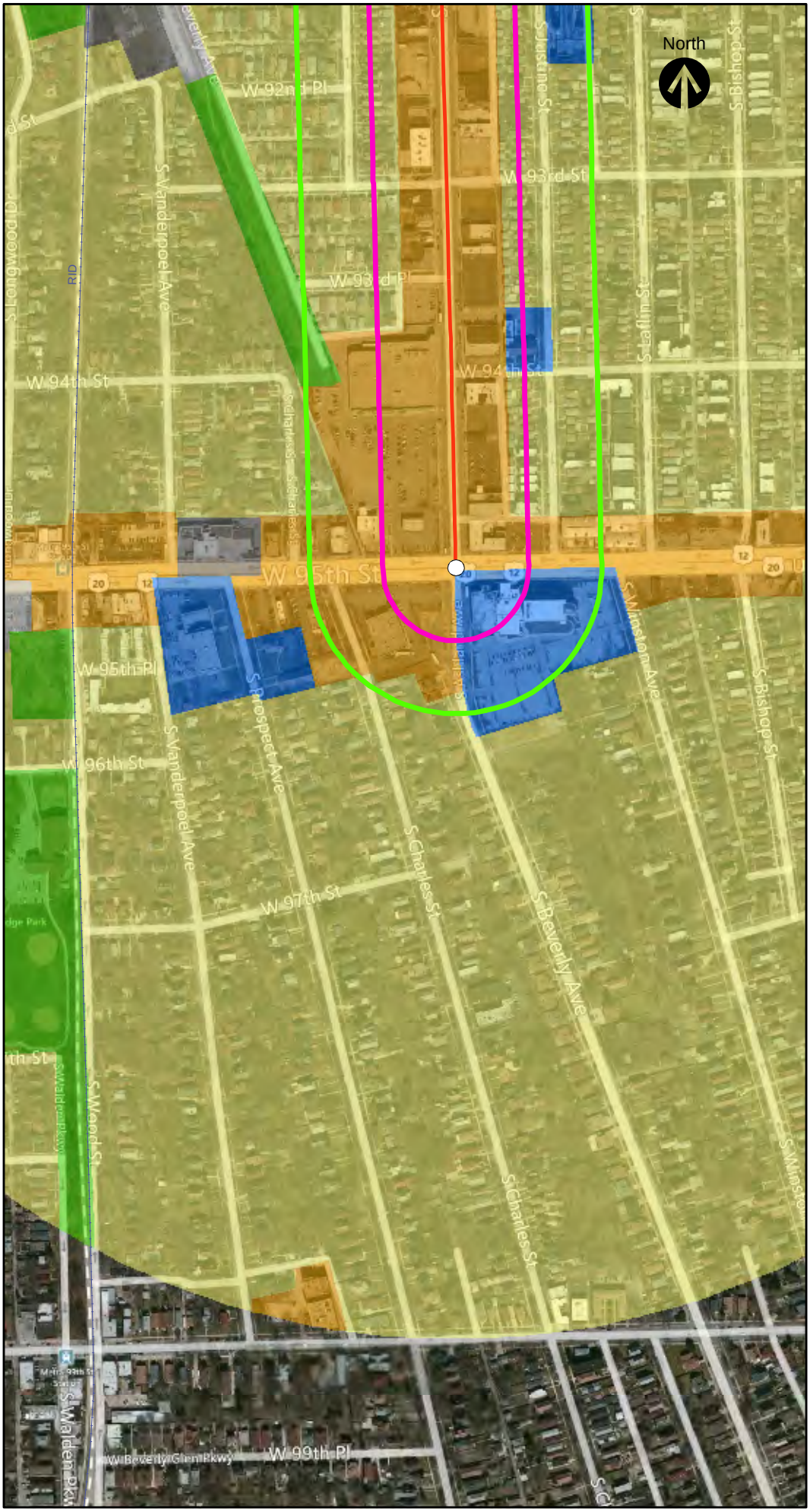

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Attachment B

FTA Noise Impact Assessment Spreadsheets

Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**Asland BRT Corridor**

Receiver Parameters	
Receiver:	**Receiver at 50' from BRT Centerline**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**60 dBA**

Noise Source Parameters	
Number of Noise Sources:	**2**

Noise Source Parameters		**Source 1**
	Source Type:	Highway/Transit
	Specific Source:	Buses (diesel-powered)
Daytime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Nighttime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Distance	**Distance from Source to Receiver (ft)**	50
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No

Noise Source Parameters		**Source 2**
	Source Type:	Highway/Transit
	Specific Source:	Buses (diesel-powered)
Daytime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Nighttime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Distance	**Distance from Source to Receiver (ft)**	50
	Number of Intervening Rows of Buildings	
Adjustments	**Noise Barrier?**	No

Project Results Summary

Existing Ldn:	60 dBA
Total Project Ldn:	59 dBA
Total Noise Exposure:	63 dBA
Increase:	3 dB
Impact?:	**Moderate**

Distance to Impact Contours

Dist to Mod. Impact Contour (Sources 1+2):	62 ft
Dist to Sev. Impact Contour (Sources 1+2):	26 ft

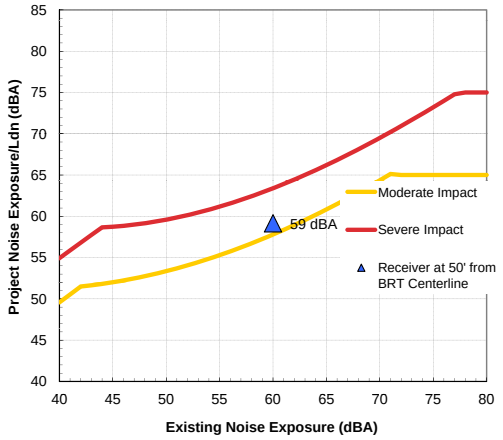
Source 1 Results

Leq(day):	49.7 dBA
Leq(night):	49.7 dBA
Ldn:	56.1 dBA

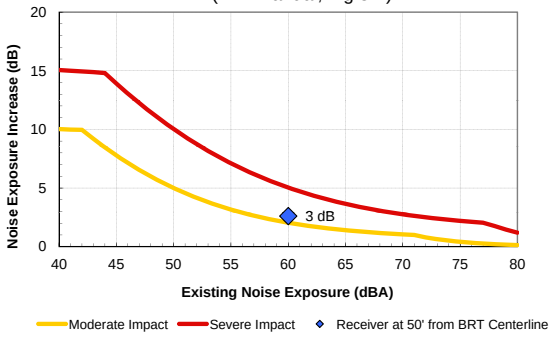
Source 2 Results

Leq(day):	49.7 dBA
Leq(night):	49.7 dBA
Ldn:	56.1 dBA
Incremental Ldn (Src 1-2):	59.2 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**Asland BRT Corridor**

Receiver Parameters	
Receiver:	**Receiver at 100' from BRT Centerline**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**60 dBA**

Noise Source Parameters	
Number of Noise Sources:	**2**

Noise Source Parameters		**Source 1**
	Source Type:	Highway/Transit
	Specific Source:	Buses (diesel-powered)
Daytime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Nighttime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Distance	**Distance from Source to Receiver (ft)**	100
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No

Noise Source Parameters		**Source 2**
	Source Type:	Highway/Transit
	Specific Source:	Buses (diesel-powered)
Daytime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Nighttime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Distance	**Distance from Source to Receiver (ft)**	100
	Number of Intervening Rows of Buildings	
Adjustments	**Noise Barrier?**	No

Project Results Summary

Existing Ldn:	60 dBA
Total Project Ldn:	55 dBA
Total Noise Exposure:	61 dBA
Increase:	1 dB
Impact?:	None

Distance to Impact Contours

Dist to Mod. Impact Contour (Sources 1+2):	62 ft
Dist to Sev. Impact Contour (Sources 1+2):	26 ft

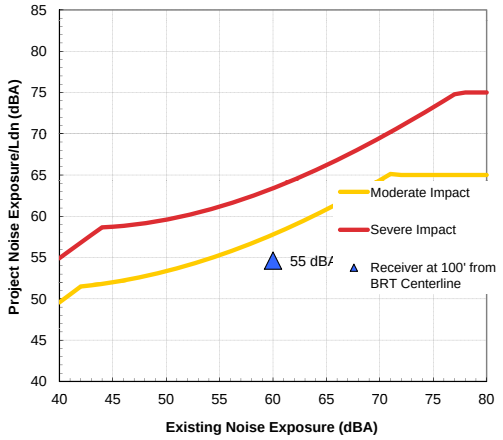
Source 1 Results

Leq(day):	45.2 dBA
Leq(night):	45.2 dBA
Ldn:	51.6 dBA

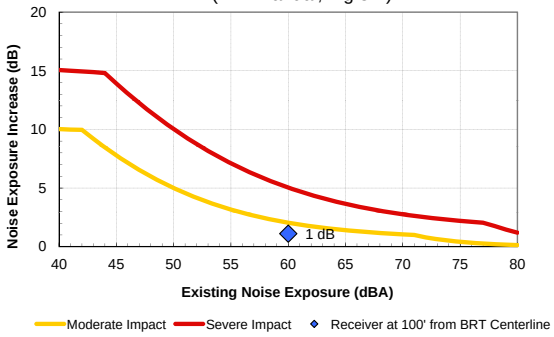
Source 2 Results

Leq(day):	45.2 dBA
Leq(night):	45.2 dBA
Ldn:	51.6 dBA
Incremental Ldn (Src 1-2):	54.6 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**Asland BRT Corridor**

Receiver Parameters	
Receiver:	**Receiver at 150' from BRT Centerline**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**60 dBA**

Noise Source Parameters	
Number of Noise Sources:	**2**

Noise Source Parameters		**Source 1**
	Source Type:	Highway/Transit
	Specific Source:	Buses (diesel-powered)
Daytime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Nighttime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Distance	**Distance from Source to Receiver (ft)**	150
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No

Noise Source Parameters		**Source 2**
	Source Type:	Highway/Transit
	Specific Source:	Buses (diesel-powered)
Daytime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Nighttime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Distance	**Distance from Source to Receiver (ft)**	150
	Number of Intervening Rows of Buildings	
Adjustments	**Noise Barrier?**	No

Project Results Summary

Existing Ldn:	60 dBA
Total Project Ldn:	52 dBA
Total Noise Exposure:	61 dBA
Increase:	1 dB
Impact?:	None

Distance to Impact Contours

Dist to Mod. Impact Contour (Sources 1+2):	62 ft
Dist to Sev. Impact Contour (Sources 1+2):	26 ft

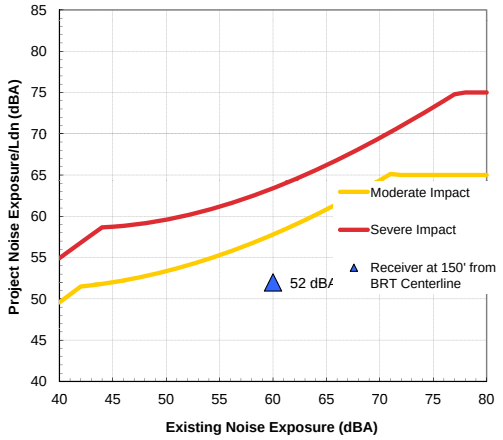
Source 1 Results

Leq(day):	42.6 dBA
Leq(night):	42.6 dBA
Ldn:	49.0 dBA

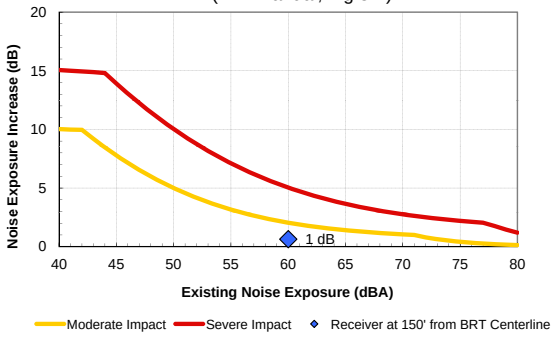
Source 2 Results

Leq(day):	42.6 dBA
Leq(night):	42.6 dBA
Ldn:	49.0 dBA
Incremental Ldn (Src 1-2):	52.0 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)



Federal Transit Administration
Noise Impact Assessment Spreadsheet

version: 7/3/2007

Project:	**Asland BRT Corridor**

Receiver Parameters	
Receiver:	**Receiver at 200' from BRT Centerline**
Land Use Category:	**2. Residential**
Existing Noise (Measured or Generic Value):	**60 dBA**

Noise Source Parameters	
Number of Noise Sources:	**2**

Noise Source Parameters		**Source 1**
	Source Type:	Highway/Transit
	Specific Source:	Buses (diesel-powered)
Daytime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Nighttime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Distance	**Distance from Source to Receiver (ft)**	200
	Number of Intervening Rows of Buildings	0
Adjustments	**Noise Barrier?**	No

Noise Source Parameters		**Source 2**
	Source Type:	Highway/Transit
	Specific Source:	Buses (diesel-powered)
Daytime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Nighttime hrs		
	Speed (mph)	15.9
	Avg. Number of Events/hr	12
Distance	**Distance from Source to Receiver (ft)**	200
	Number of Intervening Rows of Buildings	
Adjustments	**Noise Barrier?**	No

Project Results Summary

Existing Ldn:	60 dBA
Total Project Ldn:	50 dBA
Total Noise Exposure:	60 dBA
Increase:	0 dB
Impact?:	None

Distance to Impact Contours

Dist to Mod. Impact Contour (Sources 1+2):	62 ft
Dist to Sev. Impact Contour (Sources 1+2):	26 ft

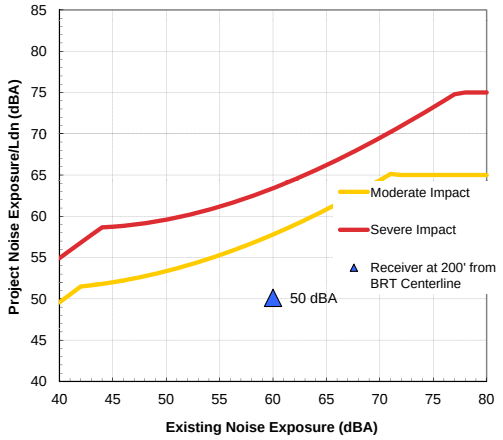
Source 1 Results

Leq(day):	40.7 dBA
Leq(night):	40.7 dBA
Ldn:	47.1 dBA

Source 2 Results

Leq(day):	40.7 dBA
Leq(night):	40.7 dBA
Ldn:	47.1 dBA
Incremental Ldn (Src 1-2):	50.1 dBA

Noise Impact Criteria
(FTA Manual, Fig 3-1)



Increase in Cumulative Noise Levels Allowed
(FTA Manual, Fig 3-2)